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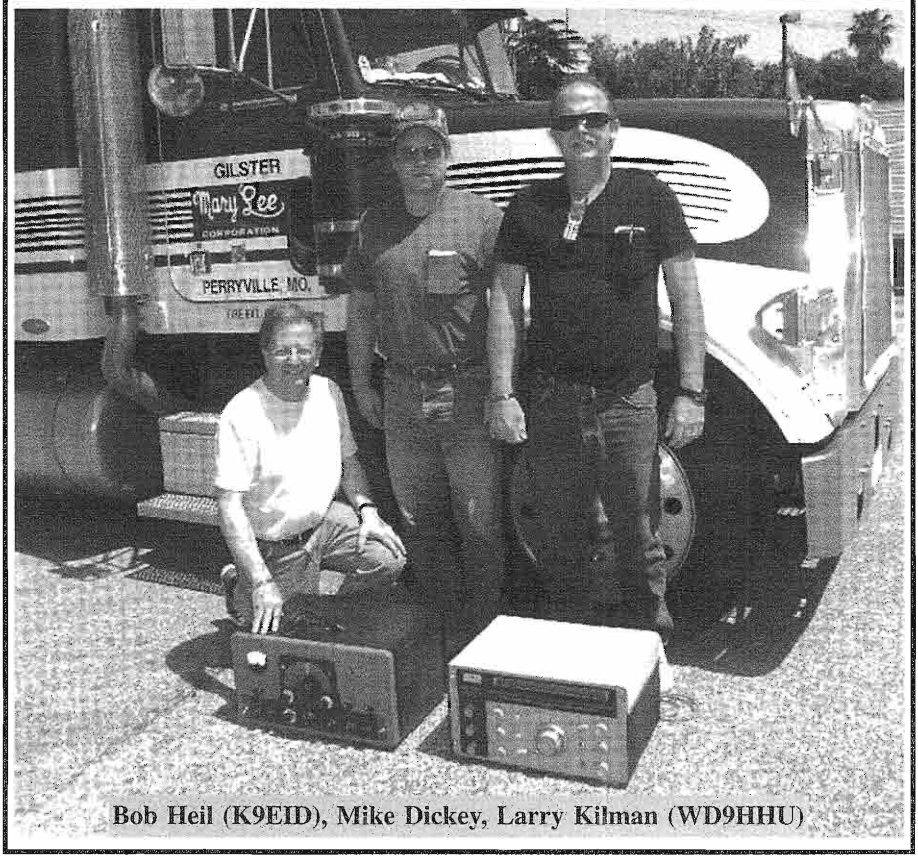
ELECTRIC RADIO

celebrating a bygone era

Number 181 June 2004



Bob Heil (K9EID), Mike Dickey, Larry Kilman (WD9HHU)

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 for those who appreciate the intrinsic value of operating vintage equipment and the rich history of radio. It is hoped that the magazine will provide inspiration and encouragement to collectors, restorers and builders.

We depend on our readers to supply material for ER. Our primary interest is in articles that pertain to vintage equipment 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 (KW1I), Chuck Teeters (W4MEW), Bruce Vaughan (NR5Q), Bob Grinder (K7AK), Jim Hanlon (W8KGI), Brian Harris (WA5UEK), Tom Marcellino (W3BYM), John Hruza (KBØOKU), Bill Feldman (N6PY), Hal Guretzky (K6DPZ)

Editor's Comments

Conditions on 10 meters have been steadily deteorating this year and will probably stay that way for several more years. I think this would be a good time to try some AM event weekends on 15 meters. As Dale Gagnon (KW1I) mentioned during the Dayton AM Forum, I'd like to set aside the first weekend in July, August and September for an AM Weekend. Check the AM window, 21.400 to 21.450 Mc.

Many readers have sent me comments about how much they would like to see the return of shack photos in Electric Radio as in years past. I notice that no photos arrived with the request! I am running low on Hamshack photos, so if everyone will send me photos and a short description, I will get them into the magazine.

Former RCA Coastal Station KPH Returns to the Air

Dick Dillman (W6AWO) is announcing the return of KPH to the air for the annual special event in July, 2004, reprinted in part below:

...In the fifth annual event that has become known as the "Night of Nights", historic Morse code radio station KPH will return to the air in commemoration of the last commercial Morse message sent in the United States. KPH, the ex-RCA coast station located north of San Francisco, will return to the air for commemorative broadcasts on 12 July (or 13 July, 0001Z), 5 years and one minute after the last commercial Morse transmission in the US. These on-the-air events are intended to honor the men and women who followed the radiotelegraph trade on ships and at coast stations around the world and made it one of honor and skill. Transmissions are expected to continue until at least 0700Z. KFS may possibly be activated. Veteran KPH Morse operators will be on duty at the receiving station at Point Reyes, CA, listening for calls from ships and sending messages just as they did for so many years. The transmitters are located 18 miles south of Point Reyes in Bolinas, CA at the transmitting station established in 1913 by the American Marconi Co. The original KPH transmitters, receivers, and antennas will be used to activate frequencies in all commercial maritime HF and MF bands. KPH will transmit on 4247.0, 6477.5, 8642.0, 12808.5, 17016.8 and 22477.5kc on HF and 500 and 426kc on MF. If KFS is activated, check 12695.5kc....

73, Ray, NØDMS

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Cover: Bob, Mike, and Larry pose with American-made AM equipment near St. Louis, Missouri. The donated Valiant and NC-303 were in-route to W1AW where they will be used to return the ARRL station to the AM frequencies June 18th.

The Great Dixie Boatanchor Haul

By John Hartman, NM1H
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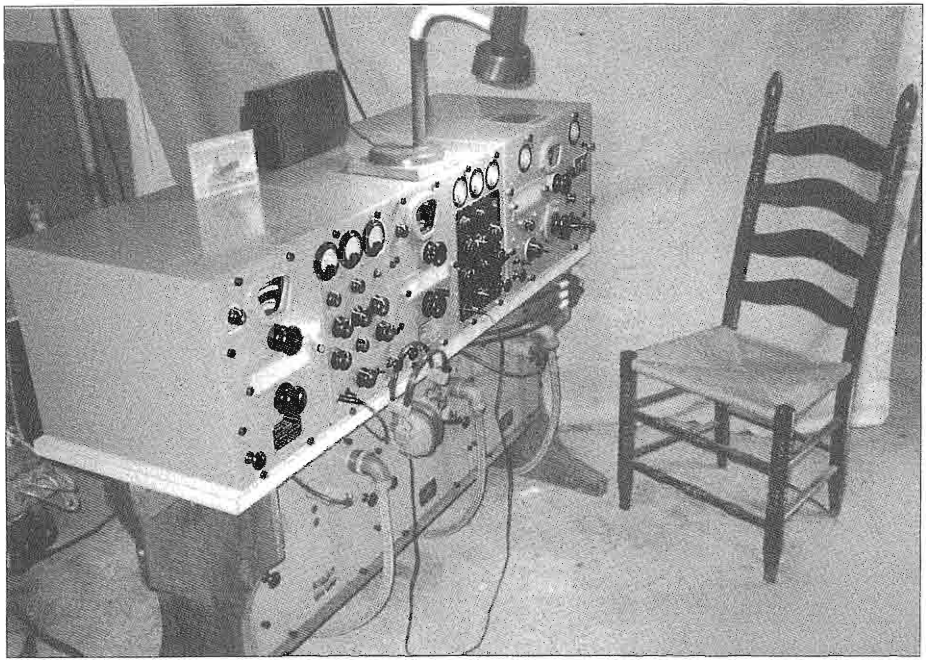
Author's Note: There are times when the thrill of acquisition is the most memorable thing about getting a new piece of radio gear. As the thrill of ownership slowly fades, the memory of the adventure of acquiring it sometimes becomes the most lasting and pleasurable experience. The author would like to share the experience he had finding, buying and hauling a ton of military surplus radio gear across the width of a continent.

My fascination for collecting and restoring old radios must have something to do with my first childhood memory. In my first home in Tucson, Arizona, I was attracted to the softly glowing dial of our cathedral radio. I remember crawling back behind the set to see if I could find the man talking inside. Sticking my face deep inside the back, I remember seeing the pilot light. It looked like a little fireplace reflecting off the shinny vacuum tubes. It was like a doll house inside, but warm and cozy and it smelled real nice. Well, fortunately, my mother must have found me in time to snatch me out of there because I am here to tell the rest of this story.

It was many decades later and years ago that I saw my first Navy RBA, RBB, and RBC radio sets. I had just taken my Boy Scout Troop to their bunks for an overnight sleep-over on the Battleship USS Massachusetts in Fallriver, MA. Having some free time, I naturally headed straight for the ship's radio room. There they were! Massive, black and gray with big control knobs and with those softly glowing tuning dial windows. Suddenly, I got that same feeling in the pit of my stomach that I get thinking of that early childhood memory of that cathedral radio! I knew then and there that no matter how long or what it took, I HAD to have them! Returning home, I immediately renewed my subscription to Electric Radio and placed a free "wanted"' ad for a set of these receivers.

A year or so passed, but I never forgot about those receivers. There had been only a few responses to my ad. None serious. People must have thought I was a dealer and not willing to pay top dollar for these radios or maybe it takes a long time for readers to get around to reading the "wanted" ads! Then, last fall I got a call. George, in Jackson, Mississippi, had read my ad and called to tell me he had them and the price was right! Unfortunately, they were 1500 miles away- deep in Dixie. For many months George and I kept in touch. As we grew to know each other (a critical requirement to doing business in the South), he told me that he knew of a lot of other military gear that could be available. Besides the two RBAs, RBB, RBC, several power supplies and cables, he was willing to part with a BC-610, TCS-12, TCS-14 transmitter, BC-348, BC-648, two TBYs, R-388, several BC-221s, and many, many other things. Unfortunately, all of it was 1500 miles away. I checked all the usual ways hams got stuff shipped to them and nothing made sense. Even bulk ground freight did not work since everything would have to be crated and put on pallets. It was simply too much work, cost, and was too far away to pick them up in my van. I would have to get innovative here. I



My fully restored Navy receivers: RBA, RBB, and RBC

then thought about my friends- one in particular, "Old Buzzard" John, K1KHP! Besides being a concert organist and a pilot, he is a long haul truck driver and an avid boatanchorhor collector. He also makes trips to his second home in Florida. It became clear I had found a solution and a partner!

John and I quickly struck a deal. I got the navy receivers and the BC-610 and he would get first bid on everything else for swinging through Jackson to haul everything on his next trip from Florida to New England.

We set D-Day for January 21, 1998, a day after a business meeting I would be attending in New Orleans, LA, and when he would be returning from Florida. I would drive up from New Orleans, meet John in Jackson to load up, and then fly home while he hauled the stuff up by land. After weeks of planning and helping him find a military M880 truck to pull his home built double axle trailer, we were all set. He was off to Florida and I was off to New Orleans. The Great Dixie Boatanchor Haul began!

It was 9:30AM Wednesday, January 21, when I finally woke up in New Orleans. I had badly overslept! (My alarm clock had been no competition to the late hours I had spent the night before in Pat O'Brien's tavern in the French Quarters). An hour later I was out of New Orleans, speeding up I-55 across Lake Pontchartrain towards the Mississippi state line. Our battle plan had been for a pinchers movement on Jackson. I would come up from the south and John would come from the east to converge on George and his pile of boatanchors at high noon that day. Soon after crossing the state line, I stopped to eat and call my telephone message service. I pulled into a Kentucky Fried Chicken (I figured the chicken had to be very good this close to Kentucky). As planned, John left me a voice message. To my surprise, he was

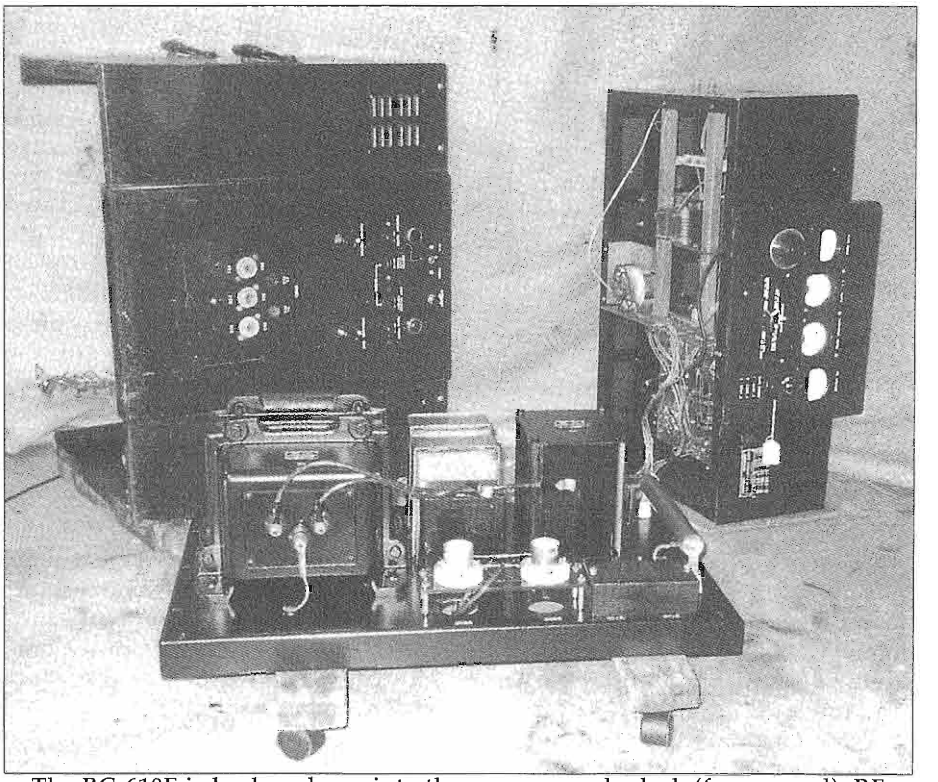
Down into the basement goes the BC-610E for restoration. Note the block and tackle and the help of a few trees.

already in Jackson! Like Custar at the Little Big Horn, John had gone in alone! He was now positioned to pounce on my pile of boatanchors without me! I also noticed he did not sound very well at all. (He had been fighting the flu). With my chicken-to-go under my arm, I jumped into my car and started to leave just as two police patrol cars with lights flashing pulled in front blocking me! I soon realized the police cars were escorting a 5 MPH funeral procession. Judging from the unending line of cars, everybody in McComb, Mississippi, must have known the departed. I was late! John was early and I was blocked! I did the unthinkable. Turning on my headlights and smiling, I slowly headed into the funeral procession. Some fine folks smiled back and nodded their approval as they let me in line thinking I wanted to show my respects too. I am SURE they had a very low opinion of my Yankee ingenuity as I cut back out of line a minute later to get back onto the interstate!

Thoughts of voodoo hexes put on people like me doing things like that occupied my mind as I sped up the interstate. Fortunately, I managed to reach the Jackson city limits without getting stopped by a trooper along the most famous stretch of speed traps in the South. However, the sky clouded up. It got dark. It started to rain and now a lightning storm began like only a southern winter storm can do. (This is where all that lightening static comes from that we in New England hear on those cold, clear winter nights). I spent a lot of time searching in the storm for George's house. I began thinking about that voodoo hex again. Finally, I found the house! Parked outside was John's M880 truck and trailer. John was sleeping inside the truck along with a bunch of his cats. At least I knew John had not pounced on my pile of boatanchors yet. It was then that I really started worrying about John's health and whether cats really do devour their masters when they die. I went in out of the rain to meet George and his lovely wife and their strange menagerie of cats and dogs. Having a similar set of strange pets myself, and thinking of John's cats, I wondered if this pet ownership was characteristic of serious boatanchor collec-

tors? George and I spent the better part of the afternoon in his warm parlor discussing different radio gear and experiences. Meanwhile, the storm outside increased in fury. The lawn became a lake.

John finally staggered in and it was clear he was in bad shape with flu and cold symptoms but he insisted on not seeing a doctor. So, after a while, we headed outside to finally see the boat-anchors we had come so very far to get. The rest of that afternoon was a blur of activity, dashing around town in the rain going from this storage shed to the next collecting the gear. What initially made it difficult was that John's 20-foot long trailer was already 3/4 full of stuff he was hauling up from Florida. Everything from organ pipes, furniture and of course, boat-anchors were in the trailer. Several times we had to stop and unpack and repack to make more room. The first shed had the RBA, RBB, RBC receivers, power supplies and cables all by themselves. At last! There they were! Gray and black and a little scuffed up but complete with no missing knobs or broken meters! We loaded them first with plenty of padding and tarps over them. (John's trailer had developed a considerable leak in the roof). The next series of sheds were packed with all kinds of stuff. George knew pretty much where everything was but it was quite a trick getting it all out and up into the trailer in the increasing rain and darkness. John was starting to cough real bad. Finally, we came to the last shed containing the BC-610. By that time we were soaked with rain and sweat. Our arms were numb with fatigue and cold



The BC-610E is broken down into the power supply deck (foreground), RF deck (right background), and modulator deck (left background).

The restored BC-610E just before lifting onto the power deck in the foreground.

and I seriously wondered if it was worth it. (We are all in our 50s). It was not easy, but somehow we managed to get that BC-610 into the trailer without losing any toes, fingers or slipping a disk. A quick exchange of cash and we were heading back to the motel. Unfortunately, none of the available parking areas were big enough for the M880 and trailer. We easily solved that problem by parking across the street in the empty parking lot of some law offices. I wondered how those lawyers were going to deal with that when they came to work in the morning! At that point, John and I were beyond caring!

One of the things I had promised George and his wife was to treat them to dinner that night. She was not about to let me out of that promise no matter how tired, wet, grubby, stinky (and sick) we were! So, off we all went to the restaurant. It turned out to be very nice and very formal. It was built open inside so everyone could see anyone who was anybody including us who looked like nobody. With white marble Greek columns, it rivaled the best. We were soon seated and settled down to big portions of steaks, potatoes, wine and coffee oblivious to the stares we were getting. Strangely, our conversation did not center on radios. We'd had enough of radios that day. George's wife seemed to appreciate that too. Even John perked up out of his cold and flu symptoms. He had planned to sleep in his trailer that night, but that was a recipe for pneumonia so, in between dinner courses, I called the motel and got another room for him. Later that night we said our good-byes and John and I headed back to the motel. The wheezing in John's chest told me he was getting very close to pneumonia!

The next morning I was up at 5:00AM

to catch my plane ride home. I gave John a call and told him I felt bad leaving him in his condition.

"You gotta do what you gotta do," John wheezed.

An hour later I was sipping a Bloody Mary as I gazed out the airplane window at a beautiful sunrise above the clouds that only a plane traveler sees. I was really feeling guilty leaving John behind. I figured he only had a 50% chance of getting back alive and my ever seeing my boatanchors again! Oh well, I did my part. Little did I know at that very moment, John was meeting up with George again to go check out another pile of boatanchors that morning! They had planned this caper while I was away from the table making that telephone call to the motel the night before!

No word from John the rest of the week as I expected, since he was on the road. By the next weekend I started wondering. He should have called by then. I started to imagine the worst. An M880 truck, trailer, John and over a ton of mangled radio gear and a few cats strewn along the side of some lonely road! I could just imagine the state troopers trying to figure that one out and calling the National Guard to dispose of that military gear!

Saturday morning saw no John checking into The Old Military Radio Net on 3.885 MHz.

Later that day I got my answer when my wife woke me from a nap asking: "Honey, there is an ugly military truck with a weird trailer and a strange man in our driveway. Do you know anything about this?"

"I'll go check." I mumbled as I tore down the stairs to help John unload my beloved boatanchors! After greeting John and hearing of his considerable experiences getting back, something caught my eye. Drops of water were dripping out of his trailer. I knew all about that water. That was Mississippi rain that had traveled 1500 miles to finally fall on my New Hampshire driveway! Somehow, I had the funny feeling that all might be forgiven about my indiscretion at that funeral procession. Maybe the voodoo hex was off! Maybe not! An incident occurred when we used an old oak door as a ramp to unload the BC-610. Halfway down the ramp there was a protracted crack, as the door split cleanly in half. Fortunately, the BC-610 settled slowly onto the driveway and was not damaged. I now probably own the only BC-610 that has ever broken down a door!

Well, things settled down after this great haul. I spend my extra time down in my basement restoring those navy receivers and scrounging parts for the BC-610. Even my dog knows I really live in the basement now. My wife is getting used to seeing the BC-610 in the spot where I used to park my car in the garage. A few weeks ago I got another telephone call. It seems somebody else finally got around to reading my "wanted" ad in Electric Radio. Yes, you guessed it, RBBs, RBCs, power supplies and a garage full of other military boatanchors for sale out in Syracuse, NY! My wife was thrilled when I suggested we visit Niagara Falls this summer for our 28th wedding anniversary. I wonder if she will be understanding when we take a detour to Syracuse to meet up with John, his M880, trailer and his cats to load up some more boatanchors?

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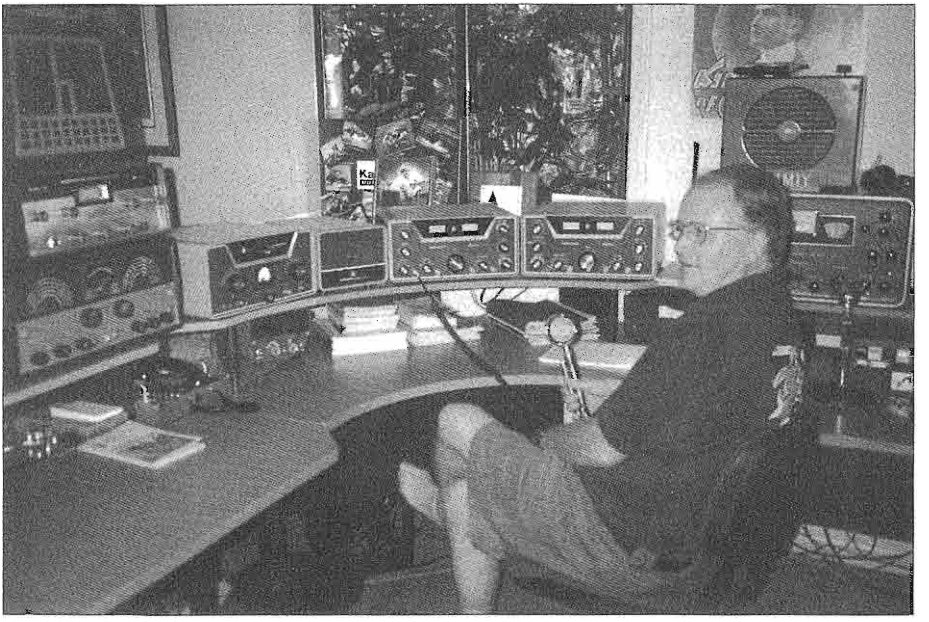
PHOTOS

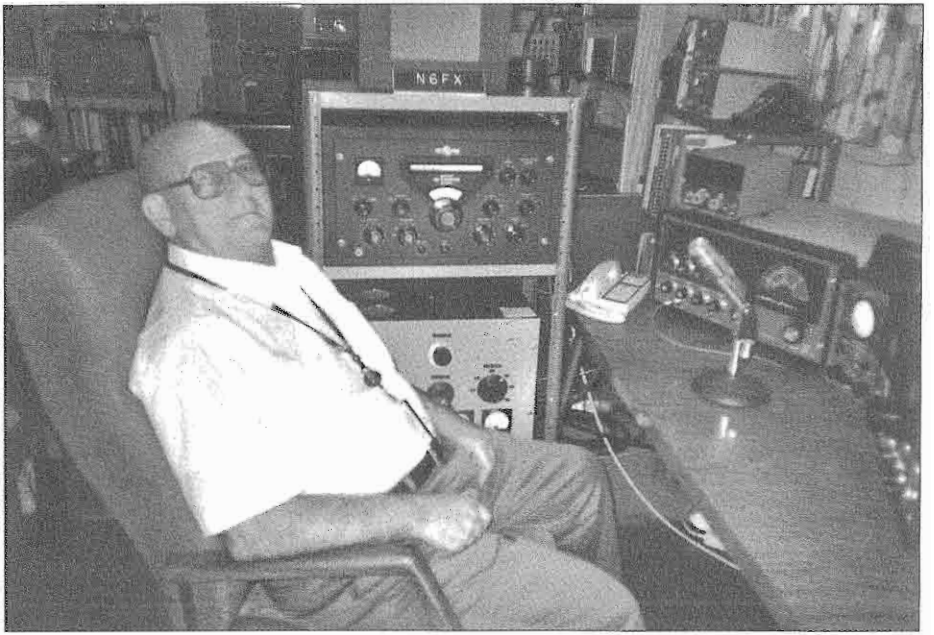


Lanny DeLaney, WA4MIY, Seneca, SC

WA4MIY: Lanny was first licensed in 1962, and grew up near W1AW. He got his Novice license in 9th-grade radio club. His current line-up includes NC-155 (Cosmic Blue), Globe Chief Deluxe, Ranger II, HQ-180A, SX-117, HT-44, HT-45, SX-99, SX-100, Valiant II, Globe Scout Deluxe, Century 21, Icom 761.

N6FX: Chuck was born in Wilmington DE, and is now living in California. He got his present call during Incentive Licensing, and traded off all of his vintage equipment during an interest in DX'ing. Realizing the mistake, he now has several Collins, Hallicrafters, SBE, Heathkit, Signal One, and Hammarlund stations. They can be placed on-air by throwing coax switches. All the gear is original and Chuck has done all of the restoration work himself in his home radio shop.

W2MPK: On one of Don's QSL cards is his vintage Ham shack, with classic Collins, Drake, and Heathkit equipment showing. Many operating awards are mounted on the walls.



Chuck Banta, N6FX, Claremont, CA

Don Moth, W2MPK, Chittenango, NY

By Jerry Barry, K5AXN: In the mid 50 and early 60's, there was a group of AM guys that grew up in San Antonio and went to several different high schools. We did our own junior Field Days when the regular radio clubs considered us too young to work the good bands. We had a transmitter hunt every weekend and took our dates with us. Usually we hunted on 50.4 AM, but we also hunted on 75 meter AM, 10 meter AM, and 2 meter FM. We also hunted in Austin, as some of the group went to the University of Texas. On June 20th, 2004, I organized a reunion of this group, with Linda and Augie Meitzen, W5GLN, as our hosts at their Windy Hill Winery in Brenham, Texas. Brenham is in the center of Texas, fairly convenient for everyone to get to, and beautiful in the spring-time with all the wildflowers. After attending the Brenham, Texas, Hamfest we all gathered at the Meitzen's to have a catered Texas Bar-B-Que, Blue Bell Ice Cream, samples from the vineyard, and a really emotional get together. We could have visited for a week, since it had been 40 years since some of us had seen each other. Jeff Lindsey (K5AAK) came down from Carbondale, III. - 860 miles. Eddie Reynolds (AD5PD, ex-K5WQG), and Jimmy Heye (K5WLQ) had let their licenses expire over the years, but they re-tested and re-licensed, and they both say its as good as when they started. Jimmy Heye's daughter Christi also took her test and is now KE5ALV, making him a very proud and happy father.

The following Hams and ex-Hams and their wives and a few new friends attended: 1. K5AXN, Jerry Barry-San Antonio, 2. W5GLN, Augie Meitzen-Brenham, 3. W5ZHU, Bobby Meitzen-Franklin, 4. K5WLQ, Jimmy Heye-Dallas, 5. K5ALX, Don Janota-Canyon Lake, 6. K5FOU, Jim Wolfshohl-San Antonio, 7. AD5PD, (ex-K5WQG) Eddie Reynolds-Tomball, 8. K5SUZ, Gordon Dial-San Antonio, 9. W5HFG, Carl Zettner-San Antonio, 10. WA5FSR, Neil Martin-St. Hedwig, 11. WB5LCT, Louise Martin-St. Hedwig, 12. K5HQR, Charley ElbelMason, 13. K5JDA, (ex K5TYE), Jim Abernathy-Helotes, 14. K5HML, Harry Winship-San Antonio, 15. K5AXD, Gary Wray-Houston, 16. K5AIL, Jerry Brown-Seabrook, 17. K5AAK, Jeff Lindsey-Carbondale, III, 18. K5AUW, Bobby Rodriquez-San Antonio, 19. K5WQX, Hank Canamar- Boerne, 20. WB5YPG, Jackie Canamar-Boerne, 21. K5KVH, Stuart Rohre-Round Rock, 22. WA5BJV, Susie Maloney-Austin (her deceased husband was K5DBF) 23. W5PCW, (ex-K5GJV) Phil White-Fredericksburg, 24. W8SYD, Byron Armstrong- San Antonio, 25. KD5YRR, Denny Findley-San Antonio, 26. KD5YVI, Rosi Findley-San Antonio. Also present, but not shown in the group picture: 27. AA9TT (ex-K5BLD), Dave Meitzen The Colony, 28. WA5EFA, Leonard Clark- Burleson, 29. KE5ALV, Christi Heye-Dallas, 30. K5ERF, Pete Morey- Kingsville, and 31. KJ5WN (ex-K5QJH), Charley Wheeler-Temple, 32. KA5BKG, Brian Gaskamp-Brenham.

Homebrew Microphones

By John Bipes, KØYQX
906 Adams St.
Mankato, MN 56001

Anyone who's watched TV's "The Simpsons" has seen principal Skinner trying to address the student body – the PA system always whistling with feedback at the outset.

This Stromberg-Carlson 'MD-37AS' microphone could have been Skinner's. The dynamic head and the little body containing the off-on slide switch was retrieved from our high-school's wastebasket. Apparent reason it was trashed: the 5/8-27 threads were more crossed-n-lost and 'Skinner' must've gotten embarrassed one too many times as the bobbly-headed thing probably tumbled apart before 'Bart' and his friends. But then – the fact that the mic element was still fine even though the enclosure was a mechanical discard is testament to the characteristic ruggedness of the dynamic type of microphone cartridge.

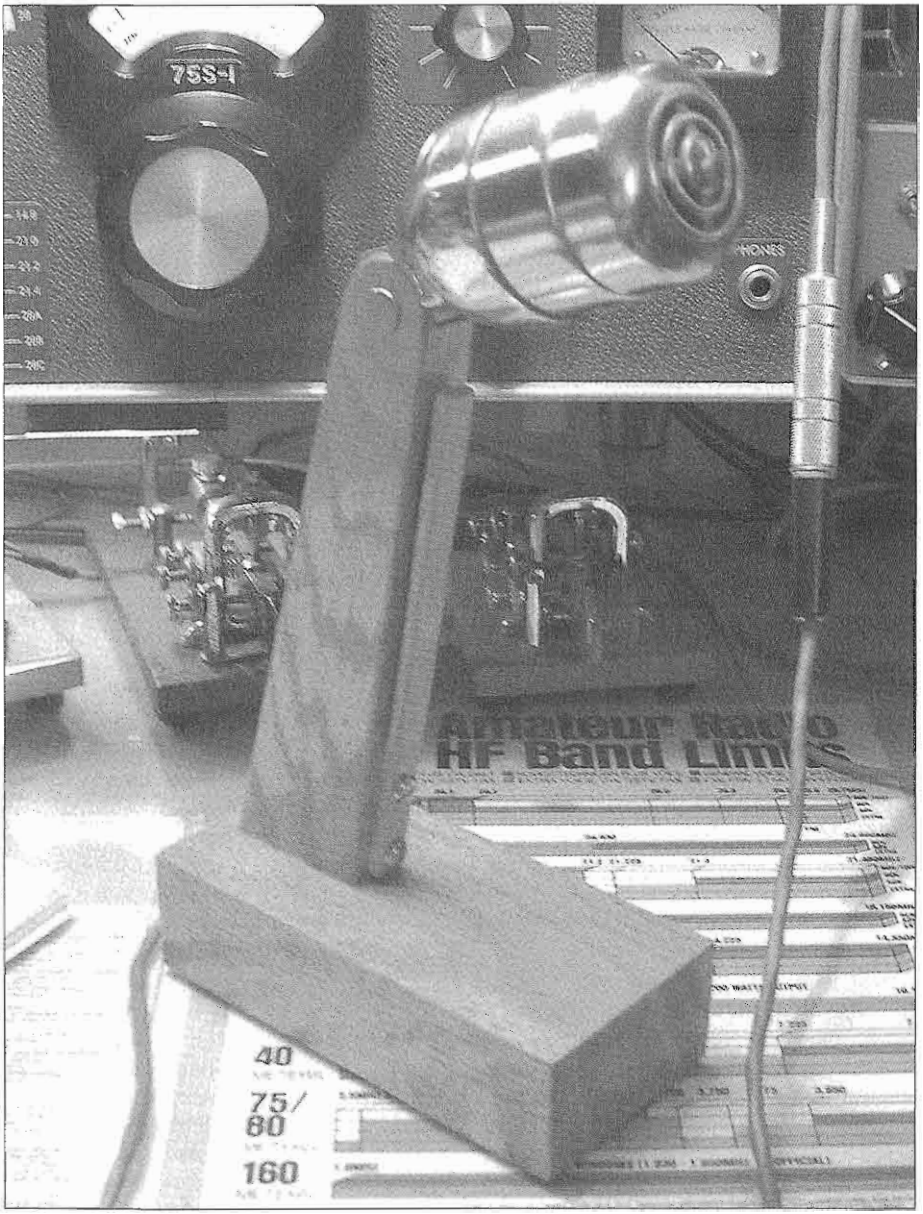
With delight in 'resurrection' and enjoyable use of discarded electronic stuff, a not-insignificant characteristic of ER-readers, this reader (years before ER began) had already resurrected and was pleasurably using the discarded mic in it's new Ham radio application. Here's how.

After some cursory checks to ensure the mic element was still functional, the hinge-pin was removed and the tiltable mic head was separated from the damaged base. While the glue was setting between a pair of ¾" scraps of oak set aside to form the base, the end of a single narrow scrap of the same oak was carefully rounded, ever-so-carefully sawn with a fine-tooth saw, and drilled for the hinge-pin to the same dimensions as the old base. With a Dremel® tool, some additional contouring was done to hollow out room in the prosthetic hinge for the wires. When it was assured that the fit of the head and hinge-pin was correct, a long ¼" twist drill was used to drill longitudinally down through the new mic handle.

A thin strip of oak was prepared for the PTT switch lever. At thumb level, just below the mic's head, the Dremel® tool was used to hollow out a pocket for a tiny Microswitch®, also from the junkbox. Gentle inward pressure along the length of the wooden lever – especially at the top under which the Microswitch® is located – keys the rig and turns on the new microphone's battery-powered amplifier.

Before assembling the base to the handle, et al, I hollowed out the base. Not yet having a mill, or ever used one, I took the laminated block to work and prevailed upon Charlie, the lead mechanical engineer at E.F. Johnson, for help. Out in the model shop, in true Ham spirit, Charlie swept his hand towards the half-dozen Bridgeport mills and said, "That one down on the end is just here for government jobs – err, ahh – low priority government jobs. If higher priority, any of these!" Then, chucking up a ¾" end mill, he expertly milled out a little cavity in the base for me.

The amplifier employs a quite ordinary NPN transistor in a common-base circuit. What's a bit inventive is its activating switch-circuit. It had to meet the requirements of the Microswitch®, having only a single pole (SPDT) whose normally-open contacts I'd determined should be dedicated to grounding the the mic plug's tip, i.e., something clever would have to be designed to make use



A junked microphone with a worn-out base was the starting point for my homebrew mic. The text describes how the oak base and stand were built, how the Microswitch PTT was installed, and how the opening in the base for the preamp was milled out of a solid piece of wood.

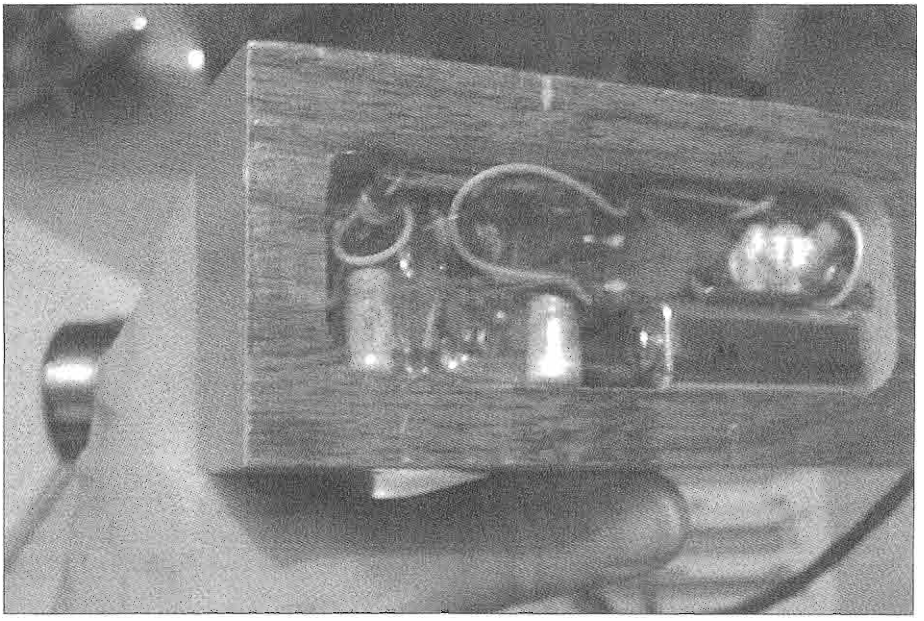
of the remaining fact that one normally-closed pole becoming un-grounded would have to connect the little 9 volt battery to the amplifier circuit. (I'm always setting these peculiar design limits for myself, and not always for a logical reason; often enough to just solve a self-created puzzle.)

The completed thing has worked like a champ for over 20 years now – with perhaps 3-4 batteries having shared that span of time. Not bad considering my little switching circuit. (If only the expensive little battery inside my Vibroplex Brass Racer lasted a fraction as long!)

Back to E.F. Johnson: In those years, some will remember they also had an acoustics lab, and were fortunate to have mic expert Frank Swinehart* on-staff. He tinkered, tested, and invented – amongst other things – the popular little ceramic mic used on zillions of EFJ CB radios. With the point of a pencil, Frank would point to what most of us can forget to put back into a microphone we might dare to dissassemble – that little shower-drain disk – and he'd say, "This little hole is the acoustic equivalent of an inductor...and this little space between holes (or whatever he was pointing to) works like a capacitor. What do you mean you thought it wasn't important!"

Well, these many years later I seem to remember that Frank glanced at my active dynamic microphone with a professional bit of disinterest and practiced skepticism. After running its curve in his anechoic chamber, however, his skepticism seemed gone and I could tell he was fighting to retain some remnant of disinterest.

*Microphones for CB, Frank Swinehart, Sams Publications, Indianapolis, 1977.



This is a bottom view of the Oak base that shows how the preamplifier and battery fit the milled space.

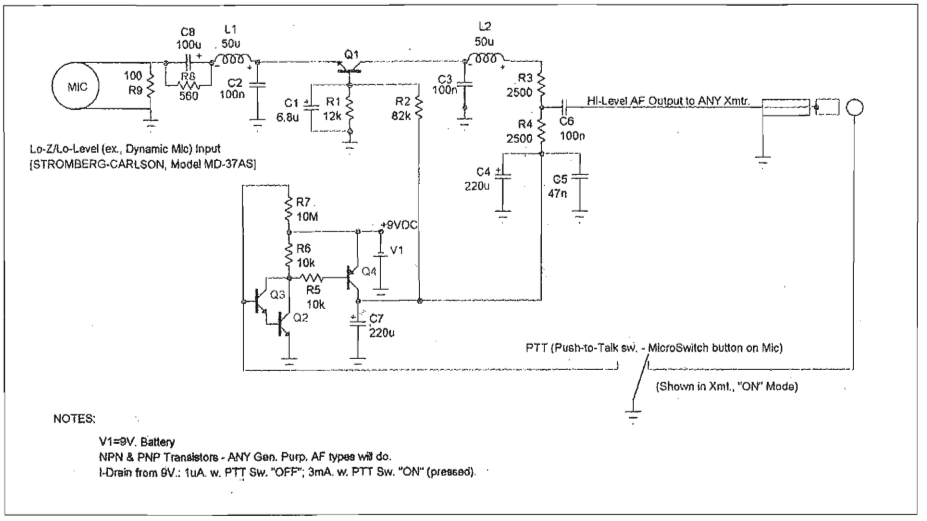
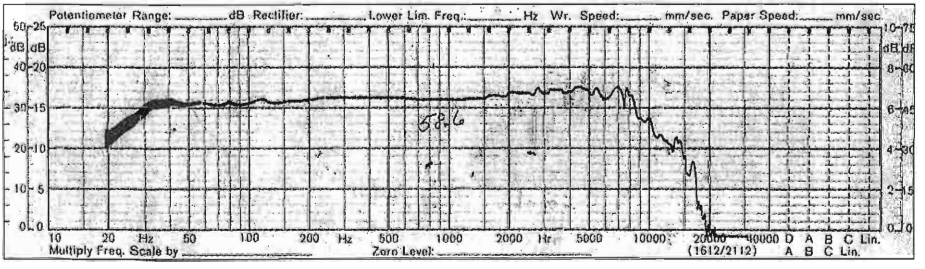


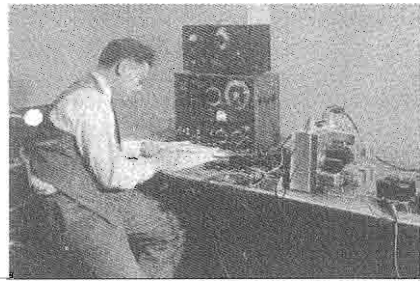
Figure 1: The complete schematic of my microphone preamplifier. Not only does it fit completely into the mic base, but the current is so low that the battery will last about five years.



Here is the curve of my microphone response that was made in the anechoic chamber at E.F. Johnson by the in-house mic expert Frank Swinehart. This chart shows the smooth response of the microphone in the areas where it needs it the most.

ER

The Restoration Corner



Transmitter Service and Maintenance Hints, Part 2

This material is taken from a booklet originally published by Heathkit in 1956, and is from the collection of Clark Hatch, WØBT

Operation Of Medium-Power Transmitters At Reduced RF Output

Many customers have asked us how they might reduce the RF output of medium power rigs for novice operation as well as for using the transmitter as an exciter for a high power RF final. Power reduction can be accomplished by loading technique, that is, placing the pi-network in such a position that the transmitter loads somewhere below 100 mils. The RF output can also be controlled to some degree by varying the amount of available grid drive or in other words, excitation. One other very satisfactory method of reducing power output in a more or less permanent manner is through use of the clamp control adjustment in transmitters that have this type of circuit. Follow the manual instructions for initial setup and test of the transmitter, and then load to a satisfactory antenna, as would be the case for normal operation. Let us say, for example, load the final amplifier to 250 mils, and then turn the clamp control counterclockwise (this is done with the plate switch on) until the plate current indication falls to the desired level, that is 100 mA or below. Through this method then it will be impossible to exceed FCC power input regulations for novice operation or in the case that the transmitter is used as an exciter for a high power final amplifier, the driven final cannot be damaged through over-excitation. The output of the transmitter cannot be increased then until the clamp control is reset.

Driver Plate Current

Many transmitters offer a metering range for the driver plate current. The driver plate current may not necessarily remain at a constant or specified level in direct proportion to frequency of transmission. The driver plate current will vary from frequency to frequency and from transmitter to transmitter. It is not at all critical and therefore we do not state in the operating manuals any specific driver current reading. When operating the higher frequencies such as 10, 11, or 15 meters, you will notice a slight drop-off in available grid drive. This, as was mentioned in a previous paragraph, is normal.

At this point it should be mentioned that the grid drive might not necessarily be reduced to zero when operating a particular band in which the VFO or crystal oscillator operates on a fundamental. An example of this would be the 40, 80, or possibly the 160-meter band. Note that the VFO operates on a fundamental of 160 meters and doubles to 80.

On 40 meters once again, it becomes fundamental then doubles to 20 and triples to 15 meters. The oscillator circuit becomes "straight through" at a frequency of 40 meters and once again at 160 meters. At this point available excitation is extremely high. There may be some residual indication on the meter with the grid drive control at minimum. We mention this as it does not in any way indicate abnormal operation of the transmitter or an error in wiring. It will not prove detrimental to the function of your transmitter.

TVI

TVI has been a subject of considerable comment and of course manufacturers of any amateur transmitting equipment are apt to receive information from the field concerning television interference. Generally however, the transmitter itself does not cause TVI, except in some extreme circumstances. Should you now or at any future time be troubled with TVI, either in your own set or neighbor's, a few simple tests should be made in order to determine the origin of TVI. One very satisfactory method (possibly not always sure fire) of determining TVI origin is to first disconnect the transmitter from its antenna. In place of the antenna, use a dummy load such as a light bulb. Load the transmitter into this dummy antenna on the specific frequency that seems to cause TVI. Check your own TV receiver and have your immediate neighbors check. If no TVI is present when operating the transmitter under these conditions but was previously when actually "on the air" you may be reasonably sure that the source of TVI is radiation from external nonlinear systems.

This will be discussed in detail shortly. On the other hand should TVI be noticed on your own or immediate neighbor's TV receivers when operating the transmitter into a dummy load, one more consideration must be given before blaming the transmitter itself; that is simply what are the make, type, and year of the TV receiver that is causing trouble. Many of the lesser expensive and older TV receivers will show the tell-tale TVI yet this may not necessarily be "genuine television interference" but due to the circuitry of some of the older and present lesser expensive TV receivers, the detector will block due to an excessive presence of RF energy. A condition of this type with many of the simpler TV receivers is not uncommon and the experienced radio amateurs can readily detect such over-loading conditions. Operating your transmitter into a dummy load and assuming that there is TVI after making certain it is not simple RF blocking or overload, then the transmitter itself may be at fault. The usual procedure should then be taken in locating parasitics not only in the VFO, the buffer, but the final amplifier as well. Loose or improperly soldered connections are a high offender of TVI. Refer to any of the many radio amateur manuals such as ARRL or the Radio Handbook for further information covering localization and elimination of TVI that is known to be brought forth from the transmitter itself through the possibility of parasitics or self-oscillation.

A moment ago we mentioned harmonic radiation from external non-linear systems. This is by far the greatest offender of TVI and can be caused by such simple things as corroded or rusted TV antennas and masts as well as guy wires, corroded heat ducts within yours or your neighbor's home, rusty or corroded rain pipes, plumbing fixtures within yours or your neighbor's home, dirty fuses in the fuse box, BX cable, BX boxes and switches, ceiling and wall fixtures as well as chandeliers, conduits, hot water installations such as the heater and associated plumbing, the power line itself, the telephone line, lightning arrestors, and lightning rods, metal fences, metal roofs, or metal lathe found in the newer houses as a base for plaster and stucco, metal TV towers, reinforcement rods in concrete, your own or your neighbor's thermostat - in other words, any combination of two pieces of metal that may be touching one another and

may be corroded or rusted sufficiently so as to form a rectifier. Even the common AC-DC table model radio receiver has been traced as a cause of TVI due to the fact that the selenium rectifier within the receiver is detecting and reradiating a harmonic.

Voltages

In some of the larger transmitters, no voltage chart is published in the operation manual. Due to the fact that most voltages within the circuitry of medium to high power transmitters are lethal, we feel it advisable not to include any checkpoints other than the resistance measurements as specified. Of course the plate voltage may be checked through use of the meter located on the panel as is the case with medium power transmitters, or in the smaller rigs by use of a VOM or VTVM before the transmitter has been placed in its cabinet. The low voltage power supply in most medium power transmitters will fall somewhere between 350 and 420 volts. The actual voltage will vary depending upon the power line supply voltage and individual power transformer characteristics.

RF On Panel

If at any operating frequency the chassis, cabinet, or panel of the transmitter should become "hot" with RF, this is an indication that grounding facilities are not adequate. In some locations, that is if the transmitter is located on the second story or quite some distance from a good earth ground, it will be found necessary to run two or possibly three separate ground wires from the transmitter itself to earth ground. Each ground wire should be sufficiently heavy as is recommended in the manual and of a different length to prevent the possibility of anyone or all of the leads becoming resonant at any specified frequency. Do not rely entirely upon a water pipe for satisfactory ground connections. Copper ground stakes at least six feet long should be used. If the ground is damp, most of the time, generally one is sufficient. If in doubt, use two or three ground stakes placed about three feet apart and each one tied together by heavy copper wire. To be doubly safe throughout the summer months, keep the ground around the stakes wet.

Modulator Idling Current

When operating phone with transmitters employing high-level plate modulation, it occasionally may be noted that the resting current of the modulator stage is appreciably higher or in some cases lower than the specified idling current stated in the operation manual. A variance of ±50% from the average resting current is not unusual nor does it mean that corrective measures should be taken. The grid characteristics in individual tubes of the same type will vary slightly causing a variation from the manual. On the other hand, if the idling current is upwards of, say 100 mA, then one or both of the modulator tubes should be replaced. If no change is noted after replacement then check the bias voltage and all components within the circuitry of the modulator tubes.

Parts placement and lead dress throughout any transmitter is of the utmost importance. We strongly urge the kit builder to follow exactly the step-by-step instructions and the pictorial diagrams included with the construction manual when assembling RF equipment. Above all, if difficulty is experienced, a visual check should be made. As mentioned before, incorrectly soldered or "cold" connections are serious offenders causing parasitic oscillation, low excitation, and generally unsatisfactory operation of the entire transmitter.

Creeping Plate Current

Should the final plate current creep upwards continually during operation regardless of whether you are using phone or CW emission, the most common explanation for this characteristic is weak or "soft" output tubes in the final. The remedy for this condition may be caused by a defect in the tube at time of shipment if the characteristic is noted immediately after the kit has been placed on the air for the first time. Abuse of the transmitter is a common cause for output tube damage that is operation of the

transmitter under severe mismatch conditions, or loading the final amplifier far beyond its normal rating. For trouble-free results, the tubes in the final amplifier portion of any transmitter should be replaced after approximately five hundred airtime hours. It is true in most cases that tubes will last considerably longer than this time but due to slow deterioration of the tubes from use; they may cause other undesirable circumstances. Rather than allow the tubes to remain in your transmitter until they fail from fatigue, you will be money and time ahead to replace immediately upon noticing signs of weakness or at least every five hundred hours. This is merely a suggestion and the final decision is up to the operator.

Tube Burnout

As repeated above, for best results tubes should be replaced frequently or as soon as deterioration is noted. However, frequent burnout of one specific tube or tubes is not a normal condition. Should you in any transmitter experience a shorting condition or other defect resulting quite often in a specific tube, it will be well to check the surrounding circuitry of that particular tube before making additional replacements. Often a shorted coupling condenser between the plate of one tube to the grid of another will cause the full plate voltage to be applied to that grid. The tube will then internally break down causing a grid to cathode (or similar) short. A reoccurring failure of this type almost invariably can be traced to a shorted coupling capacitor.

A blue glow outlining the plates of many tubes may be noted. This does not indicate a gaseous condition within the tube. In most tubes that operate at a high plate potential, there will be stray electrons not collected by the plate. These stray electrons then bombard the glass envelope causing fluorescence (blue glow) due to impurities in the glass. Generally a condition of this type is favorable as it does indicate the tube is in good operating condition as the bombardment and subsequent fluorescing is a sign of a "hard" vacuum. A tube that is gaseous may be readily detected by the overall purple glow. This is noted mostly in rectifier tubes.

Meters

Most of the lesser expensive transmitters on the market employ a moving vane type meter. This meter is capable of extremely high inertia. The meters are not damped and therefore if the meter selector switch should be in the plate position while the transmitter is being keyed, the meter indicator needle may peg itself at the extreme right side. However, the mechanical construction of the moving vane, bearings and the meter needle indicator itself is such that this pegging condition will in no way harm the meter. To lessen this characteristic when operating CW, be sure the selector switch is placed in the grid position, thus the indicator extrusions will not be quite as severe. The more expensive meter movements of the moving coil type are electrically damped thus reducing the ballistics and virtually eliminating severe pegging.

DO'S

1. Allow transmitter to warm up before turning the plate switch on.
2. Be sure your antenna and/or external match meets requirements of pi-network.
3. Be sure of a good ground.
4. Check the various metering positions frequently while operating.
5. Make final tuning adjustments as quickly as possible.
6. Replace tubes at first sign of fatigue.
7. Keep transmitter free of dust.
8. Ground antenna during electrical storms and atmospheric disturbances.

DON'T'S

1. Change band with plate switch on.
2. Change frequency of VFO more than ±20 kc without retuning
3. Exceed 5 mA grid drive.
4. Exceed plate current limitations.
5. Operate transmitter out of resonance or without load.
6. Operate transmitter outside of cabinet.
7. Operate into highly reactive antennas.

ER

The QRP Commander

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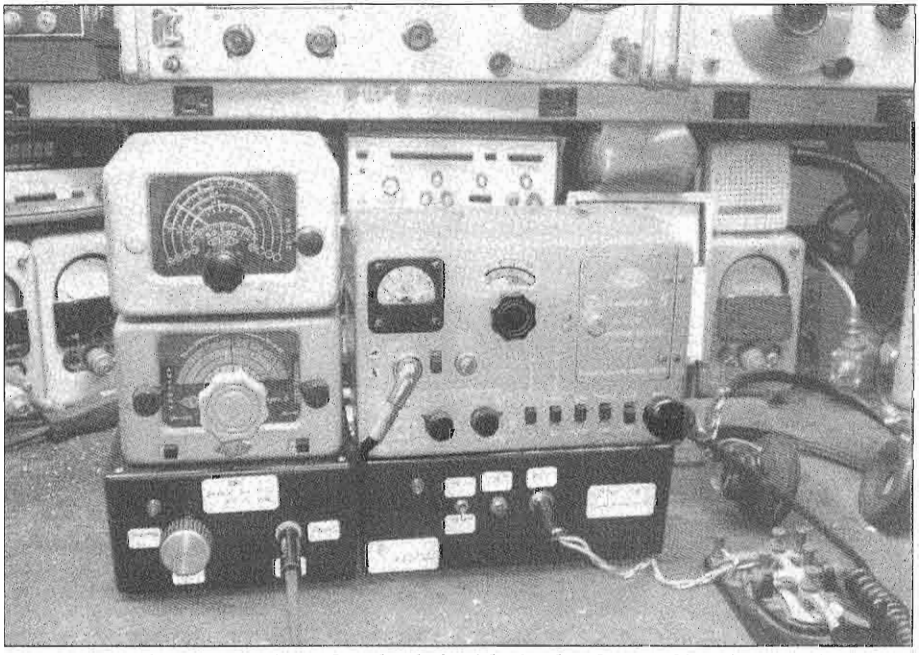
This article is about a little transmitter called the Gonset Commander that was designed in the 1950's as a mobile rig. The companion receiver, the Gonset Super-Six converter, was covered in my article in ER #179, April 2004.

The Gonset Commander was a transmitter with about 50-watts input power, and covered the 160 to 6 meter amateur bands with plug-in coils. The output tube was the ubiquitous RCA 6146, driven by a 6AG7. On the later units, the modulators were locktal-based 7C5's, and the early versions used 6AQ5's. You could run them with crystal control, or purchase the optional L-C VFO which was a outboard unit that replaced the crystal.

The Commander is not that hard to find now, and because I used one years ago for mobile operations, I thought an article would be interesting. The problem is finding a power supply, because they are harder to find than the transmitter is. My idea was to design an inexpensive power supply and use it with the Commander as an AM base station.

There are two configurations, one to provide about 10 watts input, and another for about 50 watts input. Because high-voltage transformers are getting



Here is my Gonset station. On the left side is the Super-Six Plus receiver and power supply described in ER #179, and on the right is the Commander transmitter and it's new power supply I've described in this article.

hard to come by, I used transformers with a dual-primary and 12.6 VCT windings similar to my designs in earlier ER articles.

Using four of these transformers, with the windings properly phased to produce 300 volts B+, will run the entire 10-watt version of the transmitter. All the filament windings are tied in parallel. This also produces the right voltage for the PTT and antenna switching relay. The primary windings are tied in series-parralel for about 300 volts thru a bridge rectifier.

If 10 watts was great for QRP, I decided to design another supply for 50 watts input, or about 7 dB more power. The transformers have the current capability, so I rearranged the high-voltage windings in a series configuration and used a voltage doubler to get about 500 volts of B+. This still left me with 250 volts for the low-voltage circuits. With this power supply, I get 30 watts of carrier output. This is about 65% effeciency, and not too bad for AM and CW.

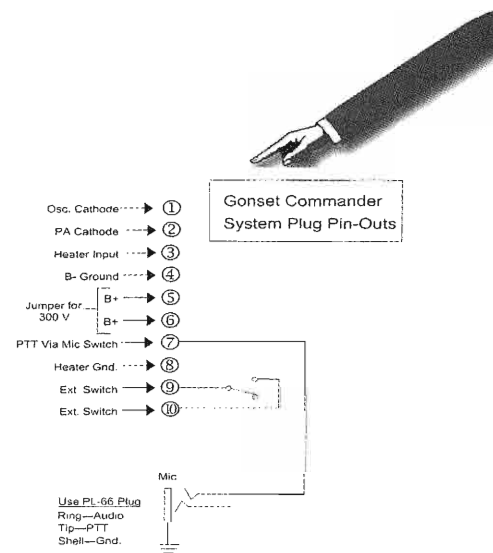
The schematics show how the transformers and diode bridges are wired to get the various voltages which are required by the Commander transmitter. All of the schematics are labeled "A", B", and "C" on the transformer outputs. These go to the basic 50-watt unit with the same letters on the filtering configuration. Then, only the way the diodes are positioned will change the rectifier from a full-wave doubler to the other two types.

Depending on what relays are on-hand, there are many ways to wire the PTT and antenna switching circuits. I hapened to have a 3-pole, 2-throw, 12-volt relay and used it in the low-power version. Also, I used a diode gate to provide a spotting function. When I hit the spotting switch, only the low-level stages are keyed in order to set the VFO on frequency.

In the high-power version, I made the relay take care of antenna switching and muting of a seperate receiver. This was done by isolating the mute contacts through RF chokes. One simple relay provides all of these functions. Notice that in the 50-watt version there is a .01 µF capacitor across the N/C contacts of the antenna relay. This eliminates arcing of the points when the transmitter goes into transmit. In the non-energized position there is a 100k bleeder which helps keep the power supply stable in operation and bleeds off the filter caps when you shut the power supply off.

It turns out that Radio Shack makes a project box which is the exact size to fit under the Commander! It is shown in the parts list, and the Commander looks nice sitting on top of it.

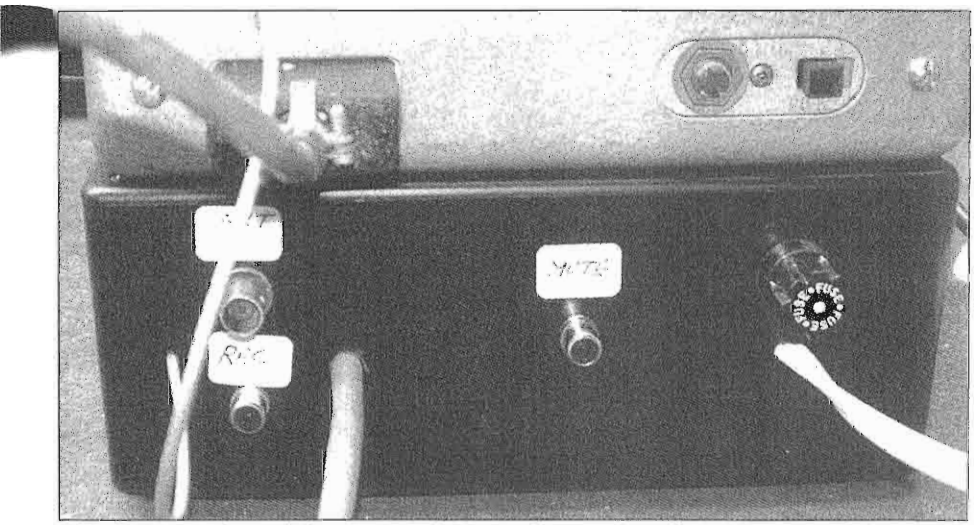
I've made several contacts with the Commander on 75 meter phone, and it has been a lot of fun to use. It is easy to get going and can be made from parts which are commonly available. It doesn't take much time to build and you get a lot of capablilty for your investment.



Parts List for the QRP Commander Power Supply

Part Description	Radio Shack Part Number
100 µF @ 350 VDC	900-2079
470 µF @ 25 VDC	900-1969
.01 µF @ 600 VDC	900-2311
.1 µF @ 250 VDC	900-2289
.022 µF @ 400 VDC	900-2300
1N4007 diodes, 1 kV, 1 amp	900-2875
4PDT relay, 12 V coil	900-2360/275-214
Toggle switch	275-612
Push button switch	275-1548
Fuse holder	270-364
Fuse, 2 amp	270-1023
Project Box for power supply	270-1809
33 µH RFC	9230-56
100 k, 2 watt resistor	900-0866
Transformers: 115/230, 12.6 VCT 2.5 amp	Jameco Electronics P/N 104387CA

Note: If 4-pole relay is used, antenna and receiver muting can be done on seperate contacts.



This is a rear view of the Gonset Commander on top of its power supply box. The system plug is shown in the upper left, and the corresponding pin-outs are on page 20.

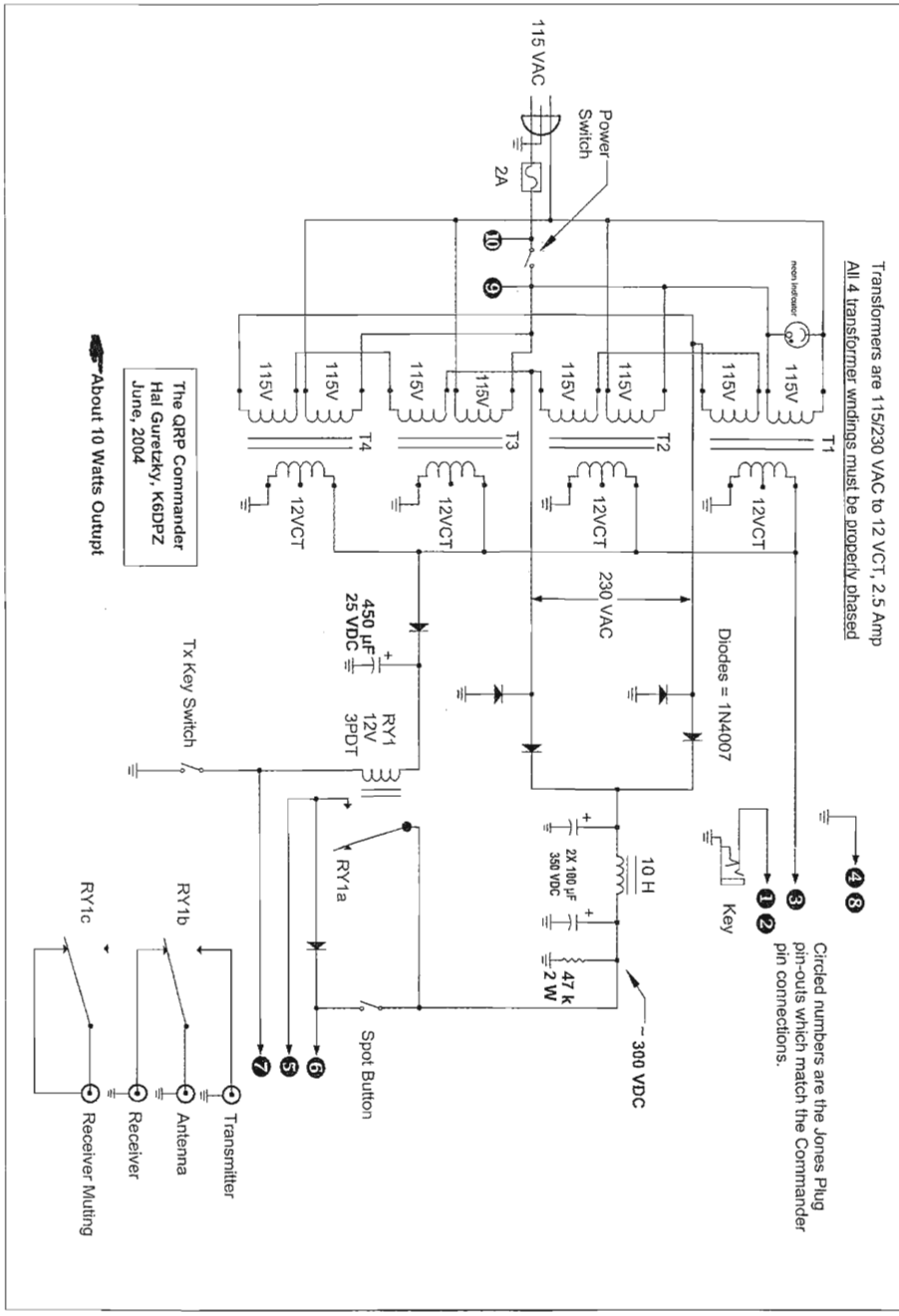


Figure 1: 10-watt version of the power supply for the QRP Commander. This circuit is discussed in the text.

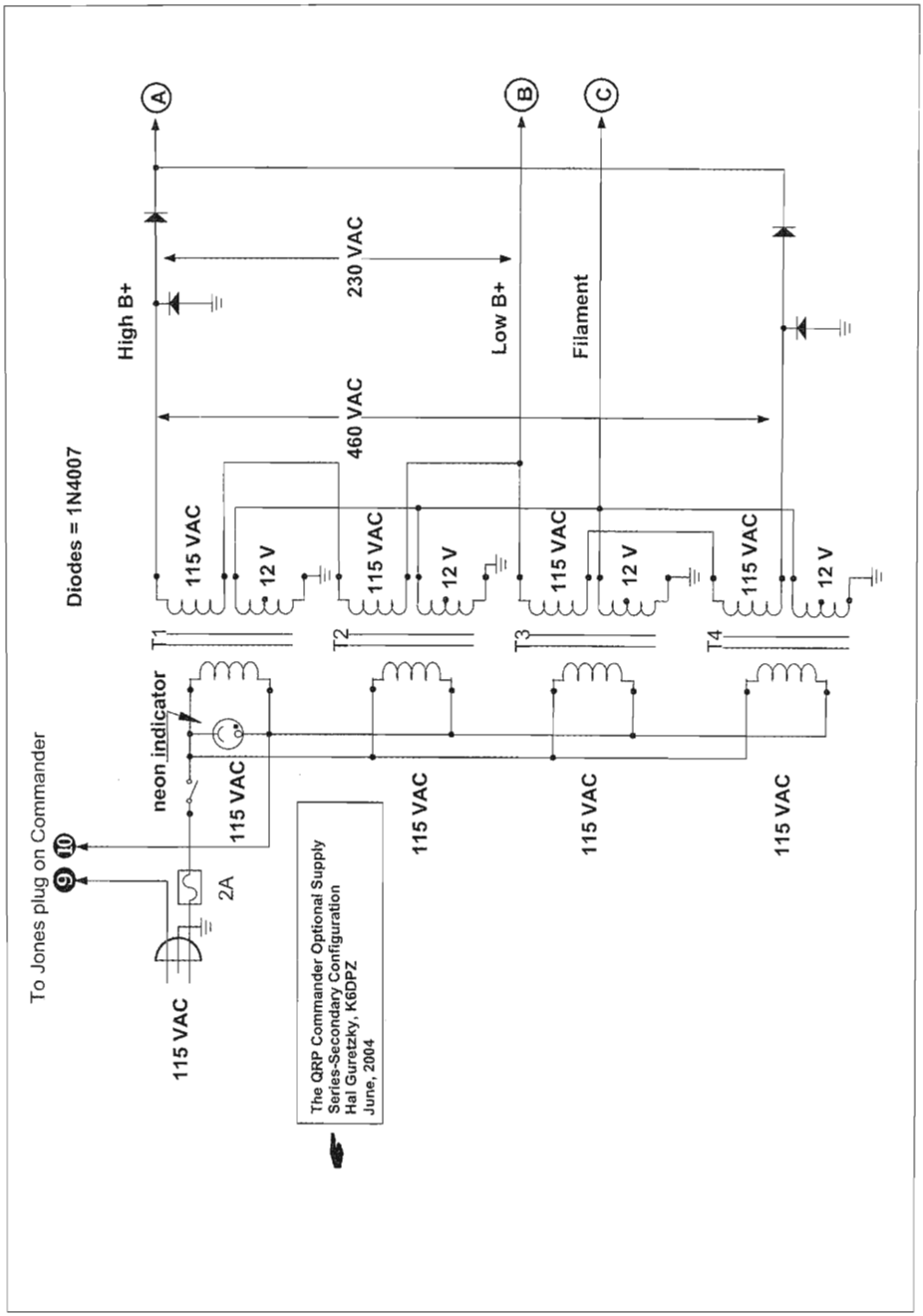


Figure 2: Schematic of the Commander optional supply with a series-secondary configuration. The letters in circles correspond to connection locations on Figure 4.

The Gonset Company ad in QST for March, 1953.

No mobile installation is complete without a genuine Premax antenna!

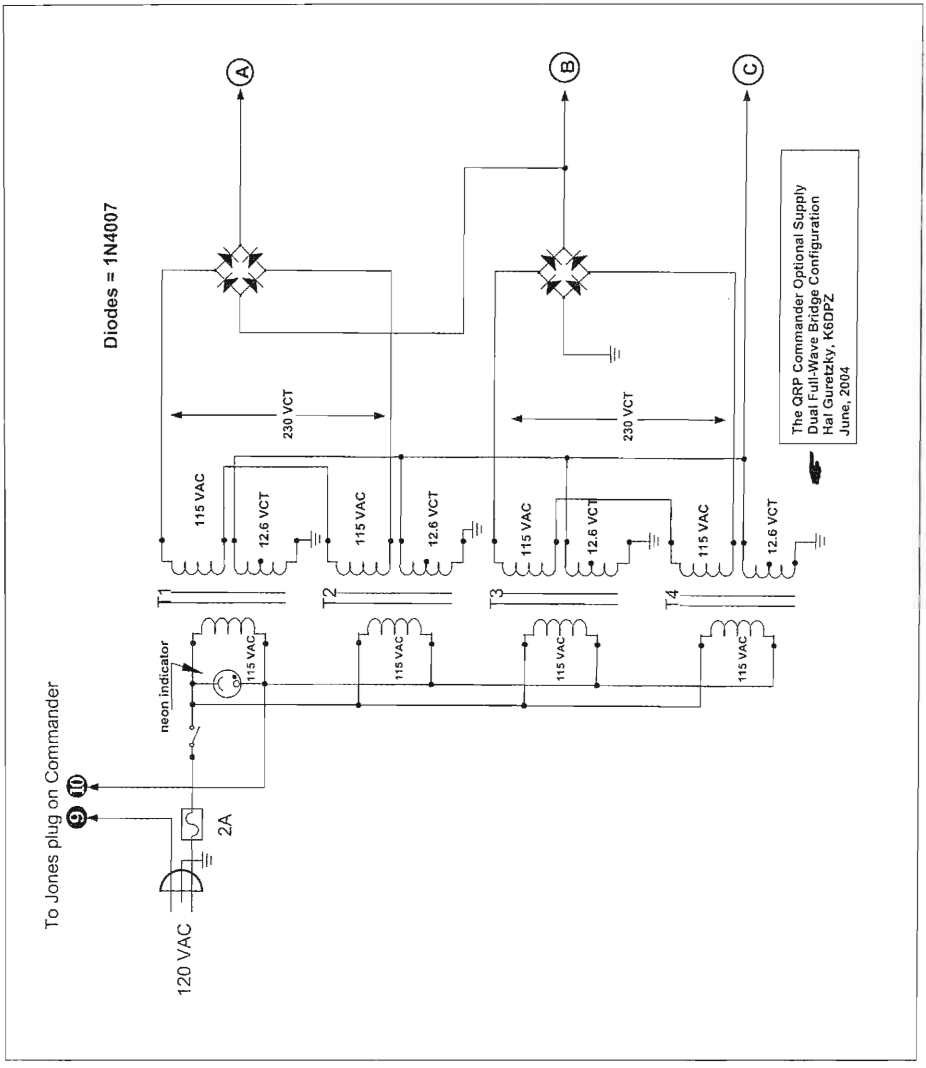


Figure 3: This is the schematic for the dual full-wave bridge configuration. The circled letters correspond to connection locations in Figure 4.

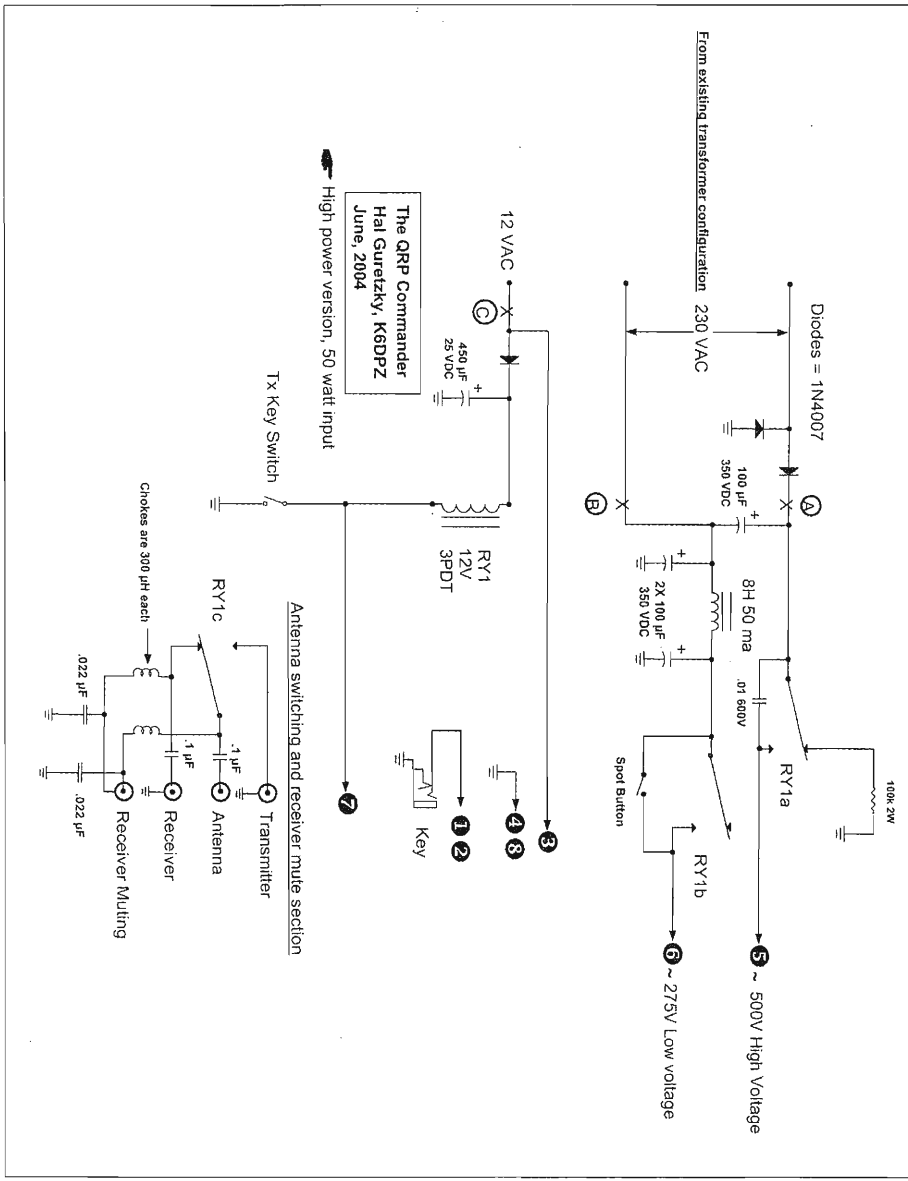


Figure 4: This is the high-power 50-watt version of the Commander power supply. It can accept inputs from the circuits of Figure 2, the series-secondary configuration or Figure 3, the dual full-wave bridge configuration. The choice is the builders option, depending on budget and parts on-hand.

ER

Workbench Audio Monitor

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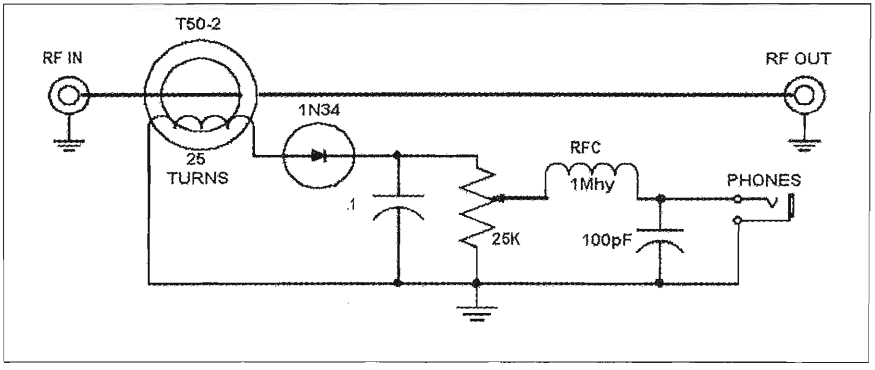
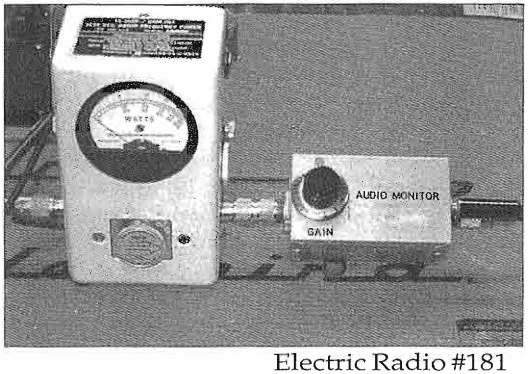
Here's another very simple project that can be built in a few hours with common junk box parts. All my Hi-Tech boat anchor work is done in the famous R&D Laboratory located at the other end of the house. You may think R&D stands for Research & Development but mine is called Repair and Destroy. It was tagged with this name by Dan, N3SMF.

The only audio monitor I had was the Tx-Rx unit (August 2001, ER #147) located in the main Ham shack. Therefore, this little project was developed to use when working on transmitters in the laboratory. It really can be used on any transmitter for hearing your own transmitted audio.

The circuit is self explanatory. The RFC and 100pf capacitor aren't really necessary but were installed to squelch the last bit of RF that may appear on the headphones. Yes, I said headphones. There is plenty of audio power available without the need for an amplifier or batteries. Headphone impedance isn't critical. The circuit will drive a load from 8 to 2000 ohms with no problem. I've used the monitor at all power levels with success, from QRP of 2 watts to the 400 watt carrier of my 813 rig.





The schematic for my audio monitor is just above, and to the left is an illustration showing how simple it was to install the completed circuit in a small minibox and place it on my workbench. Here it is shown in-line with a Bird Wattmeter.

ER

Simple Audio for the R-390A

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Introduction

One of the joys of restoring a R-390A is the process of learning about the radio as you bring it back to the level of performance that it had when it left the factory. Some of us who use the receiver in the shack also tend to facilitate a few harmless improvements along the way that make everyday operation more enjoyable. One worthwhile endeavor is to modify the audio deck so that it plays sweetly into a wide range speaker when you open it up to 8 or 16 kHz. I'm talking about obtaining full-sounding audio; something like a vintage National or Hammarlund would have. This upgrade should take no more than one evening's work and you will not have to cut up the deck or make any radical changes.

The first order of business is to characterize the existing local audio circuit. The specifications claim an output of 500 milliwatts minimum, or 17.3 VAC into 600 ohms with a maximum distortion of 10%. I don't know if you have seen what you have to do to a sine wave to reach 10% distortion, but it is not pretty. A few of my notes, measurements, and methods are described below.

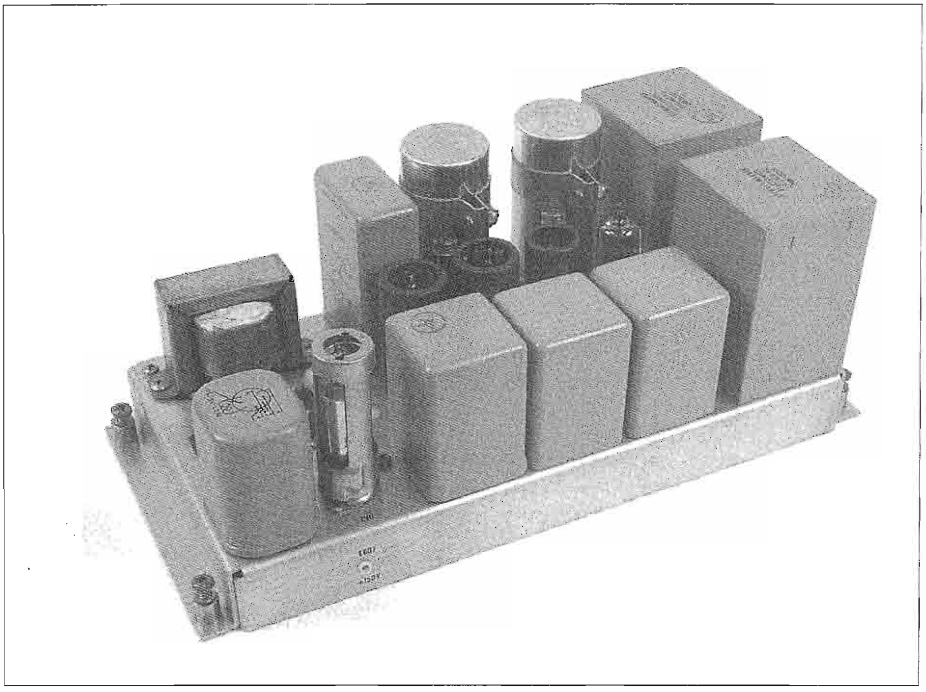
After trying a few things with the stock circuit, I finally realized that it was a no-win situation, gave up on the 6AK6 and turned to the 6AQ5 beam power tetrode. Simply rewiring the socket for the 6AQ5 and plugging one in does not quite cut it, however. A few years ago, in the R-390A AF Deck Notes, it was mentioned that a 6AQ5 could easily be put in place of the 6AK6 output stage, and a few details were discussed. To give credit where it belongs, the best description I have read of a complete 6AQ5 conversion was done by Helmut Usbeck WB2ADT. His circuit is a triode-connection implementation with no feedback and features LED's in a novel fixed bias scheme.

I want to show a best effort in a conventional tetrode implementation using the 6AQ5A with feedback. This circuit will produce hi-fi audio at the 1 to 2.5-watt level (depending upon the transformer utilized). Operation with the stock 600-ohm iron and for small 8-W output transformers is covered. Yes, the military iron can be coaxed to hi-fi at less than 1% distortion and at better than 1 watt out. The design will work fine in the R-390 as well as the R-390A if you use the existing 600-ohm transformer.

AF Deck Notes

Working on the AF deck is a pleasure if you have the maintenance manual for R-390A, TM 11-5820-358-35, and is more challenging if you do not. Testing the stock deck was not as cut and dry as I had imagined. I wanted to look at the entire chain from V601 (the preamplifier) to V603 (the power amplifier), so I lifted R601 and added a 0.047-μF coupling capacitor for my external audio generator. The other input that I found handy was the center or top of the volume control. This worked fine for testing the power amplifier section alone (with V601 pulled).

The measured audio passband was wacky. I thought that I must have been doing something wrong in the setup. I guess I had expected a military range of 300 Hz to 3 kHz or something like that. What I later found out was that production Mod 1, the addition of a 68-pF capacitor C612, was introducing a serious



The completed audio deck shows the location of the new transformer at the upper left side of the chassis.

boost in the range 900 Hz to 20 kHz and this definitely skews the passband at the higher frequencies.

The total gain of the audio chain in my "stock" deck was 47, or 33.5 dB at 1 kHz. Note that this deck had been checked out and .022-µF capacitors had been installed for C604 and C605 and a 10-µF capacitor installed for C609 per the Chuck Rippel Easy Audio Mod. The actual deck –1 dB points were 100 Hz and 42 kHz with a 5-dB peak at 10 kHz!

What was going on? V601A and B comprise a very low gain pre-amplifier consisting of a conventional amplifier and a cathode follower, but with op-amp style feedback. The addition of the 68-pF capacitor across the input resistor causes the high-end boost. Note that the feedback resistor, R602, is only in the circuit in the WIDE mode. The gain of the amplifier is increased during the switch to NARROW apparently to overcome filter losses. When C612 was removed, the passband went back to a normal shape, with the -1 dB points at 100 Hz and 5 kHz. I tested for hum and noise at full gain (pot fully CW) and by shorting my test point input capacitor to audio ground. This removed hum and noise from the IF deck.

Working with the Audio Deck

Now that we know that our AF deck is within Collins specifications, let's take a peek inside. Simply turn the whole radio upside down and remove the bottom cover. Disconnect the two interface plugs and loosen the four green head [captive] screws. Carefully lift the deck, rear first, and pull it out of the chassis. Flip the module upside down and take a look. One fact of life with the audio deck is a lack of space, most notably in the height from the bottom of the chassis to the top. This will limit the size of the components that we can shoehorn in. The component printed wiring board is where most of the action takes place, and fortunately,

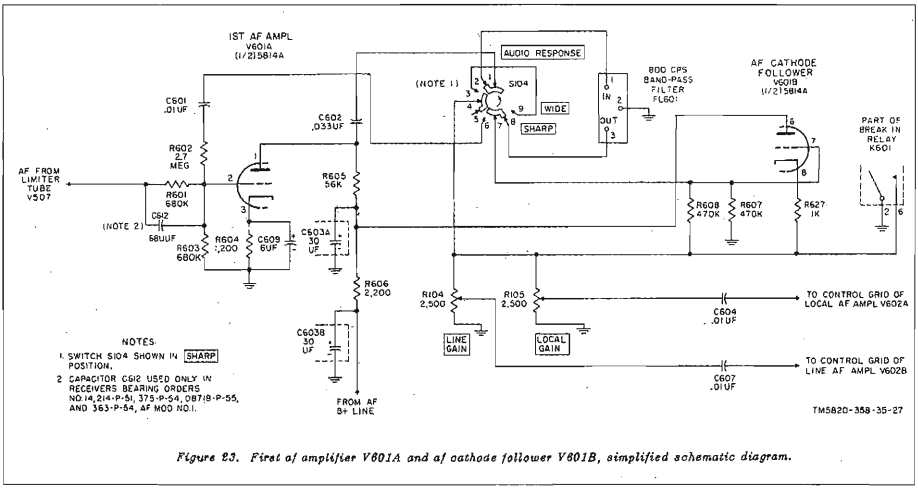


Figure 23. First af amplifier V601A and af cathode follower V601B, simplified schematic diagram.

Figure 1: The local audio system and tubes V601A and V601B.

by removing two screws and hardware, it can be completely accessed. Note: I would suggest doing the complete capacitor replacement and resistor check at this time per Chuck Rippel's instructions. The prescribed .022-µF or .047-µF capacitors will work fine with this conversion.

I have to bring up NTE's Dark Orange MLR series of high voltage Mylar capacitors. They are excellent quality and have a much lower profile than Sprague Orange Drops. Don't forget to check the filter capacitors. And don't be ashamed to add some small filter capacitors of at least 250 working volts DC inside the deck across C603A and C603B. In use, the only discernable hum should be towards full CW rotation of the audio pot and it should be going up and down with the pot rotation. Any residual hum is usually coming from the IF deck. In desperation, the deck can be balanced upside down for servicing and signal tracing, fully powered, and using the existing harness. Use something insulated like a clipboard to temporarily support the deck across the chassis top.

After doing the basics, confirm proper operation of the AF deck in the radio. It is important to start with a 100% working deck before going any further.

6AK6 and the AF Deck

There have been many discussions in the newsletters, both published and online, concerning the 6AK6 circuit and R-390A's audio quality. I will agree that the circuits in the AF deck, which were realized by Collins, are a bit odd. The use of op-amp ideas and three types of feedback, two negative (degenerative) and one positive (regenerative) in the power amplifier is unusual.

Take a look at the schematic of the local audio system in **Figure 1**. V601A and the V601B cathode follower function as a gain variable op-amp with very low gain when the loop is closed. To make a simple audio op-amp you need high input impedance, some inverting gain and low output impedance, hence the cathode follower.

In **Figure 2** we see V602A and V603 working together to comprise the power amplifier system. The power amplifier is not designed to have much gain, either. The choice of the 6AK6 for the output stages in the R-390A did make sense; after all, power amplification is the whole purpose of the tube and the 1-watt rating would seem to be just about right for 600-ohm line level service. You find the 6AK6 in many of the projects in *Editors and Engineers Handbooks* of the early 1950's. It seems to be the preferred min-

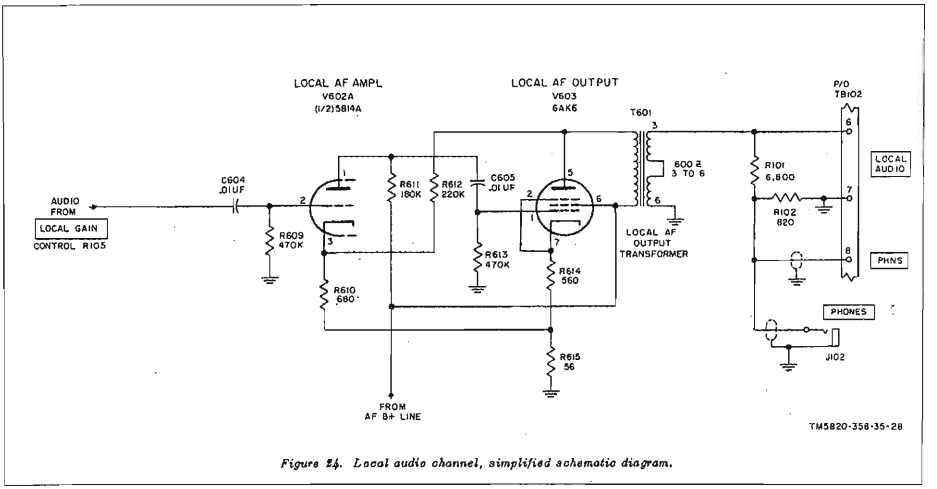


Figure 24. Local audio channel, simplified schematic diagram.

Figure 2: V602A and V603 comprise the local audio power amplifier system.

iature output device used in small receivers at this time. The 6AK6 is a noisy beast however, with a 10% THD at its rated power of 1 watt. It is actually a repackaged 6G6 just as the 6AQ5 is a repackaged 6V6. The 6AK6 has a military pedigree and predates the 6AQ5 by a few years too, being available during WW2. Perhaps Collins was trying to tame the little noisemaker with the clever circuit. I know of at least one amplifier project that specifically uses the 6AK6 as an effects generator for guitar, because of its cool distortion properties!

The 6AQ5

The 6AQ5 and 6AQ5A miniatures (industrial type 6005) were specifically developed for the output amplifiers in 6 Volt automotive radios and AC-operated receivers in a peanut tube size. The "A" suffix is capable of handling more plate voltage and has a controlled heater warm up time; otherwise it is identical to the original. In most circuits, the tube was called on to deliver a modest 1 to 4.5 watts of audio power to a small speaker. It's design maximum ratings, plate and screen voltages of 250 VDC, a 12-watt plate dissipation and 2-watt screen dissipation suggest a tube, which can be abused, or when operated below ratings, should last almost indefinitely. Promised in the 6AQ5 was a miniature that would deliver respectable power with low distortion and with a low part count. It really took until the late 1950's to convince the manufacturers from switch from octal to miniature though. Many shortwave, ham and military manufacturers bought into this tube at this time and put it into such classics as the National NC-190, 303, 400 etc., Hammarlund HQ-160, 170 etc., Hallicrafters SX-111, 115, 117 etc., Drake 2B, TR-3, TR4 and on and on.

Reference Pin Outs

6AK6
1 Control Grid
2 Suppressor Grid
3 Filament
4 Filament
5 Plate
6 Screen Grid
7 Cathode

6AQ5
1 Control Grid
2 Cathode and Suppressor Grid
3 Filament
4 Filament
5 Plate
6 Screen Grid
7 Control Grid

Quick and Clean R-390A Audio Mod
Difficulty – 1 Cup of Coffee

So lets get going and coax some decent audio out of the beast. All we are going to do is remove the 6AK6, clip out C612, rewire the socket for the 6AQ5, remove the positive feedback, install the 6AQ5 and go home. This circuit retains the existing primary-side negative feedback loop and operates the tube in conventional tetrode mode with a bypassed cathode.

Remove V603 (6AK6) from the AF subchassis and discard. Just kidding – seriously, have any of you actually discarded any electronic component much less a perfectly good tube? It just sounds normal when you are writing conversion articles to use words like *discard or cut and strip or remove 5 turns from...*

Remove the AF subchassis from the radio and turn it over, printed wiring board facing up, power resistors to the right. Cut out C612, a 68-pF capacitor that is in parallel with R601 a 680k-resistor going to pin 2 of V601. Don't be surprised if your R-390A does not have Production Mod 1.

Remove the two sets of hardware and flip up the printed wiring board. That's right, the one with all of the new shiny capacitors and resistors on it. I assume that you are already used to dealing with this because you did Chuck Rippel's suggested overhaul.

The socket of V603 should now be accessible. Cut and remove the jumper between pin 2 and ground (or in some receivers this jumper is between Pins 2 and pin 7). Cut and strip the wire that goes to pin 7 and attach it to Pin 2. (See pin out reference)

Add a 10-µF (or larger) electrolytic capacitor across R614, the 560-ohm, 1-watt resistor nearest the end of the printed wiring board. Positive is "up" or closest to the deck wall. This is the 6AQ5 cathode bypass capacitor. Without this, you will suffer a significant gain penalty.

Short R615, the 56-ohm, ½ watt resistor or remove it and add a jumper. If this positive feedback path is not removed, bad things like motorboating may occur, especially with the bypassed cathode on the 6AQ5.

Plug the 6AQ5 (or better yet, 6AQ5A) into the empty V603 socket. No shield is recommended on the tube due to bulb heating.

Reinstall the printed wiring board and the AF subchassis into the radio and test.

Initial Data (Rippel Mods, No C612)

Gain @ 1 kHz: 33.5 dB
Passband to –1 dB: 100 Hz to 5kHz Distortion @ 1kHz: 50 mW 1.4%
Into 600 ohms 250 mW 3.0%
500 mW 4.1%
1 watt 11%
Hum and Noise: 10 mV RMS

Data 2 (6AQ5 Quick Circuit)

Gain @ 1 kHz: 33.9 dB
Passband to –1 dB: 80 Hz to 6 kHz
Distortion @ 1kHz: 50 mW 0.6 %
Into 600 ohms 250 mW1.0 %
500 mW 1.7 %
1 watt 3.0 %
Hum and Noise: 11 mV RMS

Results

This is a good starting point. We now have a little more headroom and the sound is clean through an external 600-ohm to 8-ohm transformer to a speaker. This should satisfy most R-390A users who don't want to change much in the deck. The output power on my radio was better than 1 watt with less than 5% distortion and the frequency response was smooth. One of the problems with using the military transformer in the deck is the 10k primary impedance, which limits the amount of output power you can get out of the tube. A 4k or 5k-ohm primary transformer is a much better match for the 6AQ5. The biasing has not been optimized in this simple circuit either because the cathode resistor R625 (560 ohms) is a bit on the high side. But the R-390A will now drive common bookshelf type speakers with good fidelity using the external transformer.

Simple Audio - A Best Effort Circuit

If you are willing to do just a little more work, we can get the distortion down and the gain and power output up. The

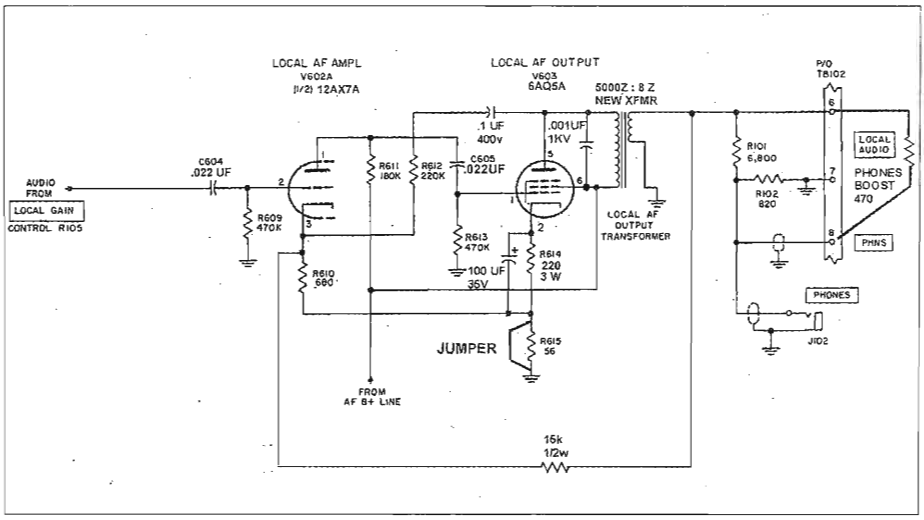


Figure 3: The final configuration with a 6AQ5A amplifier and the new output transformer

5814's can be retained but I wanted to try some lower noise tubes for the preamp stages too. The 5814A is a select military graded version of the 12AU7, which is a fairly noisy device. I suggest replacing the 5814A located in V602 with a 12AX7A. We can use the extra gain of the 12AX7A and it is a quieter tube. The preamplifier, V601, can be replaced by either a 12AY7 (Industrial 6072) or a 12AV7; both of which are quieter tubes than the 5814A. The advantage of these tubes is lower noise and distortion without adding excess gain. We are going for higher fidelity, so starting with a better tube lineup across the board is a good move. We are also going to set the quiescent current in the 6AQ5 higher and increase the value of the bypass capacitor on the cathode. There is 204 VDC available in my radio for audio duty. According to my load line analysis and the data sheet, a grid bias of between 8.5 and 12.5 Volts is called for to set the quiescent current. This should allow the tube to run more than 2 watts of output power. In this final circuit (**Figure 3**), the 6AQ5A is biased with a 300-ohm, 3-watt resistor. This puts the tube into a condition that produces around 27 mA of quiescent Class-A plate current through the tube. You would measure around 10 VDC on the cathode resistor. A 330-ohm, 2-watt carbon is fine as well. This resistor is bypassed with a 100-µF, 35-VDC electrolytic capacitor.

We will also retain the primary-side negative feedback from the Collins design, but add a capacitor in series with the feedback to break up the DC path. I found this to lower distortion. Global (around the transformer) feedback can also be used with this tube, but primary–side feedback is remains a good choice. The obvious advantage of this simple type of feedback is the removal of phase reversal problems associated with the transformer itself and the accidental reversal of the secondary windings and best of all, it's already there. I also added a .001-µF capacitor across the primary of the transformer to discourage ultrasonics.

Install the new 300-ohm, 3-watt resistor (or 330-ohm, 2-watt) and 100 µF, 35V capacitor combination in place of R614, which was a 560-ohm, 1-watt, located at the far right end of the printed wiring board. The positive side of the capacitor is towards the wall.

Solder a 0.1-µF, 400-VDC capacitor in series with R612, or a smaller 220k, ½ watt resistor and install the network in

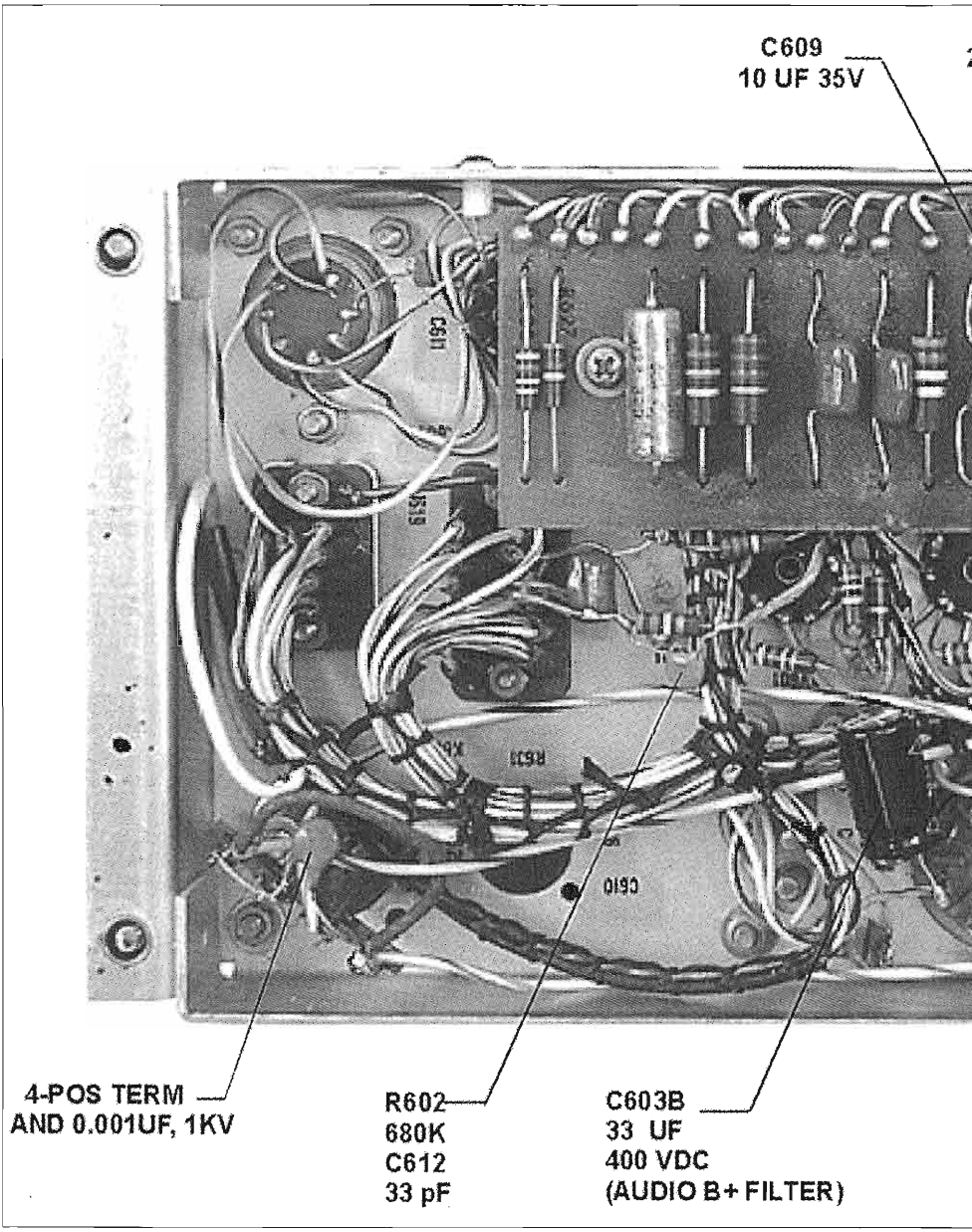
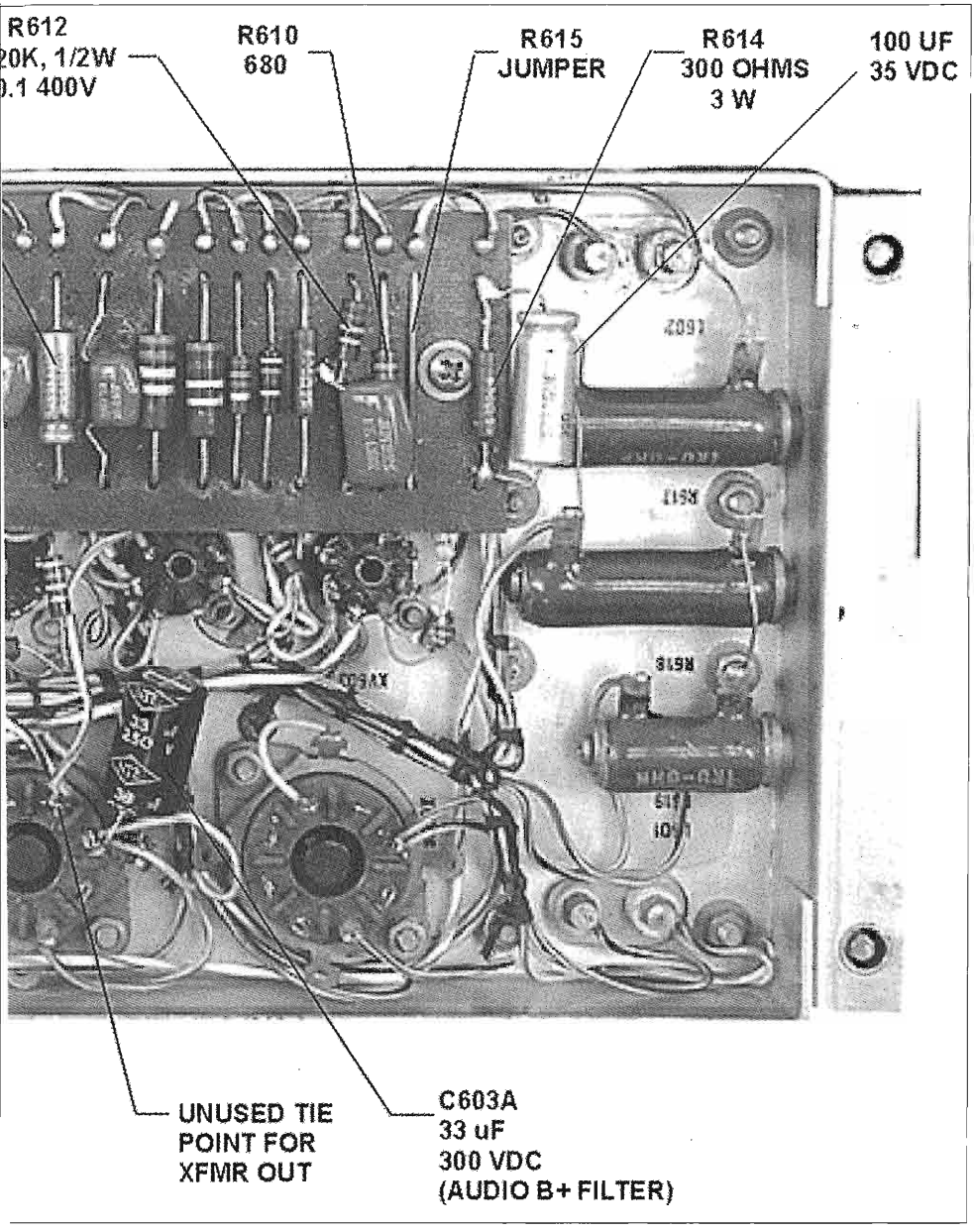


Figure 4: This is an under-deck view of the component locations for the R-390A

place of R612. Add both components on top of the printed wiring board. By the way, do not use a much smaller value capacitor here or you may wind up with a hump in the low end of the spectrum around 60 Hz – not good. This feedback resistor is how you set your overall gain.

Install a .001-µF, 1-kV capacitor across the primary of the transformer. Connect it between terminals 1 and 2.



Simple Audio modifications which can be completed in a short amount of time.

Install a 33-pF ceramic disk across the 680k resistor where C612 was. I told you to take C612 out before and now I'm telling you to put it back in? Yes, it turns out we do need some high-end boost if we want a -1 dB point above 6 kHz. The preamp stage does roll off for some reason. We just do not need 68-pF. I found that 27 pF or 33 pF is about right to extend the high end past 15 kHz without

any peaking.

If you want to continue to use the 600-ohm transformer, you are finished.

Installing a New 8-ohm Transformer

No matter the circuit, most articles suggest mounting the transformer where the squelch plate is located on the end of the chassis. This area was used for the squelch components used in the original R-390 (non-A). Anyway, this area can allow even a moderately large transformer to be mounted like the P-T31 from Antique Electronic Supply. This is a 5-k to 8-ohm impedance, 8-watt transformer and mounts on 2.375" centers. This transformer will give excellent results. Not bad for under $15. WB2ADT suggested the Hammond #125ASE as a good transformer in his article.

Remove the access plate, which covers the squelch tube socket holes. Save the hardware; you can use it to mount the transformer or for adding a terminal strip.

Mount the transformer or at least mark the chassis where you want to mount the transformer. The idea is to try to use existing holes if possible. Drill away.

Secure the transformer to the deck. There are two acceptable methods for connecting the transformer, one is to extend the leads of the transformer using heat shrink and run the wires across the bottom of the deck. The other is to mount a small terminal strip under the transformer and use it as an interface. For the terminal strip idea, use a 4-position (one pin grounded) type. The transformer leads will go to this. Remember, one of the leads (one side of the 8-ohm output) goes to ground. Attach the remaining leads temporarily to the other terminals of the strip. Again, if the transformer leads are long enough, or you extend them, you can get away without a terminal strip.

Remove the mounting hardware and lift up the printed wiring board. This time move the board away from the upper edge, and pull away the harness, exposing the transformer, T601. T601 should be nicely marked as to pin number. Locate the lead attached to terminal 1 of T601 going to pin 5 of V603. Cut and remove this wire or if you prefer, cut it only at the tube pin, but remember to insulate the end. You may want to reattach it some day. Make a connection from pin 5 of V603 to the primary of the new transformer using one of the terminals of the new strip. This completes the plate connection. If you are using the long lead method, run the primary wire across the chassis and attach it directly to pin 5.

Running a new wire from terminal 2 of T601 back to the terminal's strip can make the B+ connection to the bottom of the primary. If you are using the spliced wire method run it across the chassis and attach it to terminal 2.

The last connections are for the speaker output. Cut the wire going to terminal 3 of T601 and thread it back across the chassis to a tie point like an unused pin (pin 2 of C603) on the power supply capacitor octal socket. Make sure you have an unused pin! From this point, complete the connection with a new wire to the last terminal on the new strip. If you are using the long wire method, splice the two wires together and insulate with heat shrink.

The final connection is the other side of the transformer secondary, which goes to ground.

With an 8-ohm connection, you may find that 600-ohm headphone output is somewhat lower. This can be remedied by connecting a 470-ohm, ½-W resistor between terminals 6 and 8 of terminal strip TB102 on the rear of the radio. This tip was from the AF Deck Notes.

Data 3 (Simple Audio 600-ohm)

Gain @ 1 kHz:	39 dB
Passband to –1 dB:	30 Hz to 17 kHz
Distortion @ 1kHz:	50 mW 0.32%
Into 600 ohms	250 mW 0.32%
	500 mW 0.43%
	1 watt 0.58%
Hum and Noise:	22 mV RMS

Data 4 (Simple Audio 8-ohm)

Gain @ 1 kHz:	21 dB (8 ohms)
Passband to –1 dB:	30 Hz to 30 kHz
Distortion @ 1kHz:	50 mW 0.34%

Into 600 ohms	250 mW 0.39%
	500 mW 0.52%
	1 watt 0.70%
Hum and Noise:	2.5 mV RMS

Note: Numbers including distortion include all stages; not just the power amplifier. The 8-ohm data is for a small All-American 5 Style transformer; larger transformers will give better performance.

Results

The R-390A Simple Audio sounds fantastic into hi-fi speakers or into communications drivers with plenty of juice available. Actually, the gain is 5 or 6 dB higher than the stock circuit. Even with a small All-American 5 type transformer, I could get a solid 1-watt out with less than 1% distortion and the frequency response was smooth with no peaking. The -1 dB points were 30 Hz and 30 kHz and even though we increased the gain and bandwidth, hum and noise stayed fairly low. Ultimately, the available plate voltage, and the Class-A1 current you want to run govern the output power. I would say that 2 watts out would be a good number. If we had 300 volts available (I know - this is slightly above the ratings) we could squeeze 4.5 watts out of the 6AQ5.

I hope that this article helps a few more of you to bring out the good sound that is hiding inside the R-390A. Let me know how you conversion goes!

Finally, I had some time to try out some more exotic circuits. Theoretically, all of these should provide benefits if implemented correctly, which may have been my problem! I did not try an ultra-linear transformer but that would be an interesting approach. Anyway, here is a list of what I did try:

1) Fixed bias instead of self-bias on all stages- dunno; I didn't see any improvement.

2) Different values of grid resistor on V602 like 220k instead of 470k; ditto.

3) Different values of plate resistor on V601 – no differences noted other than gain.

4) Feedback around the transformer – better low signal distortion but trouble-some peaking showed up at the extreme high and low ends of the bandpass. The implemented primary-side feedback had a smooth response with every transformer. In my tests I used a 4.7k resistor from the secondary of the 8-ohm output to the cathode of V601. Low signal (50 mW) distortion was less than 0.2%.

5) A series 2.2k resistor between the grid resistor (220k grid to ground) and the grid of the 6AQ5, hi-fi style – no differences observed

6) Add 2.2k 6AQ5 screen dropping resistor, with and without bypass – slight distortion increase at high power levels. The tube may like you better.

7) Triode connection of the 6AQ5 – A 180 connection to the plate. Gain reduction but this idea works fine.

Some of these ideas provided a slight improvement of one parameter or other at certain power levels but no one circuit gave any significant improvements across the board. In other words, if the original 470k resistor works, why change it to a 220k?

References:

R-390A Audio Modifications, By Chuck Rippel, WA4HHG, which can be found at http://www.amwindow.org/tech/htm/r390aud.html

Audio Modification for R-390A/URR Radio Receiver, vze2gmp4@verizon.net which can be found at http://www.geocities.com/husbeck/CONTENTS.HTM

AF Deck Notes can be found at http://www.r-390a.net/Pearls/AF-deck-tips.pdf

A 4.5 watt Single-Ended Amplifier, Radiotronics Magazine, March, 1955

Real Audio For The R-390A, Bill Kleronomos, (KDØHG), ER 42, October 1992

Real audio for the R-390A, Revisited, Bill Kleronomos, (KDØHG), ER 94, February 1997

6AK6 Guitar Amp: http//www.mergili.com/guitar/Boteek.Bijoux.htm

Radio Handbook, 14th edition, Editors and Engineers, 1956

Installment 12

W. J. Halligan
Newspaper Reporter and the State of Radio 1923-1924, Part 5
Amateur Radio State Of The Art, 1923-1925

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Full Outline of Part 5*

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Calling CQ
B. The American Radio Relay League (ARRL) at work
ARRL conventions
Transatlantic receiving tests and contest
1-MO–French 8AB two-way contact
C. The silent period and the crises of interference at every turn
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9. WNP ("Wireless North Pole")
10. Irving Vermilya, 1ZE

***Topics formatted in bold are covered in this installment.**

A. General Happenings

American amateurs are being heard regularly by amateurs in New Zealand over a distance which approximates 3200 miles. All of the English speaking countries are now connected by amateur wireless. [3/15/23]

The station at Massachusetts Institute of Technology, 1-XM, reports that its signals are heard consistently in England, France, and Switzerland. [3/15/23]

We have been asked for a definition of the "ham." A ham is a code enthusiast. The word is probably a corrupted contraction of the word amateur and is used by all non-professional radio telegraphers in describing themselves. [4/16/23]

One of the most thrilling adventures ever recorded in the annals of stormy Lake Erie was the rescue by amateur radio of Harry Holzworth, keeper of the crib in the waters a few miles outside of Cleveland. While Holzworth lay sick with pneumonia, [with] a storm raging outside the steel inclosure, two of his companions frantically sent out a call for help which was picked up by a Cleveland amateur. [4/17/23]

"What's the advantage of being an amateur?" a certain BCL was heard to ask the other day. It was evident from his question that he had never been in an amateur's station.

Take the matter of wall paper alone. There's where the amateur effects a great saving. With wall paper at 10 cents a square foot, 1-BNT figures that he's saved his parents many dollars to date. But he's not the only one: There are thousands of other hams in the country who are getting similar returns on

their investment.

The explanation is simple, Someone out in South Boston hears 1-BNT. They send him a card. Someone else in Saugus hears 1-BNT. Another card. And so on, until all the walls are covered with cards from remote points. [5/22/23]

CQ—Send in your waves, fellow hams. [5/22/23]

The radio Noah Webster, who may be preparing a book of terms and definitions, may well hesitate and include among them the word "Modulascope"—an instrument designed by John L. Reinartz, designer of the famous tuner of that name. John, be it said is known to the "ham" world as 1-QP. His contributions to the radio field have been many and varied. The function of the modulascope is to show visibly whether the output of the tube is real CW. It is the latest radio gem of this amateur whose circuit is known all over the world. A complete description of the instrument will appear in the June issue of "QST." [5/23/23]

Many of the local fans are wondering who it is who is sending out the four Q's and a long dash. John Hays Hammond is as we understand it, conducting some experiments in which he uses a transmitter to send out three wavelengths at the same time. The wavelengths he's now using are 310, 320, and 330. It's interesting to note that his signals come in about three times as loud on the 320 meter or middle wave as they do on either of the other two. His station is still located at Gloucester. [7/24/23]

There don't appear to be many hams on the air after 10:30 these nights. Suppose old man static has a whole lot to do with that. [7/24/23]

We hear that the BCLs are following the lead of the hams in rebuilding their sets for the winter. That's fine business. The best thing we've heard about BCLs is that many of them are learning the code and expect to break out with the rest of the gang when the big transmitting season begins in the fall. [7/30/23]

Although the DX is coming in very QSA lately, there's always plenty of QRN to spoil the fun. [7/30/23]

Realizing that a good part of the present code lessons are getting too fast for some of the boys, AMRAD, WGI has announced that it will change its code program beginning Monday. The lesson period will continue to be 15 minutes in length, but will be split up into three sections to conform to the ability of the listeners.

During the first five minutes the code will be sent at five words a minute; next five minutes speed will be 10 words a minute, and for the last five minutes the speed will be greater. Also during the last period the operator will throw in code abbreviations and such other short cuts as are employed by the high speed radio telegraphers. This is a wonderful opportunity for everybody—those who want to begin code lessons, those who want to go faster and those who want to become active members of the American Radio Relay League. [9/6/23]

The Watertown Radio club expects to resume activities in a week or so. [9/8/23]

Brooklyn High School Radio club will reopen soon. It was learned today. [10/23/23]

Here's a bright idea received from a disappointed, but nevertheless ambitious owner of a five watt transmitter. "Why not," asks our correspondent, "start a list of stations called. We already have lists of stations worked and stations heard, but since no one hears us fellers on five watts, we feel that we should have some recognition, somewhere?" And he adds that he can turn in as big a list as any of them, for everybody he hears, he calls, and he has a pretty good receiver. [10/31/23]

Some good night invite a BCL or two

around to your station and work some DX right in his presence. Because he will not understand the code it will be necessary to use other more convincing means to win him over to the ham point of view. Tell him, then, the location of the distant station which you are working, and at the same tell the opr. on the other end to be sure to send a card verifying the work. When the card is received and George BCL sees that it checks in every detail with the dope he was told the night the DX was done, just watch him become interested. [11/10/23]

Notice the great number of ambitious amateurs using the intermediate "u" in all their calls. [12/14/23]

The amateurs of Greater Boston are soon to know more of their Santa Claus, Tobe Deutschmann. The latest plan of this amiable young man is to turn over part of his new headquarters for use as a meeting place for "hams" who happen to be in Boston during the day. He intends to take over two rooms adjoining his present location, one of which will be devoted entirely to the use of amateurs who may want to get together and work out problems which have been puzzling them. [1/16/24]

Evidence that the Union Radio club of the Y.M.C.U. is in radio to stay is given in the announcement that beginning Monday, regular code classes will be held for club members under the direction of William Colby, a former commercial operator. This feature will be in addition to the regular weekly meetings of the club which are held Wednesday evenings. [1/24/23]

Tobe Deutschmann, donor of the 1000 watt station to the Commonwealth Radio Association, leaves today for Germany, where, among other things, he will dig up more apparatus for the new station. He, incidentally, is going to arrange for the shipment of those tubes which are so highly regarded by local radio men. [2/5/24]

Tobe Deutschmann, who is on the broad Atlantic bound for Germany, is listening in every night while en route for amateur signals. He has promised to let the boys know how they're getting out [2/9/24]

Despite the partial destruction of their meeting place and loss of their apparatus by a recent fire, members of the Union Radio club of the Y.M.C.U., Boylston st., are still "carrying on." The club has been given the use of another room at the Union where meetings, radio lectures, and code practices are held. Two code lessons are given twice each week instead of once as formerly. Members of the code class are rapidly being rounded into shape for examination for amateur licenses. As soon as one member of the club obtains his "ticket" a five watt CW transmitter will be installed and application will be made to affiliate the club with the American Radio Relay League. The Commonwealth Radio Association, another Boston Club, is already associated with the A.R.R.L. [2/21/24]

The radio dance held last night by the Suburban Radio club in Watertown was pronounced a huge success by those who attended. Messages were sent and received much to the delight and mystification of scores present. So successful was the feature that the club is planning something similar for the near future. [3/8/24]

Amateur radio proved itself to be especially beneficial during the recent storm. In addition to Irving Vermilya, 1-ZE/1-XAL, at Mattapoisett, there were others such as Cavalini, 1-RR, Kelly, 1-CPI, and Lang, 1-KA, who rendered particularly meritorious service in bridging gaps where communication had been cut off. The telegraph lines between Plymouth and Boston were crippled for several hours. 1-RR, at Plymouth got in touch with 1-CPI, at Watertown and several emergency messages were exchanged between the

two. Both Lang and Kelley were given permission by Radio Supervisor Charles C. Kolster to operate their transmitters during silent hours. The gap which was created when wire communication was crippled between Boston and Manchester, N.H., was also filled by local amateurs in communication with 1-HM, at Manchester. [3/15/24]

With a portable receiving set located at the bottom of Yosemite Valley, Calif., between 3,000 and 5,000 feet in depth, Kenneth Hughes, amateur radio experimenter, has made some excellent receiving records.

After observations made in a deep cut about seven miles long he has been led to believe that it is possible to hear either waves from great distances despite natural barriers. He has reported amateur stations in all nine radio districts. [3/26/24]

The Tufts College Radio club is certainly stepping out in recent years. Tufts appears to lead all other colleges in this vicinity in amateur radio activities. The station call letters are 1-DZ. [5/3/24]

Calling CQ

Wonder when a whole flock of Hams [will] ever get tired of sending out about a million CQ's? [7/13/23]

Let's have some discussion on the present practice of sending CQ for five or ten minutes at a stretch. Isn't it possible to raise a DX station with shorter calls? Or wouldn't it be better to call three times and sign three times, probably repeating the whole business several times? Let's hear from some of you hams. [10/3/23]

The CQ problem is still a problem, even though the Commonwealth Radio Association failed to pass our motion the other night. Though we stood pretty much alone, we have the consolation of knowing that all the American Radio Relay League officials feel practically the same way we do about it. [11/6/23]

"Say fellows, isn't it about time this question regarding CQing was settled? As it stands we are pretty equally divided 'fer an'agin' it."

The old government regulations call for three calls and three signs. That was fine in the days of spark stuff, and today it may be all right for ship work. But amateurs are mostly spilling CW of one kind or another on the air. And CW sigs are sharp. Naturally, then the CW key pusher has got to stay on the air long enough to be heard. This is agreed.

Now comes the question, "How long is long-enough?" Nine calls should be long enough—but if they are run all in a line, they are too long. So why not simply triple the old regulations for calling; that is, call three times and sign three times, and do this three times? Or it may be that this is an exception to the rule, and two pair may beat three of a kind. Anyway, why not stay on the air as long as you wish, but not merely spill the calls all in a string and only sign three times? Let folks know who you are while you are on the air so they can fasten onto you if a flimsy is on the hook for you [a message ready to be sent in your direction]. Remember, you cannot be spotted by your tone nowadays like you could when we all used spark. [11/13/23]

B. The American Radio Relay League (ARRL) at work

The A.R.R.L. reports that amateurs in the United States and Canada are exchanging messages with amateurs in Great Britain, France, Holland and Belgium. They figure at the league headquarters that more than 50,000 messages are passed through privately owned stations each month. [3/5/23]

John Barrett, 1-VV of South Boston is to be particularly commended for his great work in organizing the A.R.R.L. publicity department in Massachusetts. Barrett, despite the boiling summer suns which usually succeed in luring the wily ham to the beach or the country, has organized a highly efficient

staff of American Radio Relay league members who will work with him in his effort to bring about a more perfect understanding between the ham and the BCL. [5/12/23]

A total of 184,085 messages was the record made by amateur operators of North America during the month of April, according to a report issued by F. H. Schnell, traffic manager of the American Radio Relay league. That doesn't look as if the amateurs were disappearing or falling by the wayside, or anything like that.

Up until a few months ago, most of the ham MSGS were handled by spark transmitters. But the continuous wave transmitter, because of its very evident superiority to the spark, has taken the lead in the traffic field. Of the total number of messages handled, 172,763 were passed along by CW sets and 11,322 by spark.

Nearly 24,000 more messages were handled during April than in March. The best showing was made in the Central Division, with a total of 49,445 messages. The Atlantic Division came next with 38,232. The New England Division, with 141 stations handled 19,496 messages. This represents 260 messages to six spark stations and 19,236 messages to the 135 CW stations. [5-29-23]

A wave of sleeping sickness seems to have swept over the entire state of New Hampshire. Even 1-GR, 1-MC, and 1-ADL, fellows who were always on the job in the past, seem to have deserted their posts. They haven't been heard lately, and until they are, all N.H. traffic must necessarily hang on the hook.

Incidentally, New Hampshire is the only state in New England that we've been unable to locate a branch of the American Radio Relay league publicity department in. Three letters have been sent to addresses furnished us by headquarters at Hartford. Two of the letters returned—unclaimed. The third fellow forgot to answer. We wrote him three months ago. [7/27/23]

HQ at Hartford says that 1-AQG doesn't live where he says he does. Clarence, who signs RD at 1-VV, says he does too. Which leaves us in somewhat the same position as we were in when we met a war vet who had been reported dead, but who told us confidentially that he wasn't. [8/14/23]

It is said that one of the purposes of the newly formed A.B.C.L. [Association of Broadcast Listeners] is to give the BCLs an organization similar to the American Radio Relay league, "as the majority of amateurs are not particularly interested in the BCL and the ordinary fan is not welcomed into their fold." Nothing could be further from the truth. A statement like that has the stigma of commercialism all over it. The American Radio Relay league is a strictly non-commercial organization. It is devoted exclusively to the interests of amateur radio. A knowledge of the code is not essential to membership. Everyone who is in radio for the fun that is in it is welcomed to membership in the ARRL. [8/14/23]

1-BES and 1-KX, two of our American Radio Relay league state news managers, have kicked in with excellent reports, thus showing beyond a shadow of doubt that interest in Radio is picking up in great style. But no one ever questioned that. [10/12/23]

We'll say 1-KX is one active member of the American Radio Relay League. In addition to being news manager for the state of Maine, he maintains an official relay station and is a district traffic supervisor as well. He also keeps well up on the list of message handlers. So far this month he has handled nearly 175, which would indicate that we can look for his call in the list of Brass Pounders in the next issue of QST. [10/13/23]

While everybody appreciates the ex-

isting high caliber network established by the American Radio Relay League for the handling of radio messages, no one will deny that there is room for improvement, especially in the vicinity of Boston. For this reason the more powerful stations around greater Boston are urged to establish schedules as soon as possible and notify Secy. Croucher of the Commonwealth Radio Association. [11/1/23]

Because of the press of school and other business, Warren Atwood, of New Haven, Conn., our news manager for the headquarters state is forced to tender his resignation. Would like to hear from more American Radio Relay league men who would like to help in perpetuating the name of the league and the hams who are its members. Atwood was one of the best men we had, and a real live one will be necessary to properly fill his place. [11/9/23]

1-VV worked Oklahoma City and his sigs were reported very QSA. Jawn and his gang of operators are now awaiting word from President Coolidge relative to the opening of the radio show, Dec. 3. The message to the President was put through to Washington without a hitch. Which clearly demonstrates the value and the effectiveness of the American Radio Relay league system of communication. [11/22/23]

Everyone should keep a sharp lookout for that message from President Coolidge which is to come over the lines of the American radio Relay league and which will open the Boston radio show Monday. Let's do a good job on the msg., gang, for it means a lot for the Commonwealth Radio association and for the ARRL. [12-1-23]

It may be interesting for local radio fans to know that the American Radio Relay league is now engaged in experiments to determine whether a radio antenna actually attracts lightning. The experiments hope to show to what extent one's property and life are endangered by the erection of an antenna with the commonly approved ground connection. The league officials also expect to learn the effectiveness of lightning arrestors now employed by transmitting and receiving amateurs. [12/14/23]

Hiram Percy Maxim, president and founder of the American Radio Relay league, is scheduled to be the speaker of the evening at a meeting January 7, of the Thomson Radio club of Lynn. The meeting will be held in the General Electric hall at 7.p.m. Mr Maxim will be introduced by Dr. Elihu Thompson, honorary president of the club. [12/29/23]

The Harvard Wireless club, using the call letters, 1-AF, is the latest Greater Boston station to communicate directly with European stations. Early the other morning operators of the Harvard club exchanged messages with amateur radio stations in England. No difficulty was experienced by operators on either side of the Atlantic at any time during the communication. Amateur radio men, members of the American Radio Relay league are certainly making history. [2/21/24]

Wonder how many of the local amateurs, members of the American Radio Relay league, entered the "Hams for Hams" contest held by the Crosley broadcasting station, WLW last night? [2/29/24]

Tomorrow is the big night of the Suburban Radio club, Watertown, when they will hold the first radio dance given in this section. All members of the club are ardent radio fans, most of them members of the American Radio Relay league. Arrangements are being made at the dance to receive messages and music from stations throughout the country. A booth will also be installed at the hall where messages may be filed for delivery to all parts of the world, after transmission over the

American Radio Relay league system. [3/6/24]

The American Radio Relay league again proved its worth when the storm crippled all lines of wire communication. Particularly in the outlying districts, transmitting amateurs came to the aid of railroads and forwarded messages to train arrivals and departures until repairs were made on the land lines. [3/13/24]

It is certainly gratifying to observe the splendid spirit of co-operation shown by the radio amateurs hereabouts when it was announced that their hours of operation were to be curtailed another hour. Much as the "ham" delights in passing messages to other members of the American Radio Relay league, and although he realizes that in so doing he causes little or no interference to broadcast listeners who listen on much higher wave lengths than those used by amateurs, he has submitted to the ruling of the Department of Commerce with never a plaint. It is a tribute to the American Radio Relay league, that great organization of real radio men, which has done so much to place the United States in a position of world leadership on things radio. [5/7/24]

[Next month, Bob will contiue Part 5--Ed.]

ER

AM Calling Frequencies

160 meter band: 1885, 1945 kc
80 meter band: 3870, 3880, 3885 kc
40 meter band: 7200, 7290 kc
20 meter band: 14.286 Mc
15 meter band: 21.400 to 21.450 Mc
10 meter band: 29.0 to 29.1 Mc
6 meter band: 50.58 Mc
2 meter band: 144.450 Mc

[Editor's note: Please send in your updates and corrections to the calling frequency list. I'd like to keep the frequencies as accurate as possible. Many newer AM'ers are not familiar with the traditional gathering spots.]

To Join AM International, send $2.00 to AM International, PO Box 1500, Merrimack, NH 03054. AMI is our AM orginazation and it deserves your support!

An on-line, searchable index to the entire 15-year history of Electric Radio Magazine may be found under the "links" tab at www.ermag.com or at Don Buska's web site: www.qsl.net/n9oo/ersearch.html

Audio Circuit Design in the R-390 Receiver Family

By Ray Osterwald, NØDMS

The audio output circuits found in the present-day R-390A receivers were originally developed at the Collins Radio Company during 1949 for the combined R-390 and R-389 development project. N.E. Houge was the engineer in charge of the audio design work, and he invested 3000 hours in this phase alone. Houge also did design work on the power supplies. The first R-390 was delivered January 1951, and the first R-389 was delivered March 1951.

The thing to know about the audio output circuits is that although designed at the Collins Radio Company, the circuitry had to meet a set of U.S. Signal Corps performance requirements outlined in their SCL-1134-B specification. This document resulted in Development Contract W36-039-SC-44552, which was awarded to Collins for simultaneous development of both receivers.

The general design goal of the audio unit was to provide the required power output within the specified distortion limits with a minimum power drain. The first audio stage used ½ of a 12AU7 with an unbypassed cathode so as to reduce distortion and allow a greater grid input voltage swing. This was important because the tube operated directly from the detector with no intervening audio gain control and could not be allowed to saturate. The overall gain specification was such that a 200-µV RF input signal should produce 7 volts at the detector, or 91 dB gain. The receiver was biased so that the last IF tube would overload *before* the first 12AU7 audio stage would begin to draw grid current.

Local Audio Channel

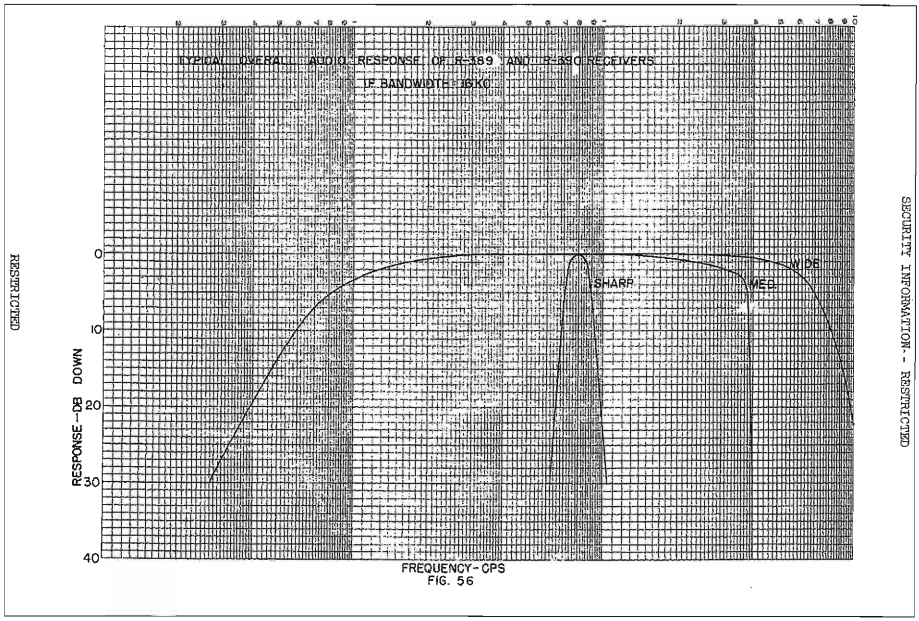
The local audio gain control fed voltage to ½ of a 12AT7, the second audio tube. The 12AT7 plate was coupled to a 6AK6 output tube. Negative feedback was used from the 6AK6 plate to the cathode of the 12AT7, *not* to improve audio fidelity, but to reduce the output impedance to meet Signal Corps specifications!

Now, Murphy's Law of Unintended Consequences enters the story. The negative feedback that Houge added reduced the output gain too much. To bring the gain back up enough to meet the output level specification, a small amount of positive feedback was introduced by making a small fraction of the cathode resistors of both tubes—the 12AT7 and 6AK6—common to both tubes. The effect of the positive feedback was to cancel the negative current feedback developed across the 12AT7 cathode, and to raise its gain. The 12AT7 and 6AK6 were Signal Corps "preferred types," and that's why they are in the circuits.

The original local audio output specification was at least 500 mW at less than 10% total harmonic distortion (THD) across 600 ohms at a test frequency of 400 cps. As originally designed, the local audio channel was producing 3% THD at 10 mW out. Any significantly higher output power greatly increases THD. 10 milliwatts is not much output power without using a very efficient speaker system.

Line Audio Channel

The line output channel uses the same 12AT7-6AK6 configuration. In order to keep the input voltage about the same for the rated output on both audio output channels, the plate resistor for the 12AT7 line output tube was reduced to 82k. Nothing changes without affecting something else, so the resistors controlling positive and negative feedback



Audio frequency response plot of the first R-390, S/N #1.

had to be changed so that the *output impedance* was the same for both channels. Originally, the 6AK6 line output tube was triode-connected for lower distortion. The Signal Corps changed the design requirement on the line meter network so that a –10 dB position was called for. That resulted in a 10 dB waste of power, and another 4 dB waste to make the meter read correctly! This change resulted in a new maximum of 5% THD. When the Signal Corps added the requirement for a –10 dB position on the line meter switch, the 6AK6 had to go to a full pentode connection in order to make up for the new 10 dB loss. But, between the line output transformer and the line output was a 14 dB pad. By inspection of the log ratios, when 10 mW is delivered to the load, the tube is actually delivering 250 mW!

The intent of this discussion is to point out that Collins was designing to Signal Corps specifications, and that the Signal Corps was not interested in faithful higher-power reproduction of music at 8 ohms.

References:

Lou Couillard, Final Engineering Report on Radio Receivers R-389 and R-390, Collins Radio Company, September 15, 1953, Declassified May 8, 1985

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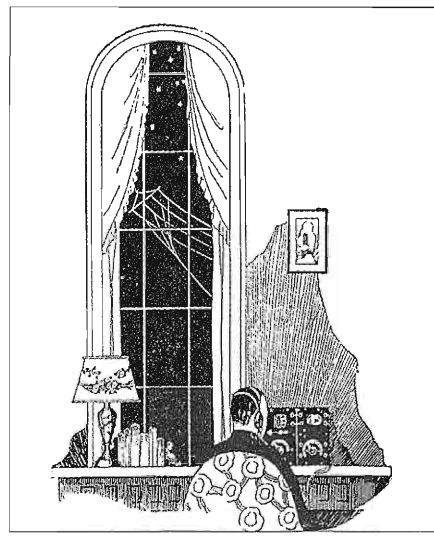

VINTAGE NETS

Arizona AM Nets: Sat & Sun: 160M 1885 kc at sunrise. 75M 3855 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 Mike (N8ECR), with alternates. The net is all about classic 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).

Heathkit Net: Sunday on 14.293 mc 2030Z right after the Vintage SSB net. Listen for W6LRG, Don.

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 1900Z-2030Z 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 Brian (NI6Q), Skip (K6LGL), 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).

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FOR SALE: Stancor P6469, 25.2V-1A, 4 ea, new, $16 lot + shpg. Henry Mohr, 1005 Wyoming St., Allentown, PA 18103

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FOR SALE: Amplifiers: Realistic stereo receiver, M-STS-77 AM/FM a/o has pwr @10 $50.00, TOA, 900 series amplifier, M-A-901A (TOA Electric CO. Japan) clean @9, $50.00. Battery Eliminator, power con, M-6BE10, 6volt dc 10 amp max w/ volt and ampere meters (weighs 14#) mfr by Cornell Dublier Elect. Corp. $45.00. Bernie Samek, 113 Old Palmer Rd., Brimfield MA, 01010, 413-245-7174, FAX 0441.

FOR SALE: Heathkit HR10B in very good condition $75 plus shipping. W9KV, 970-247-5563, jimscott@bresnan.net

FOR SALE: Eico electric keyer, model 717 w/manual, real nice, $100 + shpg. Jim, KB8RIT, 906-293-3318

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FOR SALE: Books. Electronics Laboratory Manual, $14.00. Essentials of Electromagnetism, $20.00. Electrodynamics, $25.00. Ross Wollrab, 229 N. Oakcrest Avenue, Decatur, IL 62522-1810. 217-428-7385. REWollrab@aol.com

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FOR SALE: ARRL handbooks 1990 prices. LSASE for list, must sell. Electronics manuals two-way, NOT COPIES. Operating and service for GE, RCA, Motorola and others. LSASE for list. W9MHS/Ø, 1910 Remington Ct., Andover, KS, 67002, 316-733-1856

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feltondesign@yahoo.com

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FOR SALE: National HRO-60, collectors excellent, NBFM adaptor, xtal calibrator, speaker, 10 coils. $800 pickup. Tom Raymond, W5JM, 2320 South "O" St., Fort Smith, AR 72901, 479-783-8848, w5jm@sbcglobal.net

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FOR SALE: Heathkit signal generator model G5, antique, and it still works. $25 plus S&H. Also Galena crystal radios and parts to make your own, free lists. Write or email to: Len Gardener, 458 Two Mile Creek Rd., Tonawanda, NY, 14150. email: radiolen@att.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

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FOR YOUR MUSEUM. For your rare tube collection. Uranium glass Jennings "Peanut" fixed capacitor. Still in original 1944 box. Unused "mint" condx. Glows bright green under your UV blacklight. $20 postpaid, free info. Bob Ryan, 1000 S. Gilbert St., Apt 132, Hemet CA 92543-7065

LITERATURE 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

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

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

JOHNSON PARTS 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

ACCESSORIES 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

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

DRAKE SERVICE 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.

BOOK FOR SALE: Heath Nostalgia, 124 PG book contains history, pictures, many stories by longtime Heath employees. (See ER Bookstore in the rear.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028

TUBES FOR SALE OR TRADE: Transmitting/ Receiving tubes, new & used. $0.55 & LSASE for list. I collect old & unique tubes of any type. **TUBES 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. 128th Terr. Overland Park, KS 66213. PH: 913-782-6455, Email: jhwalker@prodigy.net

TREASURES 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

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

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

PARTS 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. 631-653-5350

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

ACCESSORIES 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

PLANS 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

PARTS FOR SALE: Parts, tubes, books, ECT. Send two stamp SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761 letourneau@wiktel.com

SERVICE 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

ACCESSORY 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

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

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

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

TUBES 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

SERVICE 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

ACCESSORY 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

PARTS 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@wmconnect.com

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

SERVICE 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

COLLINS PARTS 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: Top dollar paid for WWII radios, PRC-1, PRC-5, AR-11, SSTR-1, SSTR-5, British B2, need pts for PRS-1 mine detector. Steve Bartowski, 708-863-3090

WANTED: Skirted knobs for Hallicrafters SX-71. Jim Kelly, PO Box 25, Long Lane, MO 65590.

WANTED: CD 200V, Drake R-7A, working condx. Dennis Gehrke, KC7VXD, 1035 Warm Springs Ave, Boise ID, 83712. 208-333-8615, kwmssb@cableone.net

WANTED: National NTX or NTE transmitter and HRO 5TA1, and condx or parts. Will consider all. Thanks! Bruce, W1UJR, 866-EURO-SPEC or w1ujr@brucehowes.com Portland, ME 04102

WANTED: Classroom demonstration radio board with working AC/DC tube type radio for our radio club. Contact Mike Grimes, K5MLG, 3805 Appomattox Cir, Plano TX, 75023, 972-867-6373, email: grimesm@flash.net

WANTED: SW-3 coils. Both bandspread and general coverage. John, WA8FNJ, 419.287.4561 or jhgindle@wcnet.org

WANTED: TBV headset & mic, AC or DC power supply. Ken Kolthoff, K8AXM, PO Box 215, Craig MO, 64437, 913-634-3863.

WANTED: RCA/Radiomarine T-408/URT-12 xmtr/info. Sam, KF4TXQ, PO Box 161 Dadeville, AL 36853-0161 stimber@lakemartin.net 256-825-7305 "Life is another radio."

WANTED: RCA communications receivers, ACR-175, ACR-111, CR-88, AR-8516, CRM-R6A, SRR-13. Dan Gutowski, 9753 Easton Rd, Dexter MI, 48130. 734-718-7450, dg16ms26@msn.com

WANTED: For SCR-178: Generator GN-37, Insulator IN-85, lamp LM-18, Insulator mounts, leg supports, other parts. Robert Forte, 518-696-2400, rvforte@frontiernet.net

WANTED: Knight Span Master regens. Hajime Suzuki, Nishikuniyoshi 1644-24, Ichihara-Shi, Chiba-Ken, 290-0231 Japan.

WANTED: Still need #33A and #35 coils for Universal SW-3 for cash or trade.

Hank Bredehorst 2440 Adrian St Newbury Park CA 91320. 805-498-8907 quailhill@earthlink.net

WANTED: Hallicrafters SR-2000 Hurricane XCVR. Contact me if you OR a friend has a SR-2000. Mark, WB9QZB@AOL.COM, 847-774-2937.

WANTED: Hallicrafters external S-meter for S-20R. Joe Whisnant, 1233 Newcastle Way, Maryville, TN 37803, 865-977-9024

WANTED: References to articles written on AN/PRC-6 Handie-Talkie, and instruction manual, June, 1951. Louis L. D'Antuono, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

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

WANTED: International Crystal T-12 Transmitter or just a schematic if you have that - any condition. Please contact me via license address or via http://AF4K.COM - thanks, Brian AF4K

WANTED: A Collins R-389 LF receiver to complete my SWL shack. Dan Gutowski, 9753 Easton Rd, Dexter MI, 48130. 734-718-7450, dg16ms26@msn.com

WANTED: Plugin coils for 80 meter band. Made by Insuline Corp. of America. Variable capactor inside the coil which measures 3"/1.5", 5 pin. Bob WBØDMC 507-331-5103. rspeck@hickorytech.net

WANTED: For ART-13: DY-12, DY-17, or DY-17A, K-101. Bill McCaa, KØRZ, 303-499-1936, billk0rz@aol.com

WANTED: Please, help me in my NC-183D restoration. Need: S-meter, knobs, toggle switches, bottom covers, L40, T12. If needed, have contact in USA for shipping purposes. NC183D Winter Project: http://jvgavila.com/nc183d.htm. Thanks! JOSE eb5agv@ctv.es

WANTED: Scott Special Communications rcvr. EA4JL, please call Kurt Keller, CT, 203-431-9740, k2112@earthlink.net

WANTED: Technical Materials Corp. model DCU combiner, DVM monitor, LPP patch panel, LSP speaker, DCP power panel VOX V.F.O., CFA converter, and PSP-1 power supply. K8CCV, Box 210, Leetonia, OH 44431-0231, 330-427-2303.

WANTED: ANY Harvey-Wells speaker, aircraft unit, or military surplus component. Will answer all. Kelley, W8GFG, 9010 Marquette St., St. John IN, 46373, 219-365-4730

WANTED: SCR-602 components, BC-1083, BC-1084 displays, and APS-4 components. Carl Bloom, 714-639-1679

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: James Millen coils 42080, 42040, 42015, 43015. Navy SE2511/SE2512 receiver, SE2513 coil set. Gary Carter, WA4IAM, 1405 Sherwood Drive, Reidsville, NC 27320. Phone: 336-349-1991. Email: gcarter01@triad.rr.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: 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: Looking for the emblem of National "NC". Katsu JO1GEG/ex.N8EYH, khirai@ieee.org

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: 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: 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

NATIONAL 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

WANTED: QSL card from my Grandfather, W9QLY, from before 1957. Also seeking original National Company logos from Ham or military equipment. Don Barsema, KC8WBN, 1458 Byron SE, Grand Rapids, MI 46606. 616-451-9874. dbarsema@prodigy.net

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

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 Wailing 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: 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: 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

HEATH 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: JOHNSON RANGER CABS & or BEZELS. Or the whole cab set. Dee Almquist, W4PNT w4pnt@w4pnt.8k.com 540-249-3161 (msg). Cell: 540-480-7179 Virginia. Willing to trade.

WANTED: VLF coils H & J for HRO-50. Jack Hemp, 937-548-4110

WANTED: Westinghouse MW-2 Transmitter (RF Unit, Modulator, Power Supply, Coils, Transformers, Parts). Will pickup anywhere. Gary, WA4ODY, Seabrook, TX. 281-291-7701, myctpab@earthlink.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 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.

Purchase three or more videos and get 10% off of the retail price!
Add $5.95 each for the first two videos for shipping and handling in the USA, additional videos are shipped free.

Produced by Floyd Soo, W8RO (ex-KF8AT)

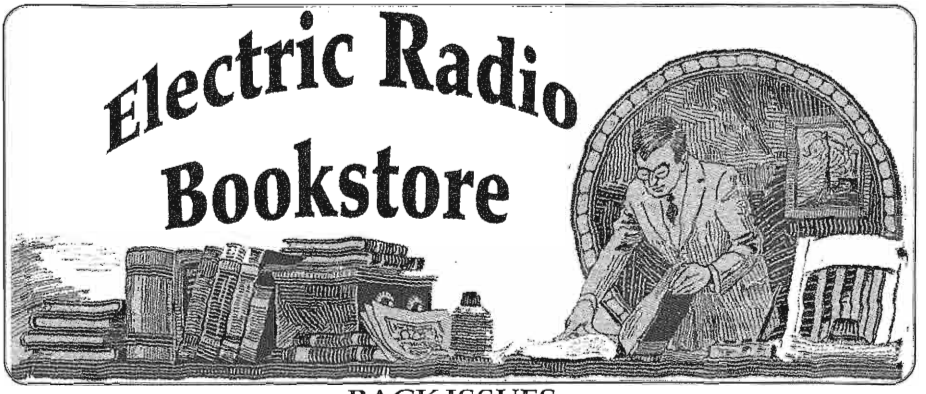
ER BOOKSTORE, PO BOX 242, BAILEY COLORADO, 80421-0242
Now Available on-line at WWW.ERMAG.COM

WANTED: Repair and alignment services for NC303, G76, and DX100B. No restoration. Must be within EASY driving distance of Rockville, MD. Tom Long, W3ONE, 5308 Manorfield Rd., Rockville, MD 20853. 301-460-9299 or TLLONGSR@JUNO.com.

NOTICE: Expert HRO-500 alignment done with modern test equipment (HP, TEK, etc.) www.nortrex.net or nortrex@bigplanet.com.Ph. 650-529-9180

FOR SALE: Collins 300G on 1885 and 1925 KHz, VGC, $1500. TMC GPR-90RX, $600. Gary, WA(MZU, 209-286-0931 or ghal@ix.netcom.com

Wanted to Buy: Issues of copies of the Collins Journal. Also copies of the CCA's Technical Data Sheets, especially A97-001. Thanks, Gary Fender, W5UUO, 931-243-5323, gna@twlakes.net



BACK ISSUES

All Electric Radio back issues are available at $38.00 per year (or any 12 issues), or $3.75 for individual copies. Buy the entire run of Electric Radio from #1 for **$350,** a 46% discount. **Special deal on any four years (or any 48 issues): $100.00.** These prices include delivery by media mail in the USA. Foreign orders please inquire for shipping rates.

COMPENDIUMS

Collins 75A-4 Modification Compendium: All the factory modification bulletins from Collins Radio Co., and all the articles printed in CQ, Ham Radio, QST and ER over the last 45 years, 85 pages, **$20.00 plus $4.00 S&H.**

Collins S-Line, KWM-1, KWM-2, KWM-2A Service Modification Compendium: 260 pages, **$45.00 plus $5.00 S&H.**

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

BOOKS

A. Atwater Kent, The Man, the Manufacturer and His Radios: This 108 page paperbound book describes Atwater Kent's biography, and his rise from a saleman and inventor of electrical equipment to become one of America's foremost radio manufacturers and a household name. There are historic photographs and diagrams on nearly every page, and color plates with vintage AK advertising, by Ralph Williams and John P. Wolkonowic. **$25.95 - 10% = $23.35**

A Pictorial History of Collins Amateur Radio Products: Jay Miller's (KK5IM) classic volume describes the amateur radio products produced by the Collins Radio Company. It has high-quality historic photographs on nearly every page, and the text is backed up by Miller's personal research. ---------- **$39.95 - 10% = $35.95**

A Family Affair, The R.L. Drake Story: The complete story of the R.L. Drake story, as told by John Loughmiller, KB9AT. 273 pages all about the history of the company, product descriptions, technical repair tips, and great shack photos make a must-have volume for Drake users and collectors. *This book is no longer in print and sales are subject to stock on hand.* ---------- **29.95-10% = $26.95**

Arthur Collins, Radio Wizard: 394 pages by Ben Stearns tell Arthur Collins biography from his early years until retirement. Steams is a professional journalist and was employed by Collins from 1962 to 1977. Many historic photographs and stories from former employees. ---------- **$18.95-10% = $17.05**

Miller's Collecting Science and Technology: 160 pages of high-quality color photographs from museum collections make this hardback volume an excellent introduction to this new collecting field. Written by Lindsay Sterling ---------- **$29.95-10% = $26.95**

Communications Receivers, The Vacuum Tube Era: 1932-1981: This is the classic136 page volume that has much invaluable information about vintage receivers in one handy volume. By Raymond S. Moore, 4th edition ---------- **$19.95-10% = $17.95**

***NEW!* Heathkit, A Guide to Amateur Radio Products:** This is the new revised second edition including some 30 additional products, a tube chart, sales data, a separate ER article index, a completely new introduction, and a new section devoted to Heath's CB equipment. The book is 75 pages larger than the original. By Chuck Penson, WA7ZZW----------**$29.95-10% = $26.95**

Heath Nostalgia: Written by Terry Perdue, K8TP, an ex-Heath employee, this 124-page book is a great history of Heath and the Heathkits that we all remember. ------- **$14.95-10% = $13.45**
SPECIAL DEAL! Heath Nostalgia *and* Heathkit, The Early Years CD both by Terry Perdue
---------- **$27.00**
Heathkit, The Early Years CD: By Terry Perdue, high quality scans of documentation from Heath publications, plus a voice recording of Gene Fiebich. ----------**$18.95 - 10% = $17.05**
Hiram Percy Maxim: Published by Electric Radio, this is the complete biography of HPM, the famous founder of ARRL, by Alice Clink Schumacher, 216 pages. ----- **$19.95-10% = $17.95**
The Collector's Vacuum Tube Handbook: This is a 205 page book that is full of unique, hard-to-find information on tube types that were released before 1934. Includes company histories and good photos. ---------- **$25.95-10% = $23.35**
Radio-Craft: 50 Years of Radio by Gernsback: This is a high-quality reprint of the March 1938 edition of Radio-Craft magazine and is about the first 50 years of radio, and contains hundreds of vintage advertisements. ---------- **$15.95-10% = $14.35**
Radios by Hallicrafters : High-Quality photos, descriptions, approximate values, and short histories of nearly everything made by Hallicrafters. By Chuck Dachis -- **$29.95-10% = $26.95**
Radio Tubes and Boxes of the 1920s by Fathauer: If you appreciate the rare and colorful vacuum tubes and advertising art from the early days of radio, then this great 104-page book will be very interesting and informative. ---------- **$26.95-10% = $24.95**
Shortwave Receivers Past and Present, Communications Receivers 1942-1997, 3rd edition:
Now in its third printing, this massive 473-page volume has become a standard reference for collectors and users, by Fred Osterman. ---------- **$24.95-10% = $22.45**
The All-American Five Radio: Although this book is about classic American 5-tube broadcast receivers, it also contains a wealth of accurate information on vacuum tube receivers, proper trouble-shooting, and alignment and is recommended for experienced repairmen and novices alike. 92 pages by Richard McWhorter ---------- **$21.95 - 10% = $19.75**
Transmitters, Exciters & Power Amplifiers : This is the companion volume to Moore's communication receiver book, by Raymond S. Moore, 144 pages. ---------- **$21.95-10% = $19.75**
Tube Lore : This is one of the best vacuum tube reference books ever published. All types of information is included, such as tube date code information and production history. 173 pages by Ludwell Sibley ---------- **$16.95-10% = $15.25**
Tube Testers and Classic Electronic Test Gear:Written by Alan Douglas, a retired engineer, the bookis packed full of valuable information about test equipment, including hard to find calibration data. 166 pages. ---------- **$29.95-10% = $23.35**
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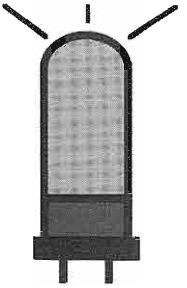

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