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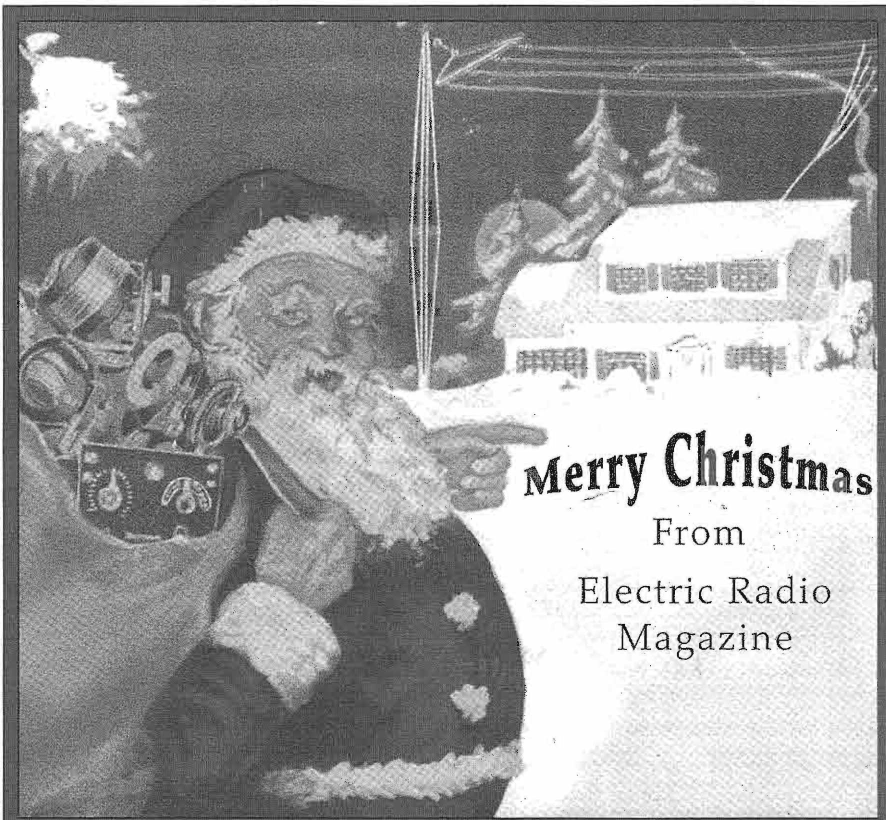
ELECTRIC RADIO

celebrating a bygone era

Number 187 December 2004



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 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.

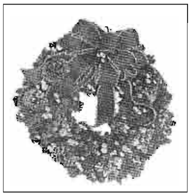
We depend on our readers to supply material for ER. Our primary interest is in articles that pertain to vintage equipment and operating with a primary emphasis on AM, but articles on CW, SSB, and shortwave listening are also needed. Photos of Hams in their radio shacks are always appreciated. We invite 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

I would like to thank every ER reader for their support during 2004, and I wish everyone a happy, healthy, and prosperous 2005. We are having quite a winter season in Colorado so far, with a lot of snow and cold weather. To the west, many back-country avalanche warnings are posted, unusual for so early in the winter. It is good that my rigs help keep the shack warm!

I'm writing this as the AMI AM Thanksgiving Jamboree is underway, and it is good to hear 10 meters open to the East Coast for a change. It sounds like there are more operators participating than ever, and many are discovering how much fun an AM contact is for the very first time. Last night, 75 meters was very crowded with heterodynes, made worse by the SSB operators who apparently do not own a receiver. In Colorado, KØOJ's Thanksgiving Day AMI Bash was bigger than ever, and here is what OJ sent me about participation this year: "...It was a great bash this year with a good spectrum of radios on AM, and even two that were not made for AM, but were modified, such as Willis's (WA5VRL) TS-830S and Ed's (NØAUB) S-line. I heard three FT-817's, one was on a small amplifier from Creede, CO. When I asked him to drop the amp, I still heard him on 1.5 watts. Ron, K7ENE, checked in with a Ten Tec Jupiter from Martins Cove, WY. Marv, KAØSKK, used his Northern Radio marine radio N510ER/N612ER, with the best audio of all. Both TX/RX are rock bound, and he revived the old art of crystal grinding to get some FT243's on 3875 kc. PJ, WØVTM in Gunnison, CO, made her first HF contact on the net with her husband Ken, WØVTL. Thanks Ken, I hope she shows up more. I had 50 in the log this year. There will be an AMI New Year's Day Bash on 3875, so hope to see all there. Thanks to all for making the AMI Thanksgiving day bash another success. Merry Christmas, OJ, KØOJ."



Please remember to update your parts-unit listings so that I can publish the list early next year in Electric Radio. As Barry Wiseman used to say, "Your dead unit can bring another one back to life," and that is still so true.

Until next month, 73, and keep those filaments lit! Ray, NØDMS.

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Cover: From the cover of the December, 1921, issue of Radio Magazine, Santa is making a stop at Electric Radio. It looks like a lot of operators will be getting dials, loose couplers, and new UV-200 detectors this year!

Busting the RME-6900 Receiver Myth

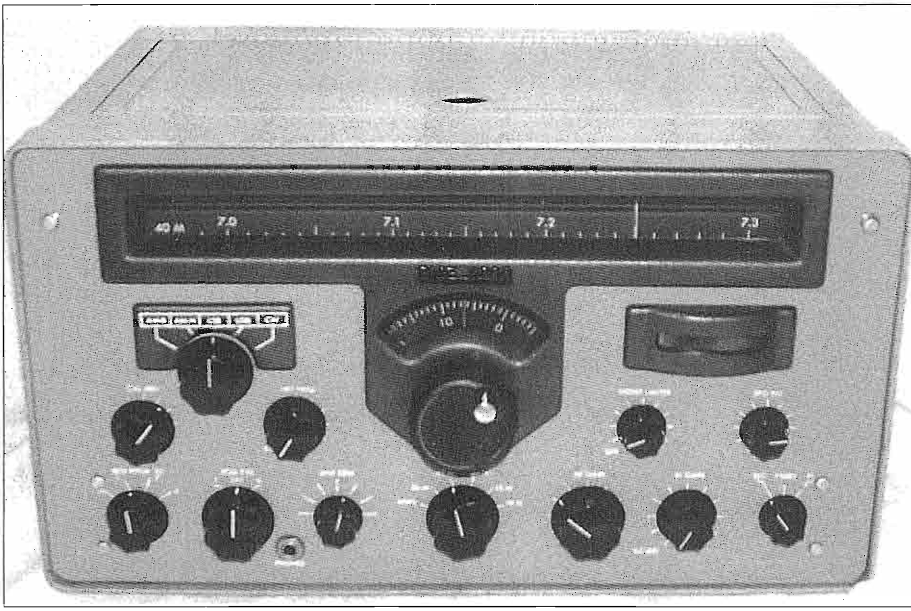
By Chuck Teeters, W4MEW
110 Red Bud Lane
Martinez, GA 30907
Cteet70@aol.com
Photos by Tony Chang, WW4TC

The 1946 RME-84 has been a joy the second time around. As I pointed out in a December, 2003, ER article, the -84 has proven to be a competent receiver. Other than my two go-rounds with RME-84s, I've never owned or operated any other RME receivers. However, when W1SUJ offered me his RME-6900 receiver I could not resist. On various occasions discussing receivers, the RME-6900 has come up as a $350 receiver equal to the $650 Collins 75A-4. The Ham-band-only AM/CW/SSB receivers were both products of the late fifties, and certainly look similar, especially the dial assemblies with their linear rotating megacycle dial drums and round kilocycle dials. I had a 75A-4/KWS-l combo back then, and the chance to compare the receivers was too good to pass up.

The RME-6900 was the last top-line receiver to carry the Radio Manufacturing Engineers label. RME started out with a bang in the early thirties, especially the RME-69. However, each of their follow-on receivers fell off in sales, due partly to more competition. The post-WWII RME-45 lost more ground, and in 1953 to keep solvent, RME combined with Electro-Voice. Four more receivers were built by Electro-Voice with the RME label, all with dwindling sales, and the RME name disappeared after the short production run of 6900s stopped in 1962. As a result, the 6900 is vary scarce and has built up a lot of mystic among receiver aficionados, some of whom rate it as one of the best receivers of the vacuum tube era.

Richard mentioned that his RME-6900 was dead on ten and not too hot on the lower bands. However, I felt this should be an easy fix, perhaps a simple alignment problem. When I got the receiver home, on the bench and out of the cabinet, I found it had belonged to a heavy smoker before Richard acquired it. A heavy nicotine coating took some time to clean off. Sensitivity wise, it took over 100 microvolts to get a hearable signal on 40 meters, and the S meter didn't come off the peg with less than 1000 microvolts. The problems turned out to be: first, bad 6U8 oscillator mixers, which I replaced with 6EA8s as Collins had done in the KWM-2A, second, a 6BA6 IF amplifier screen bypass cap that thought it was a 20k resistor, and last, poor alignment. With those items fixed the 6900 could hear stuff under 1 microvolt, like the 75A-4. However, those three fixes were not all easy.

Replacing the 6U8s with 6EA8s was simply a plug-in job. Replacing the screen bypass capacitor was a miserable 6-hour job. The 2.2 MHz first IF, the second 6EA8 converter, the 57 kHz 3-stage second IF, the "T" notch filter, and selectivity and sideband switching are in a 3" by 3" by 10" chassis fastened on top of the regular chassis that holds the rest of the receiver. It may not show in the photos, but there are no removable sides, and the entire assembly must be removed from the main chassis along with the front panel mode switch and gears to get at the undersides. This requires disconnecting 6 power leads, 6 leads to the selectivity switch, 6 leads to the BFO frequency switch, and 6 leads to the detector/AGC

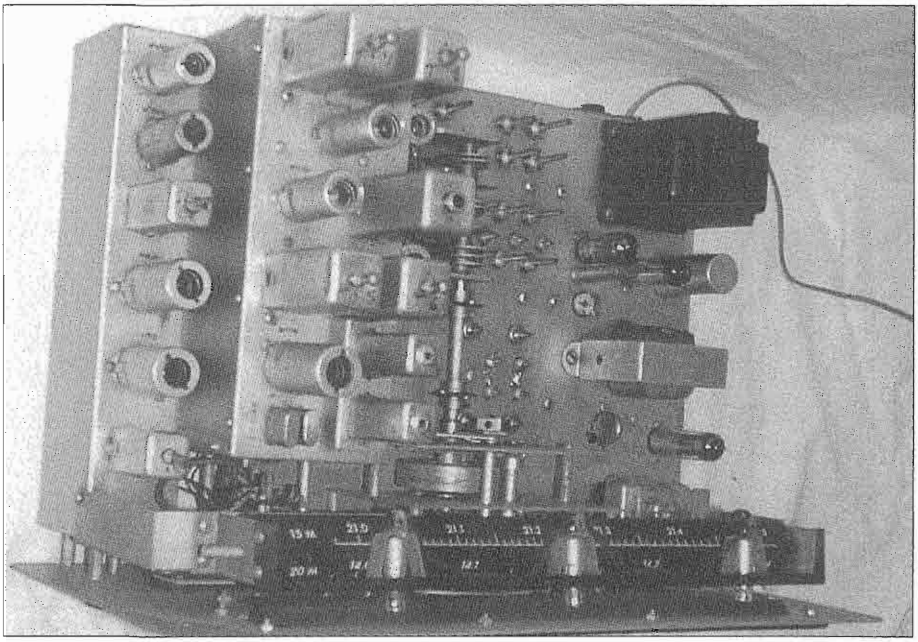


Front panel view of the elusive RME-6900, which was the last RME receiver to be produced.

switch. The front panel must be removed to free up the selectivity/mode switch from the front sub panel. Then the entire assembly is removed very carefully from the main chassis so as not to mess up the gear drive between the selectivity, side-band, and AGC, detector, and BFO switches.

The RME manual does not recognize the existence of this sub chassis and the gear-driven switching. In fact, the only comment in the manual that remotely comes close refers to the superiority of the RME "Mode-Master" control switching system, which automatically sets the "optimum selectivity, detector, BFO frequency, and AGC system for each operating mode." There is nothing about maintenance or repair of this or any other section of the receiver in the manual, except for a tube socket voltage and resistance chart. Also, there is no block diagram or theory section in the manual. The parts list has the switches listed as a pair of 4-pole 5-position rotaries, with no gears, brackets, etc. on the parts list.

The alignment started out OK on the manual's step one, the detector's 57-kHz transformer tuning. However, step two called for the signal generator to be connected to lug 4 of a 2195 kHz IF transformer located—guess where—on the underside of the IF sub chassis. No thanks; I was not removing that thing again. So, I connected the generator to the second mixer plate from the top side. The rest of the IF alignment seemed to go OK with this minor deviation. The RF alignment started out also OK until a little pressure was put on a trimmer. The piston trimmer caps are push-through types with spring-out ears that lock them into holes in the chassis and provide the ground for the caps. The nicotine and corrosion made the trimmer grounds intermittent. It was necessary to spot solder each trimmer to the chassis, after some Dremel® tool grinding and vigorous cleaning. The receiver was missing the cover plate for the RF compartment. Placing a metal cover across the bottom to simulate the cabinet bottom detuned



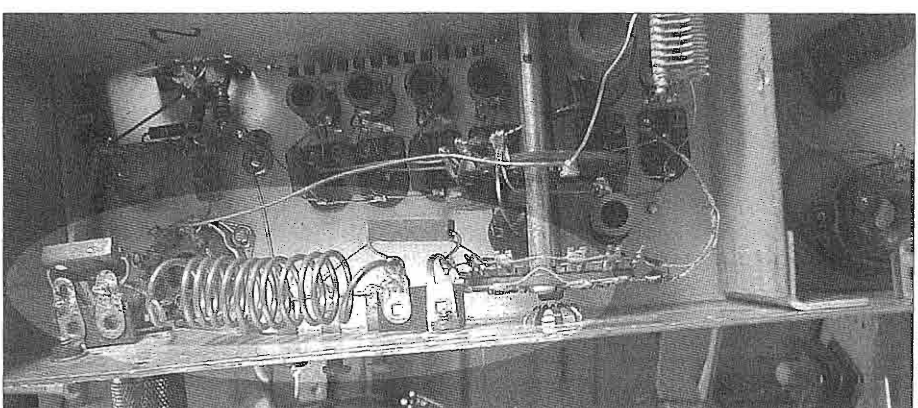
In this view, the subchassis for the 2.2 MHz first IF, second converter, 57 kHz 2nd-IF, notch filter, selectivity, and sideband switching is visible just to the left of center. This module is difficult to service.

the RF, so I made a cover. After this was done, the RF alignment was straight forward, with good quality variable inductors on the low end and piston trimmers on the high end.

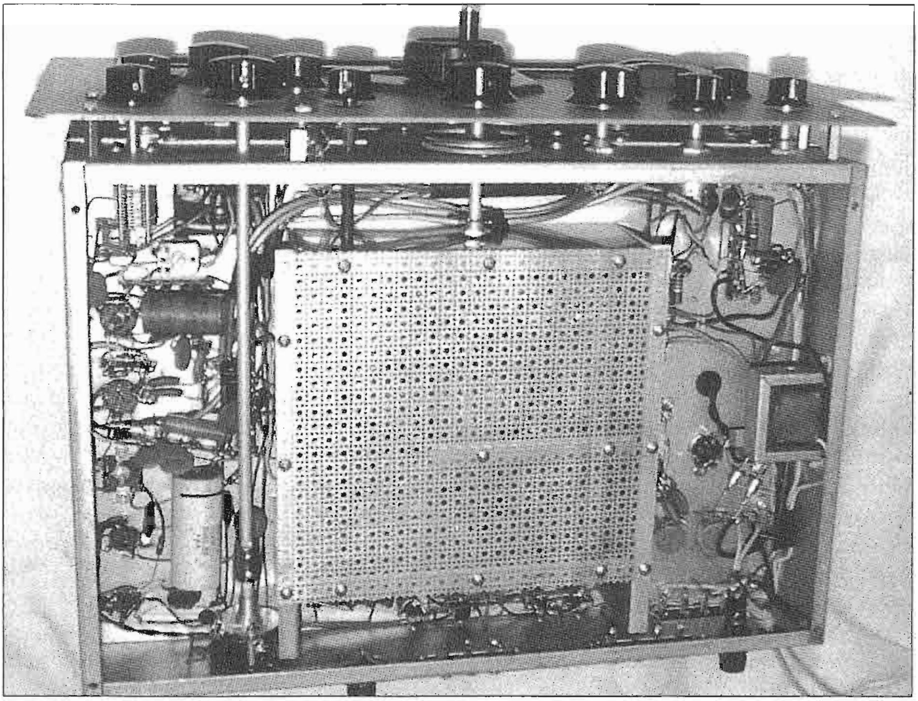
It's during the RF alignment that the truth about the tuning dial calibration comes to light. First, the top slide rule megacycle dial is not linear, and second, the kilocycle dial is not a kilocycle dial. For example, on the 3.5 to 4.0 MHz band, the physical spacing of each 100 kHz mark varies by a ratio of up to 1.6 to 1. Each division, on what appears to be the circular kilocycle dial scale, varies from 0.8 kHz to 2.4 kHz. The only accurate frequency readout is on the horizontal dial which is calibrated every 100 kHz, with 10 kHz marks (20 kHz on 10 meters) in between the 100 kHz marks. The lower circular dial is useful as a logging or bandspread dial only. The dial pointer on the slide rule dial can be moved with the calibration knob plus or minus approximately 30 kHz. By using the internal 100 kHz crystal calibrator to set the horizontal dial to the closest 100 kHz check point, the frequency can be estimated to better than 3 kHz on 40 meters with reasonable accuracy. The RME manual makes no reference to tuning the receiver or how the dial functions. The operation section of the manual has a table of each control function except the tuning dial. The picture in the manual of the receiver has the main dial set at 3810 and the lower dial at 10 which would lead you to believe that they are related the same as in a Collins 75A. However, in the case of the 6900, the upper and lower dials don't coordinate, and there is no way to calibrate the rotary dial. So much for the equality of the RME-6900 and the 74A-4 tuning systems and dial accuracy.

With that said, however, the 6900 has a very smooth-tuning mechanism. With its weighted flywheel, and all-gear drive, it feels very nice. A 1959 receiver that can read down to 1.5 kHz on 75 meters, and 8 kHz on 10 meters is not bad, not Collins, but not bad at all. Using the lower band-spread dial, previously logged frequencies could be reset within 300 Hertz. The specifications in the manual say the calibration is .03%, and that is true. Frequency drift is listed as less than .005% after a 15 minute warm up. That is not true. The receiver has serious drift problems for over 40 minutes, like 12.5 kHz on the 10 to 11 MHz band. If the line voltage changes by 3 volts the receiver moves 500 Hz on the 10 MHz band. A change of 10% in line voltage takes the signal out of the pass band even in the wide AM position. A firm push on the corner of the front panel will move the receiver several hundred hertz. However, with a warmed up receiver in the cabinet, you would probably not notice most of these problems, and in operation on 40-meter SSB I find it only occasionally needs a touch up during a QSO.

Throughout the alignment several spurious responses showed up. On the 3.5 to 4.0 MHz band the second harmonic of the first oscillator, and the not-so-great selectivity of the single 6BA6 RF amplifier, let several of the high powered 41-meter band shortwave broadcast signals through. The same thing happened on 7.0 to 7.3 MHz. These signals are easy to recognize as they tune backwards and fast, but they are noticeable and a source of interference to a desired signal. I checked the image rejection on the 28 to 29.7 MHz band and it was 18 db, so if there is a strong local signal between 32.4 and 34.2 MHz you will have some image problems. The second harmonic of the first oscillator makes the receiver susceptible to TV channel 3 interference when operating on 10 meters. This is also a problem with Collins 75As unless you have the Howard Mills (W3HM) front end mod which could be added to the 6900. The W3HM low-pass filter is used to eliminate spurious receiver responses to signals above 30 MHz. It is a low-pass pi-section filter made up of a shunt input mica capacitor of 50 pfd to ground; a series inductor of 12 turns of #14 wire ½" in diameter with a length of 3"; and an output shunt mica capacitor of 50 pfd to ground. It is installed between the antenna terminal and the wire to the bandswitch and antenna coils in the receiver. As can be seen in the photo on this page, two single-lug solder terminal strips are mounted in the receiver by the antenna connector, 3" apart. The inductor is mounted between the two terminal strips and they are also used to connect



The highlighted area in the photo above shows how the Howard Mills front-end low-pass filter has been installed in a Collins 75A-series receiver.



Underneath the main chassis shows the RF shielding I fabricated, and other layout details.

the 50-pfd caps to ground. The antenna connector is tied to one end, and the wire to the band switch and antenna coils to the other. The filter can be trimmed by bending the outer end turns of the coils outward. Keep the inductance as high as possible with out decreasing the receiver sensitivity at 29.7 MHz.

Another peculiarity of the 6900 was that harmonics of the tunable CW BFO were getting into the first IF. This can be tuned out with a slight change with either the main tuning or the BFO pitch controls.

Now for the question of selectivity: Six 57-kHz IF cans verses the Collins mechanical filter. There is no doubt the mechanical filter wins the battle, with a reasonably flat top and tight skirts. However, RME / EV has done a great job with the 6900 low-frequency IF. They have sacrificed some nose bandwidth to pull the skirts in a bit more than you would expect. For example, the 6900 SSB nose bandwidth is cut to 2 kHz at 6 db down, but only widens out to 7 kHz at 60 db down. This same bandwidth can be used in the AM-narrow position of the mode switch. The wide AM position of the mode switch is 3.6 kHz at 6 db down and 11 kHz at 60 dB down. The CW mode bandwidth is 0.5 kHz at 6 db down and 3.4 kHz at 60 db down. I would guess the 6900 skirts would be a bit tighter with more decoupling. RME copied the Collins 0.1 mfd IF bypassing, but in the 75A-4 this is decoupling a 455 kHz IF. In the 6900 the IF is 57 kHz and 0.1 mfd is not enough. Space is tight under the IF subchassis and I did not feel like giving it a try right now, but maybe someday I will. As it is, however, I find the selectivity very good. Signals don't drop off the sides like the Collins, but they go down reasonably fast and tuning in signals feels good to me. Also, with the 75A-4, you

THE NEW RME 6900

The design and production of communications receivers today is considerably different than in past years for two principal reasons. Costs have risen precipitously; to manufacture a receiver in the face of this and keep the price reasonable requires good tooling, long runs, and little allowance for error. Secondly, there are greater demands placed on receiver operation than ever before, versatility . . . handling ease . . . yes, amateurs have come to ask for parameters of performance almost unheard of in past years.

RME in announcing the new 6900 states without equivocation that this receiver performance is unmatched by anything near its price class. The 6900 is engineered to give optimum service for all modes of amateur communications — not merely one. Engineered under the supervision of Russ Planck, W9RGH, the 6900 has as many advanced pioneering features as its extraordinary namesake, the world famous RME69, which was the first band-switching communications receiver ever produced — over 20 years ago and still widely used today.

What makes the 6900 so Hot? First, meticulous attention to details so that every circuit is performing in an optimum manner. Second, an ingenious function selector, the Modemaster. Every circuit in the 6900 is designed to provide high selectivity; frequency stability, sensitivity and low internal noise. Finally, inclusion of *all* function controls necessary for a modern communications receiver... vernier control knob with overide clutch for fast tuning; RF gain; AF gain; antenna trimmer; band selector, stand-by/receive/calibrate/transmit; ANL; T-notch filter; calibrate adjustment; band selector.

Whether you operate CW; SSB; or AM, you will have the almost uncanny feeling the 6900 was designed solely for you — this is the test of a modern communications receiver that we believe only ours can meet on the operating desk.

- **CONTROLS: 11½" Single Slide Rule Tuning Dial; Logging Scale.**
- **COVERAGE: 80, 40, 20, 15 and 10 on 5 bands plus 10 to 11 mc for WWV or WWVH.**
- **Peak Selectivity plus tunable "T" Notch.**
- **Internal 100 kc Hermetically Sealed Crystal Calibrator.**
- **500 and 4 ohm Outputs.**
- **Noise Limiter for SSB and CW, AM.**
- **Separate Detector for Single Sideband.**
- **S Meter Calibrated in 6 db Steps Above S9 for Better Reading.**
- **Improved Fast Attack AVC Circuit.**
- **Selectable Sideband.**
- **Panel of Attractive Grey "Clad-Rex" Vinyl Bonded to Aluminum with Charcoal Trim.**
- **Front Panel Controls Re-Grouped for Ultimate Operating Ease and Convenience.**
- **SENSITIVITY: 1 mv. 30% Modulation for 100 mw output.**
- **S-N-R: 10 db at 1 mv Input.**
- **SELECTIVITY: 500 cps, 6 db down, in CW mode.**

See your RME distributor or write to RME Electro-Voice®

Dept. 40Q, BUCHANAN, MICH.

From QST, April, 1960.

have got only the 3-kHz SSB filter. The AM and CW filters were extra cost options. So that's one minor plus for RME.

The detectors, diode and product, AGC, and the first and second audio stages, other than using some different tubes, are almost identical to the A-4, and the audio fidelity is about the same—just minimally acceptable. The 6900 uses an IF noise clipper, not the audio limiter of the A-4, and it works well on all modes. Like the A-4, the 6900 has 500-ohm and 4-ohm output terminals, but does not have the "phones" output available, except at the front panel jack. The 6900 has a mute/standby similar to the A-4, but provides the RF amplifier cutoff voltage internally. The RME also has an extra set of terminals connected to the front-panel "Rec-Standby-Tran" switch, which can be used to activate an associated transmitter. With this labeling, the 6900 receiver can be used in the movies just like the old Hallicrafters receivers were: Plug a mike into the headphone jack and flip the receiver switch to send, and you can talk halfway around the world with no static, noise, or interference. Were not the old movies great? Hooray for Hollywood!

Now a pet peeve I have with the 6900, the bandspread dial illumination. Like the 74A-4, the rotary dial is back lighted. But in the 6900 the drum that holds the dial cord for the slide rule dial blocks the light to the right half of the dial. The drum is so close to the back side of the dial that there is no way to get light in there. Very poor planning on the part of the EV mechanical engineering department. Of course, these are the same people who designed the IF sub chassis system. They were probably the ones who selected the horizontal S-meter also, the same as used on the Drake TR-3 and 4. I don't like the style. To me, a meter should look like meters always looked. But, by using the flat S-meter, RME could make the slide rule dial go completely across the top of the receiver panel. As a result, the RME MHz dial is 12" wide compared to the 6" Collins. It doesn't make the 6900 read any better than the A-4, but it sure looks good.

One of the features of the 75A-4 is the passband tuning. The RME-6900 has switching for selection of upper or lower sidebands. I see no particular advantage to either; however Collins changed to sideband switching in the A-4 follow-on, the 75S-1. The switching is easier to maintain and probably cheaper to build. If you have ever repaired or replaced the BFO-PTO drive belt in the A-4 you know what I mean. The 6900 uses silicon rectifiers while the A-4 kept a 5Y3 tube; less heat versus a soft start. So who cares, other than the writers of the 1959 advertisements?

So, now the bottom line: How good is the RME-6900, well, a darned good 1959 receiver? How good compared to the Collins 75A-4?

Not so good. Dial calibration, birdies, selectivity, warm up and line voltage drift, and absolutely the worst instruction manual make the 6900 a runner up to the A-4, but as that magazine would say, "for $349 a CU Best Buy©." Perhaps a better question would be "How good is the 6900 compared to its 1959 approximate cost equals, the Drake 2-A, the Hallicrafters SX-101, the Hammarlund HQ-170 or National NC-300?"

I know the Drake would win on cost ($269), while the SX-101 would win on weight (70 lbs). The HQ-170 would win the worst (and only) clock award, and the National NC-300 would win the prize for the most expensive advertising and shortest production. Other than that, I'll leave it to the readers to decide; however I'm keeping the 6900.

ER

The "1944 Little Giant" Homebrewing During Wartime

By Don Meadows, N6DM
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Yuba City, CA 95993

Maybe this should be considered an addendum to my article titled "Radio Physics: A Beginner's Experience," which appeared in ER #159 (August, 2002). In this article, I discussed a homebrew broadcast-band receiver that I built according to an article published many years ago in Popular Mechanics Magazine. My memory was unable to pin down the exact month and year of this article, except that it had to have been in 1943 or 1944. I expressed myself as follows: "Perhaps a reader of ER with a Popular Mechanics Magazine file covering the war years can fill in this memory gap—I'll gladly pay copying and postage expenses."

Shortly after my article appeared, I received a nice letter from ER reader Jim Haynes, W6JVE.

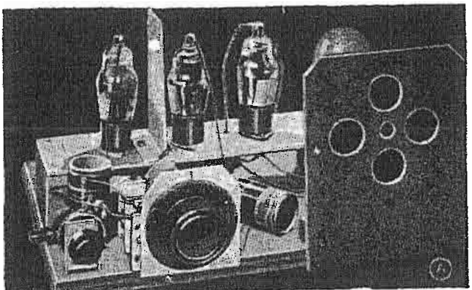
Jim said that he, too, was aware of this receiver and that it had also aroused his interest long ago. He said he'd try to track down the month and year in which the original Popular Mechanics article appeared. One day, a month or so later, I received a fat envelope from Jim. It contained a photocopy of the original Popular Mechanics article which appeared in March, 1944. Thanks to Jim's efforts, I was able to relive briefly, with full clarity, a homebrew project that had led directly toward my entry into ham radio.

I'm attaching a photocopy of this receiver construction article from Popular Mechanics, which may be of interest to ER readers. It shows what could be done in radio with very limited resources, by people with very limited theoretical knowledge. Now I'll take the liberty to recycle same text, condensed and slightly paraphrased, from my prior article in ER.

"My third radio construction project came right out of Popular Mechanics Magazine. In one issue during the war, probably in 1943 or 1944, the magazine's radio column described a construction project that seemed most interesting. It was a TRF broadcast receiver built on a breadboard, powered by household AC current. It required four tubes—RF stage, detector, audio stage and rectifier. I wish I could remember the exact tube types; I know the RF tubes were either a 6J7G or a 6K7G. They were octals with the grid cap on top. The rectifier was, I think, a type 1-V, a diode with a 6-volt filament. The audio output tube may have been a type 41 or 42. A light bulb was the series dropping resistor for the filaments. The RF coils were hand wound on paper cylinders, the cases of expired D-cell flashlight batteries, just as the article recommended. I remember the chore of winding many turns of fine wire onto these forms.

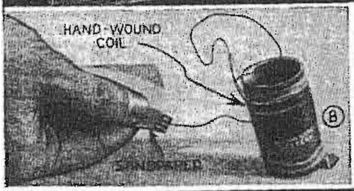
This breadboard receiver with loudspeaker worked great while I owned it—I later traded it for a BB gun. The TRF circuit provided good selectivity on the broadcast band and its loudspeaker gave much better fidelity than I had experienced through the crystal set's headphones, and it didn't require frequent touch-ups of a regeneration control. This radio sat on a table beside my bed during the last war year. At night, I would turn

1944 "LITTLE GIANT"



By Stanley A. Johnson

ALTHOUGH stripped of peacetime frills and built entirely from parts and tubes salvaged from old radios, this March, 1944, "Little Giant" tuned-radio-frequency 4-tuber is an effective and practical model for a classroom project or the individual student experimenter. Despite its simplicity, the receiver has more than ample volume, sensitivity and selectivity for good broadcast reception. Like previous models of this popular set it teaches the student builder to be self-reliant in using available non-critical materials for practical construction purposes, and supplements classroom instruction.



Employing an easy-to-follow breadboard layout, the set uses four common older-type tubes for which numerous substitutions are possible.

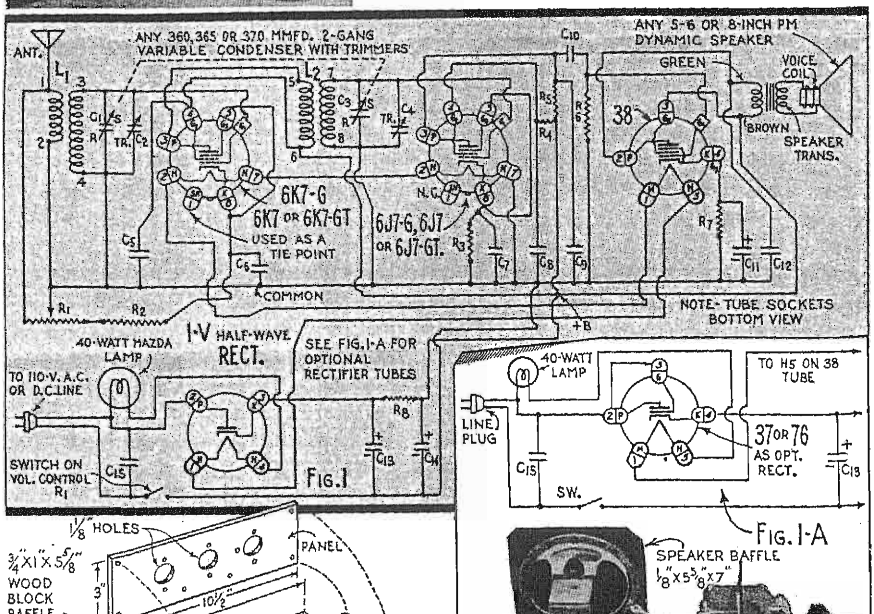


FIG. 1
FIG. 1-A

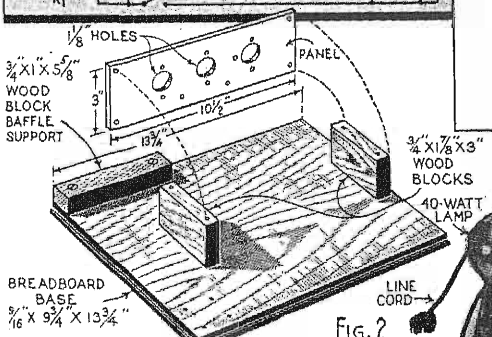
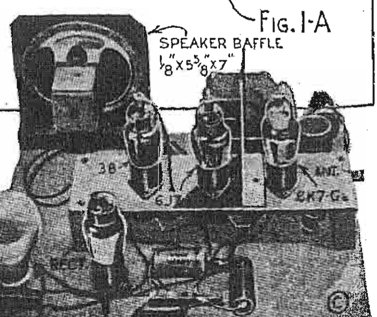
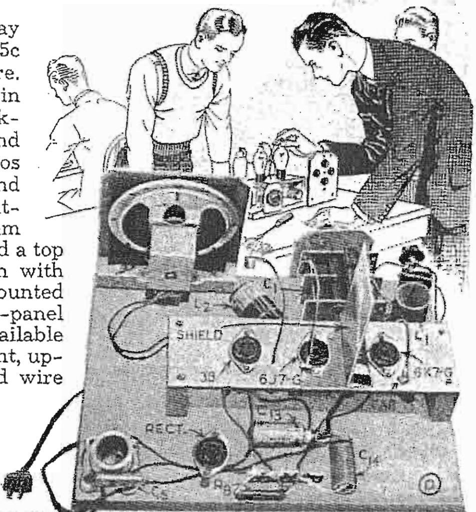


FIG. 2



BUILT *from* ODDS *and* ENDS

An ordinary 40-watt lamp does away with the usual linecord resistor, and the 35c breadboard comes from the "dime" store. The schematic circuit diagram appears in Fig. 1, and an optional rectifier tube hookup is shown in Fig. 1-A. All baseboard and layout details are given in Fig. 2 and photos A, C and D. The coils are hand wound and the leads prepared for soldering as indicated in photo B, and pictorial wiring diagram Fig. 3. All parts values are identified, and a top view of the baseboard wiring is shown with connecting leads running to the parts mounted on the underside of the elevated tube-panel strip. Detailed material list R-322 is available from Popular Mechanics radio department, upon receipt of postage. No. 32 enameled wire for the coils was obtained from a burned-out filter choke; these close-wound primary and secondary coils are spaced 1/8 in. apart and all wound clockwise. No external ground is used.



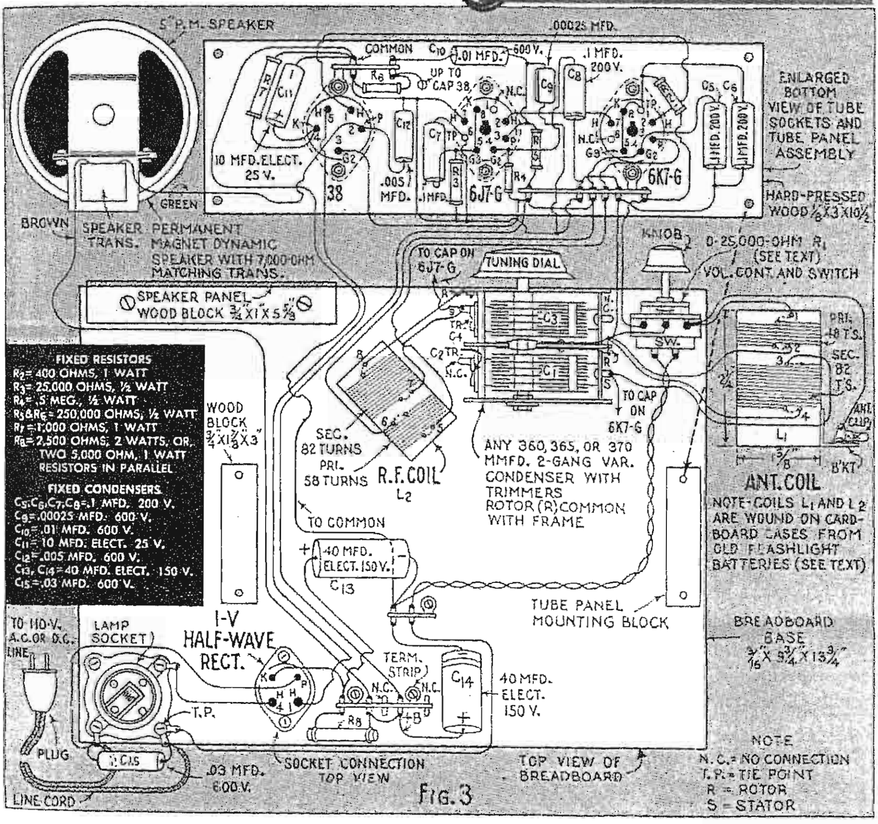


FIG. 3

the gain way down so as not to bother my parents. Homebrew TRF broadcast receiver's speaker also announced to me the A-bomb drops in early August, 1945. Over this speaker came word of Japan's surrender and the end of World War II."

ER readers will hopefully pardon my recycling this segment of my prior published text. But now this text seems much more valuable, more immediate, because it represents not only an old-timer's recollection, but something that has suddenly been made real once again through the original document as it was seen through the teenager's eyes.

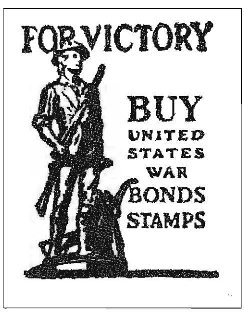
Thanks to my obtaining the original Popular Mechanics construction article through the kindness of Jim Haynes, I now face a small dilemma. Should I attempt to build an exact replica of this receiver? My junk box would support the project—except for one small detail. Where, today, can one find cardboard cases from expired D-cell batteries for coil forms? Yes, one can easily fabricate substitutes. But the true essence, the perfume of the past would be lacking. Also, who today needs a new AM broadcast receiver on a breadboard? No, I won't build a replica of this receiver. Reliving a brief documented flashback to my radio past at age 13 has been a more than adequate fulfillment.

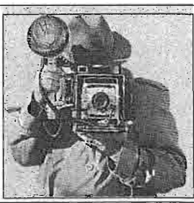
Having read W2HBE's many fine ER articles describing homebrew receivers, I began to speculate. Could that old breadboard circuit from Popular Mechanics perhaps also perform on the shortwave bands? Would it, a basic TRF (Tuned Radio Frequency) circuit, be sensitive enough without regeneration? Adding controlled regeneration to the detector would be fairly easy, if required. But this would mean trading off AM fidelity for sensitivity and selectivity. The traditional TRF receiver circuitry has always been able to capture the full fidelity of the AM signal, as there is no IF nor regenerative selectivity to restrict the signal's bandwidth. On the other hand, the regenerative detector allows one to copy CW signals—a feature that sometimes appeals to those who listen on the shortwaves.

The 1944 Little Giant circuit incorporates two features that may be of interest to those who homebrew radios based on yesteryear's technology. First, neither power transformer nor batteries are required. Household AC current is the only power source. One will notice that the original article specifies that no external ground connection should be used. Second, a light bulb is used as a resistor to drop the voltage for the series-connected filaments. Traditionally, a "line-cord" resistor was used to drop the voltage for the filaments. Apparently such dropping resistors were hard to find during wartime—thus the use of a light bulb. Such "line-cord" resistors are almost impossible to find today. The light bulb's wattage is calculated according to the required voltage drop. The four 6-volt tubes in the 1944 Little Giant each draw the same filament current.

Homebrewing radios based on yesteryear's principles and resources helps keep young the roots of our hobby—helps us who nourish these roots stay young.

ER





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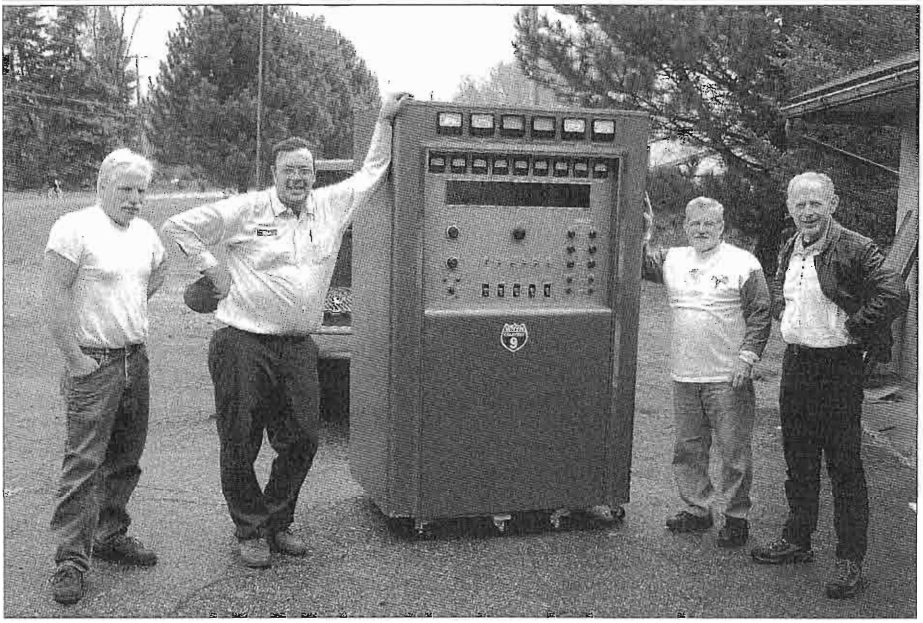


Big Iron Finds Another Home

Recently a General Electric XT-1A Transmitter found a new home with Mike, N8ECR (The Voice of the DX-60 Net).

The transmitter was initially obtained by Bill, K8DBN and Dan, N8ETQ in 1999 when it became available from an AM station in Canton, OH. With two 833's modulated by two 833's, and at over 2,000 pounds, it was an impressive machine. So impressive that neither Dan or Bill could get it into his home.

However, the two AMers, being as resourceful as AMers are known to be, placed it in a building out in the country with lots of real estate for a full wave 160-meter antenna. Unfortunately, the 30 to 40 minute drive to the building got old very fast. And, as with the best of intentions that start out at a run, then a jog, then a walk and eventually a back pedal, the transmitter languished after the oscillator was up and running.

Along came Bob, W8ATH who made K8DBN and N8ETQ an offer they couldn't refuse. Bob took control of the transmitter in 2003. Control is the proper word, because it remained in the original building. Bob eventually came to the "back pedal" mode and put out the word that, once again, it was available.

Mike, N8ECR, then came "running". Of course, he came running about 300 miles with a stop to pick up Rob, KC8DDH for muscle and moral support.

The odds are that Mike will "run" all the way with this. It should be up and running shortly.

Pictured are left to right KC8DDH, N8ECR, W8ATH and K8DBN

George and Marian Silva provided an outstanding West Coast AMI BBQ.

By Bill Feldmann N6PY
N6PY@qnet.com

On Saturday August 28, 2004, nearly 35 AMI west coast members gathered for our annual BBQ at the home of George (WA6HCX) and Marian Silva in Santa Ynez California. This was a perfect location at George's home on top of a hill overlooking the beautiful Santa Ynez valley. Now we all know why George has such at great signal on 75 and 160 meters, and it isn't just his Collins 30K-1. He also has a great hilltop antenna location.

About 10:00 AM the gathering started off with a great flea market set up on George's driveway where many rigs, parts, and books changed hands. There were even lots of free items available. The owners of the two best rigs for sale, a really nice Collins 75A-4 and a really clean ART-13 with a very nicely built power supply made a great trade. The following night I worked the ART-13 on 75 meters and was able to confirm it had outstanding audio to its proud owner, DJ (K6RCL). I even obtained a very restorable SX-28 and some small parts and tubes and managed to sneak them into our car before the XYL knew what was happening.

After lunch a great lunch of burgers, hot dogs and cool drinks hosted by George and Marian, many of us retired to George's radio shack and workshop located in a separate building just east of his home for a tour. George's shack, with his big 30K-1 and lots of Collins S-Line gear, is very comfortably and professionally arranged. His workshop is excellent for the restoration of vintage and homebrew gear. George gave use some very valuable tips on painting and lettering panels using dry transfer lettering kits. We also spent time discussing some of our own projects. One interesting project was a Western Electric broadcast transmitter from the late 1930's that Brian (NI6Q) is now restoring.

These annual get together are a great opportunity for many of us who have talked on the air to meet in person. Also it's a great chance to meet the XYL's and convince them there are real people on the other side of a QSO. One really pleasant surprise was the announcement by Wayne Spring (W6IRD) that his wife Sharon is now K6IRD after passing her General tests a few weeks ago. She will now be a regular on 3870 kc AM, she sounds even better than Wayne on their T-368 and is setting a great example for the other gals. Now we all are looking forward to our next gathering.

The picture on page 14 shows our group picture taken just after lunch. On page 16 is a picture of George, on the left, explaining to Brian (NI6Q), in the center, and Damon (W7MD), on the right, his present restoration project, a Collins 30K-3 that is visable on the bench to the left of George.

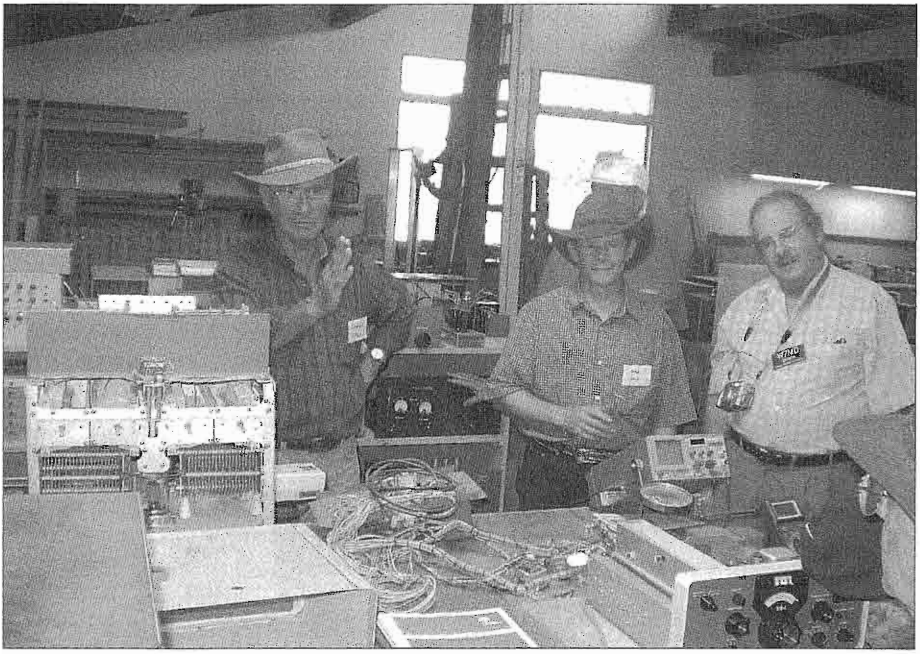
Dennis DuVall (W7QHO) presented a proclamation from AMI Headquarters honoring the event to the host, WA6HCX (copy below). There were also certificates of recognition for Joe Walsh, WB6ACU, and Bob Heil, K9EID, who, unfortunately, were unable to attend.

Proclamation to AM Operators in Southern California

To the AM operators gathered in Southern California this 28th day of August 2004: Greetings from AM International headquarters representing AM operators from all over the US, a number of foreign countries, and even some ships at sea. Your enthusiasm for our favorite mode of operation, and your fellowship with like-minded amateurs, as witnessed by your assembly here today, is hereby duly recognized and celebrated. I congratulate those of you gathered here and the many other active AM'ers in the Southwest for your on-the-air activity which is making AM more visible on the air waves and creating increased interest in AM generally. This interest has resulted in more requests to AMI headquarters for membership from your region than any other geographical area. Increased visibility for AM sends a message to amateur radio policy makers and regulators that AM is alive and well. So, I give you this charge: get on the air as often as possible, don't just operate in the "AM Window," get to know your local ARRL officials, keep them informed of AM happenings, send your responsible and well reasoned comments to the FCC on rule making petitions that may affect Amplitude Modulation on the amateur bands, ...and finally, have a good time today!

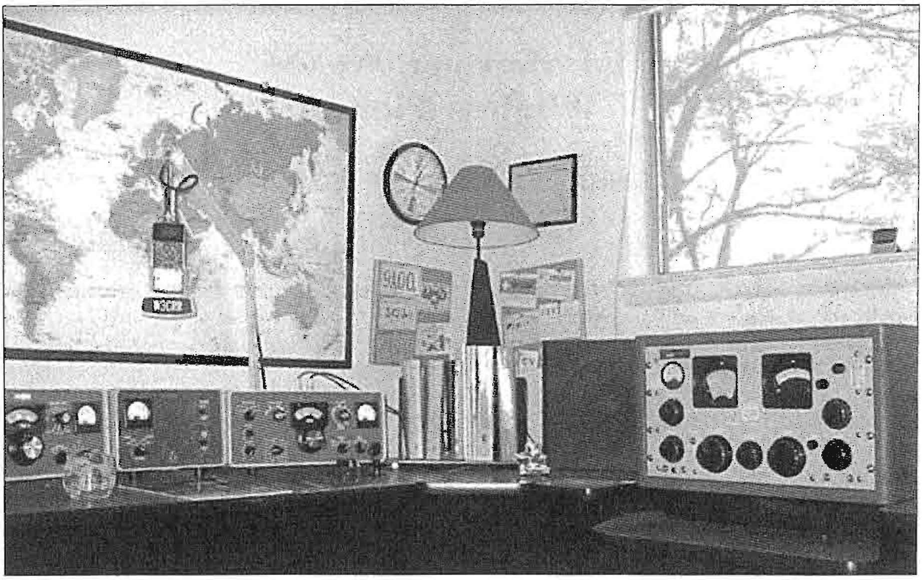
Warm regards and 73 from AM International,

Dale Gagnon, KW1I, President

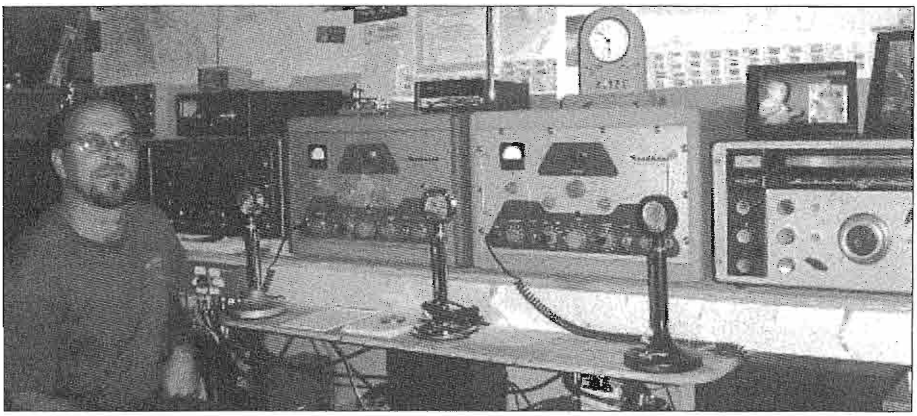


Above: George Silva (WA6HCX), left, is explaining his Collins 30K-3 restoration project to Brian (NI6Q), center, and Damon (W7MD), on the right. Parts of the transmitter are on the bench in front of George.

Below: Richard Fleischer (WA1SKQ) operates a variety of classic American-made equipment and modern gear from his shack in Cranston, RI.



Craig Roberts (W3CRR) is using some great-looking Collins S-Line equipment for Ham band operations, and a Hammarlund SP-600 does the duties for his general coverage requirements. Craig is located in Silver Springs, MD.



Bob Robinson (N1TZU) operates a DX-100 and NC-300 that were inherited from his father, K1PRR. The equipment on the left duplicates his dad's 1960's station with an NC-183D and another DX-100. Bob also has a military surplus GRC-19 station that is not pictured. As Bob says, "...The list of equipment, the selling and trading that happens when the AM bug bites you is sometimes enough to write a book about in some cases. I believe it's that case with me and many others, but it's fun all the same!" Bob's QTH is in Brunswick, ME.

Ed Marriner, W6XM
Wireless Pioneer

By Harry Marriner, HK3ZOR (KA6JEG)
17155 Oak Rd.
Atascadero, CA 93422

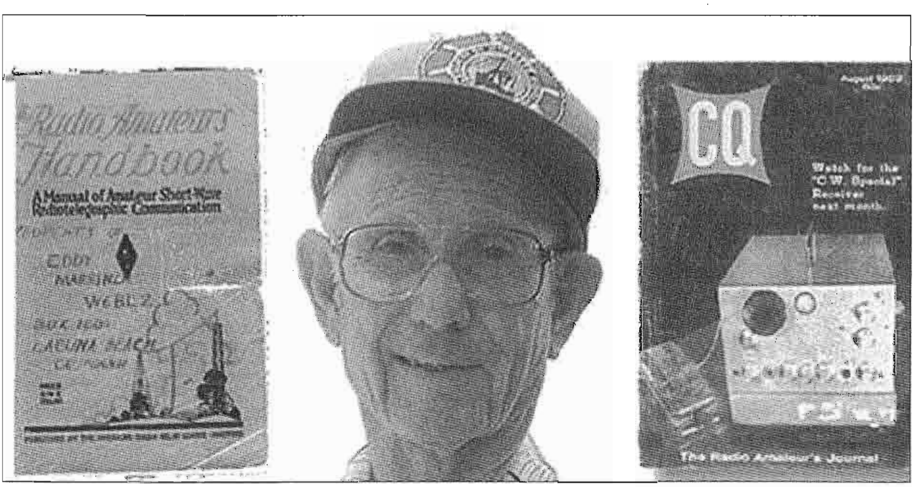
Edmund Hayes "Ed" Marriner (ex-W6BLZ), at eighty-eight years of age, has serious health problems, but his memory is as sharp as ever when he recalls his eighty-two years of Ham radio experiences.

An older brother Williard built and operated a wireless spark set in the family home attic from 1914 to 1917. Williard instilled a curiosity in electronics in Ed at age 2 which is still with him today. Ed claims he remembers crawling to the window to watch his brother run an antenna from the house to the barn using rubber insulators, and also taking the antenna down when WWI started. Ed remembers playing with Williard's Leyden jars filled with liquid which generated power from the wet cells. Try as he did though, Williard's QSO's to other members of the Lincoln Wireless Club never went further than the city limits.

At age 7, in 1922, and with the help of a neighbor, Ed made a crystal set by winding wire on an oatmeal box for the coil. The sliders and crystals came from the local Woolworth's Five and Ten Cent store, which in those days had a table of radio parts. Wood placed on the ends on the box was used as bases for square pieces of brass used for the slider. What a joy it was when Omaha, Nebraska, came in from 50 miles away!

His father's electrical contracting office at 11th and N streets in Lincoln was also a favorite place to look for pieces of wire and anything else which might be used for a project, but his Dad got angry when Ed visited there and always chased him home.

In 1924, Ed and his mother moved to Long Beach, California, where he and a neighborhood friend, Glen Eastwood, built a telegraph line between their respective homes. They made sounders from "T"-shaped pieces of tin which were pulled down by a magnet made by energizing wire wound on two nails driven in a board. From that modest beginning they graduated to a spark transmitter



made by soldering two nails on the side of a Model T Ford spark coil. Ed soon learned the Morse code and before long was sending at a rate of about one word per minute.

After Ed's mother died in 1927, he moved to Laguna Beach, California, where he lived with his brother, John, and his father, Henry Charles. Around this time he met Lynn Aufedenkap, 6SK (later W6BXQ), one of very few hams in Laguna Beach at that time, who had a spark set in a log cabin. 6SK helped Ed build a tuned-plate, tuned-grid transmitter using a 210 tube. For other parts he would go to auctions in Long Beach ,buying old receivers and old battery eliminators. Ed took the capacitors out and put them in series to increase the voltage rating. Then he put them in a coffee can and poured wax over them. Ed's high school physics teacher donated a brass telegraph key and a school chum, Mil Thompson, built a crystal set showing him how to use a piece of galena crystal across the coil of a Brandes earphone, as a detector to receive music. Clamping onto the water faucet in the physics room provided the antenna.

Mil built four different tube SW receivers and traded one plus some earphones to Ed for a homemade canvas canoe. The man in the gym laundry had been a wireless operator and told stories of how he was on the ship that brought the first spark transmitter around to California. Ed was thrilled by these stories and was determined to become a wireless operator. In his high school machine class, the teacher let Ed make a speed key as a project. In the yard Ed built a radio shack and covered it with shingles. Two 20 ft. eucalyptus trees were cut for his antenna masts, and Ed and his friend Les Collins tied them onto a wagon and hauled them three miles to his home from the distant hill where they were cut. Number 20 wire was obtained by unwinding an old Rola loud speaker coil to make an off-center fed Hertz antenna for 80 meters. Since 80 meters was such a limited distance band he soon changed to 40 meters. He vividly remembers his first contact with a fellow in Lancaster, California.

After high school in Tustin on Friday afternoon between 1928-33, Ed, and a buddy who had an old Ford, used to visit W6BAM who had a "real" shack. His brother had a Ham station in an old water tower. Ed frequently heard W6BAM on the 40 meter band at 7.054 MHz.

Code receiving speed was increased to 10 wpm by listening to the call signs of commercial operators at shore stations such as KFS, KOK, or KTK as they made their "VVVVV de KFS." Ed was an avid listener to the station on Catalina Island talking to the main land.

Ed received his first Ham license (W6BLZ) in August, 1931, at age 14. All he remembers from the test in Los Angeles, administered by FRC Inspector Chappel in June, 1931, was the requirement to draw a transmitter diagram in addition to sending code.

Since aluminum was very difficult to find in those days, the receiver panel was fashioned from a piece of aluminum pounded out of a Packard automobile hood. Usually receivers and transmitters were made from wood. This receiver had a chassis made by the local sheet metal shop out of sheet metal. Ed sat on another piece of metal to equalize the hand capacity that detuned the receiver. The grid coil was wound on a piece of dowel rod with screws in the ends fitted into a resistor clip. The tank coil was copper tubing. The feeder for the off-center fed Hertz antenna clipped on to the tank coil through a .001 mfd capacitor. It wasn't long before he built an orthodox transmitter with a UV112 tube. His 1931 QSL card proudly states "Xmiter-112 Tube-200 Volts."

After three months of waiting, a big blue certificate inscribed with W6BLZ finally arrived in the mail. Now he was officially one of the 20,000 hams in the USA at that time and began communicating on 40 and 20 meters consistently hearing stations from Honolulu to Pennsylvania. Every day he would get up before school and sometimes talk to stations as far away as Australia and New Zealand, using batteries to power his receiver.

Ed's shack as it looked in 1932

About this time, type 46 tubes were popular, and Ed made a transmitter using two of them in a push-pull configuration. One day he got a 211 tube from a Navy Radioman and made his first high power rig of fifty watts with a maple panel and Readrite milliammeter. Now he had a nice Super Wasp receiver, a monitor and could hear himself sending. He learned to copy code on a typewriter. That ability came in handy when he joined the Navy and worked as a Radioman.

In 1932, the Long Beach earthquake occurred while Ed was operating. He quickly moved his transmitter down to the floor and ran for the stairs. As he passed through the kitchen, apples were rolling all over the floor and the power lines outside were swinging.

In 1933, Ed and his buddy, Howard Wilson, got off a school bus and poked a screwdriver into a soil embankment to uncover what would later be known as the "Laguna Lucy" or the "Laguna Woman" skull. It was dated over 17,000 years old and is presently the oldest known human remains found so far in the western hemisphere. Ed's other lifetime passion, archaeology, stems from this famous find.

At age 18, Ed obtained his first seagoing job as deck boy on a Norwegian oil tanker. A short excerpt of a longer story Ed wrote about his on-board experiences and joys at finding the radio room follows: *"During the middle of October, 1933, I saw my new home for the next three months. It was a ship with a Norwegian flag hanging from the stern. On the funnel was the Texaco Oil Company insignia. The ship was the Motor Vessel South Africa, the third largest oil tanker in the world at that time.*

One Sunday in early November I went up to the wireless shack to talk to the operator. I was an amateur radio operator myself, W6BLZ. The wireless man was filling the capacity of third mate on the ship, a custom on foreign vessels.

The wireless operator seemed to be an understanding fellow but was difficult for him to associate with me, the lowest man on the ship, the "Deck Boy." When he found out I knew a great deal about fixing radios, I was invited into the shack to fix his short wave receiver. He was impressed! About that time the Chief Mate came walking into the radio room and didn't approve of me being in the radio shack. It was against rules for crew members to be on the bridge off working hours. The wireless operator didn't pay any attention to him, having found someone who could help him maintain his equipment and responded by letting me tune the receiver any time I wanted. I had great fun as I could tune in many of the amateurs who I knew back home. My greatest thrill came when he let me call KFS, the land station, on his spark transmitter, a type which had been outlawed by our government. The equipment bore the name "Lehundal," the maker in Norway. The wireless shack consisted of two transmitters, a one kilowatt self-rectified tube job, and a quench spark gap. The key was a gigantic affair mounted on the edge of the table and you had to hold your arm stiff and in an angular position to operate it. I went down to my room and brought up my telegraph key to show him. I had brought it along so that I could practice, hoping some day to be a ship operator. He picked it up and wondered how one could ever send on a key as small as that: it was the only key size we knew in the U.S. The call of the M/V South Africa was LDNV.

"Sparks" told me in Norway work was scarce, and the boys have to go to sea to survive. After four years at sea they are sent to the mate's school, and if they want to be a wireless operator, they attend another ten months of schooling. After a few more years they go to Captains school."

Being a Ham had its advantages away from home. In every port a brother amateur was at the dock to show him around town and his home. Ed remembers outstanding hospitality at Dunedin, New Zealand where he and hams drained a keg of beer. The hams then presented him with the wooden spigot carved and signed with their call signs. This spigot was seen in a conspicuous location in Ed's Ham shack for many, many years. In Hong Kong, he had a real thrill crossing the bay to Kowloon where he visited VS6AG. Very few foreigners made that trip in those days.

In 1934 Ed worked as a merchant marine Jr. Officer Cadet on the Dollar Line steamship SS President Lincoln, where he visited various oriental ports and spent considerable time in the radio shack becoming good friends with Paul Means, the ship's radio operator who was also a Ham from Santa Barbara. In Hong Kong a fellow Ham showed him his factory. He also had dinner there with Clyde De Vinna, a cameraman from Hollywood, who was a Ham. The next day they visited many other Hong Kong hams.

The U.S. Navy was Ed's home from 1935-1939. When a boot camp code test with a straight key showed he could send 33 wpm, Ed was sent directly to a cruiser to man a general Navy Fox schedule broadcast circuit, bypassing the radio school entirely. As Radioman 2nd Class, he vividly remembers target practice onboard the cruiser USS Pensacola in 1936: "*Soon the word was passed to man all battle stations. The water tight doors were shut; the shellmen, powdermen, rangefinders and gunners mates were all at their stations ready to go. I was in the radio room with a head set and earphones connected to the sky control to give the reports from the aircraft as to whether the shells were hitting high or low. After awhile "commence firing" was announced and the first salvo left the radio room deep in paint chips. Papers were strewn all over the floor. All the furniture in the room was covered in a coat of dust. As the guns go off the ship slides over and paint chips, dirt and everything that is loose falls the floor or deck. The top of the compartment bends over to the side and then flies back into place.*"

By 1940, Ed had received all his commercial wireless licenses and got a job with the Civil Aeronautics Administration who assigned him to Wendover, Nevada, to work as a radio operator and weatherman. After transfers to Phoenix and Kingman, Arizona, he obtained a job with the FBI in Washington, D.C. in October 1941.

His first job there was as a radiophone operator communicating with agents in cars. It was sweet, but short. He had a nice upholstered leather chair with brass tacks and a beautiful red rug under his feet. One week later the bubble burst and on a cold November day he was sent to operate WFBA, an unheated hidden radio station at an isolated porous clapboard summer cottage with an outhouse perched on a high windy cliff at North Beach, MD, overlooking the Chesapeake Bay. It was so cold that the operators wore long johns, overcoats, hats, left-hand gloves and boots inside the house. Cooking was done on a coal burning stove. WFBA was commonly known as the Bay Station. The rig was a BC-610 transmitter (military version of the 450 watt Hallicrafters HT-4), an HRO receiver and three Johnson "Q" beam antennas placed broadside to Europe. Jack Walter, assisted by Richard L. Millan, made and installed the switchable, but not rotatable, antennas on telephone poles.

Unbeknownst to Ed at the time, he

was relaying five-letter coded teletype messages from a clandestine British intelligence office located on the thirty-sixth floor of Rockefeller Center, New York City to England for William Stephenson's British Security Coordination (BSC) group. Stephenson was the legendary "man called Intrepid" who was selected by Winston Churchill to take charge of all British secret intelligence, security, and allied interests in the Western Hemisphere. Stephenson secretly worked with FBI Director J. Edgar Hoover before the USA officially entered WWII. It would be many years before details of Intrepid's work with the FBI would be released to the public. Using the call sign CIR, the Bay Station operated around the clock sending a series of VVVs until XQR in England answered that it was ready for traffic.

The station was noticed by an inquisitive reporter, but its function was not publicly known until much later. An article in the Washington Star read:

NORTH BEACH, MD., Nov 29, 1941

At the top of a 109 foot cliff along the west side of Chesapeake Bay a little south of this town, the Naval Research Laboratory is completing an extension project that may solve or simplify many of its most acute radio testing problems. It is no longer possible to conduct the most delicate tests of ship radios and radio equipment in a region that is criss-crossed with high-tension wires and beset by low flying airplanes. So the research laboratory has picked a rural site for its new workshop that commands a view of nearly 15 miles of the Chesapeake Bay. Proof of the value of the locality as a radio center is the fact that a few hundred yards north of the new laboratory there is a set of "mystery" radio towers, said to be operated by another Federal agency.

On December 1, 1941, Ed and one other radio operator were recalled to FBI headquarters. They were informed that the Navy was not going to be able to handle all the government CW traffic because an emergency situation was coming up. They were told to leave immediately. Ed was instructed to drive to San Diego, California, and take over Clem Stewert's Ham station that the FBI had obtained. He was told to call in every 50 miles. On the morning of December 7th he passed through Memphis, TN and was driving over the bridge when his wife said "You better turn back and call in." This time, instead of a routine "Keep driving," his superior said "Get to the Memphis airport as soon as you can-we have an American Airlines plane waiting." When Ed arrived at WFBB, the San Diego station on top of Loring Street hill, his co-worker Jim Corbett had RTTY teletype paper all over the floor. It contained names of Japanese that were scheduled to be picked up. It was several weeks later when his wife Wilda arrived at San Diego with a new car transmission and finally located Ed in Pacific Beach.

In 1943, Ed was transferred back to Washington D.C. to the monitoring division. One of his funniest assignments was to stay up all night locked in a closet in an office building. Someone had reported a man listening to code every day at 5AM in an adjoining room. As it turned out, the man was a watch repairman listening to the WWV signal.

Weather and life in Washington D.C. couldn't compare to San Diego, so when he was offered a job with the Office of Scientific Research and Development at the University of California, Division of War Research in San Diego at Point Loma, Ed happily accepted.

In order to increase his income, Ed worked nights in 1944-45 building radios part time for J.L.A. McLaughlin in a rented commercial building in the 300 block of Bird Rock Avenue, La Jolla, CA. McLaughlin had a government contract to build the first Single Side Band Transceivers using Bernell Filters. The Bernell Filters were made in Santa Barbara, CA. Ed worked with George Coates, another Ham and close friend, to build the radios on stainless steel chasses. The radios were used by the FCC and the OSS. The OSS, according to John McAdams, used the radios on missions inside of China and many times were subject to abuse and hard treatment in the rural areas. Although they were covered with mud at times, they kept on working.

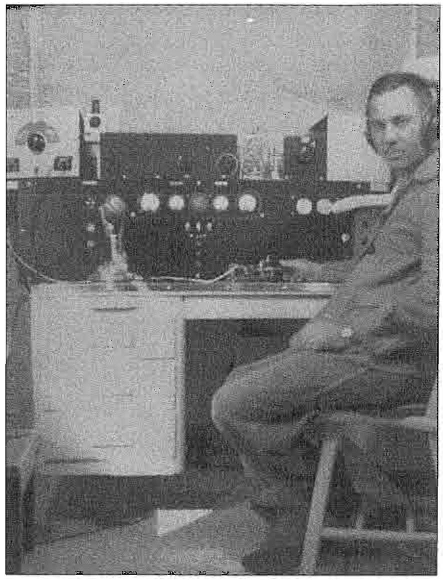
Ed returned to Civil Service during 1946, when the Naval Electronics Laboratory (NELC) was created at Point Loma, and stayed there until his retirement in 1970 as an electronics engineer after 32 years of federal service.

At NELC Ed worked under futuristic engineers such as Dave Baldwin who developed a contour ocean bottom scanner for locating coral heads and underwater objects which were then blasted and dredged for safe ship navigation during the Bikini Atoll atomic bomb tests of 1946. He was also part of a group which received a commendation for their experimental sonar breadboard equipment. This equipment was placed onboard the submarines *Flying Fish* and *Taugog* which were equipped for going under mine fields in the inland Sea of Japan.

Ed also worked on another creative device developed by Dr. Al Hudimac. It was a low-pressure wave detector called "seiche" (seiche is a tsunami wave) that showed a ship's outline in the form of a shadow graph. This device was developed into what we know today as sonar.

In 1960 Ed was part of a team comparing propagation and properties of SSB and AM signals.

During the 1950s and 1960s, Ed was a prolific writer for Ham radio magazines such as: CQ, QST, West Coast Ham Ads, Western Radio Amateur, and the Electronics Journal. Over 350 of his articles were published. Post-WWII San Diego provided a bonanza of government surplus stores with cheap military radios and parts for experimental projects. ARC-5 receivers and transmitters were radios favored for easy band conversion. Airplane propeller starter motors found at the Convair factory surplus store were geared down and used as antenna rotors. A photo of one of Ed's many construction projects appeared on the cover of the May 1963 CQ magazine and a transistorized grid dipper he made was on the cover of the September 1957 West Coast Ham Ads magazine. Along the way, in addition to his Amateur Extra Ham license, Ed obtained a Broadcast



W6BLZ's homebrew shack in the 1950s.

Station Operator license and a Shipboard Operator license. He is also past Vice President of a Chapter of the Society of Wireless Pioneers.

In 1995, son Harry Marriner had a QSO with D. Reginald Tibbetts, W6ITH, (ex-6PD in 1927!) who had Ed's W6XM call sign from Dec. 1, 1935 to March 1, 1936. Reginald said the W6X calls were originally known as Special Experimental calls and that W6XM was assigned to him for a mobile radio on the steel superstructure of the east end of the San Francisco-Oakland Bay Bridge construction project "for the purpose of determining the usefulness of the ultra-high frequencies in connection with the construction..."

Today Ed lives with his wife in an apartment complex with strict antenna restrictions and is limited to Ham communications via internet using Echolink, and doing Marriner family genealogy research. While his workshop and Ham's shack have been dismantled, some of his tools, parts, and projects live on in the hands of Lynn Fisk, K5LYN, who has a collection of old Ham radios and Ham radio magazines containing many of Ed's original articles. **ER**

The Labgear LG300
A Popular British 150-watt AM transmitter of the 1950s

By Dave Gordon-Smith, G3UUR
Whitehall Lodge, Salhouse Road
Rackheath, Norwich, Norfolk
NR13 6LB, United Kingdom

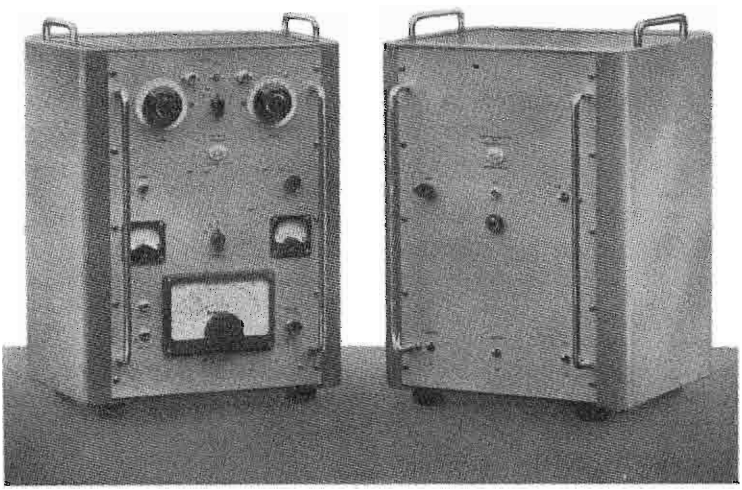
Introduction

The Labgear LG300 is a VFO controlled AM/CW transmitter that covers the HF bands from 80 through to 10 meters, not including the new WARC bands, of course. It's capable of running the legal limit in the UK (a carrier output of 100 watts with 100% modulation – 400 watts PEP total) with some ease. You might already have noticed a couple of these transmitters in the shack photographs that accompanied my article on AM activity in the UK [ER #182, July, 2004]. The RF unit and the power supply/modulator are housed in separate matching cabinets, which are compact enough that both can be used side by side on the operating bench if space is available. In their advertising, Labgear were keen to point out the fact that each unit only occupies about one square foot of operating bench. One of their promotional leaflets even refers to the LG300 as a 'HIGH-POWER MINIATURE TRANSMITTER.' Their idea of miniature is a bit different from mine! Most owners find it convenient to have the RF unit on the operating bench, and the power supply/modulator unit tucked under the bench, out of the way. The cabinets are both 19 inches high, by 14 inches wide, by 11 inches deep, excluding the handles. The front panels are a light grey mottled finish, in contrast to the darker smooth grey enamel paint of the cabinets. The cabinet top and back panels are made of perforated steel to provide ventilation. The RF unit weighs approximately 50 lbs. The power supply/modulator is somewhat heavier at 96 lbs. In order to ease the problem of moving and carrying these units, there are handles on either side of the top of each cabinet, as well as full-length handles running down either side of the front panels.

Labgear (Cambridge) Ltd was a small British manufacturing firm that was registered as a private limited company in 1947, but had actually been formed just prior to WW II to make instrumentation for scientific research and electrical components. Their financial backing came from Pye Radio Ltd, but the connection between Labgear and Pye was not made obvious in the early years of the company, possibly for political, or maybe for tax reasons! During the war they made components and telecommunications equipment, and also designed specialised electronic equipment for research. At the end of the war, Labgear suffered a sudden drop in demand for their components and equipment because of cancelled government contracts, and as a result were looking elsewhere for a market for their products. Two well-known radio amateurs, G2PU and G5JO, were associated with the company, and this probably influenced their decision to enter the amateur radio market. Initially, they offered their war-time range of transmitting capacitors, wire-wound resistors, RF chokes, IF transformers, a frequency

BRITAIN'S TOP TRANSMITTER

for the 10, 15, 20, 40 & 80 metre amateur bands



This installation effortlessly handles 150 watts fully modulated and provides a clean and potent signal. The LG300 Mk.II can now be supplied with companion power unit/modulator (type E5036)

Price in U.K. (both units) £137. 15. 0. (or Transmitter alone 55 gns.)

Send large S.A.E. for full information

Labgear (Cambridge) Ltd. **WILLOW PLACE, CAMBRIDGE, ENG.**

Telephone: 2494 (2 lines) – Telegrams: Labgear, Cambridge.

Figure 1: Advertisement from the front cover of the January 1956 RSGB Bulletin showing both the RF Unit (left) and Power Unit/Modulator (right) of the Labgear LG300 Mk II.

standard, and modulation monitor to amateurs, and later produced multi-band switched coil assemblies, wavemeters, and plug-in coils with fixed and swinging links specifically for the amateur bands. An HF preselector/convertor covering 14 Mc/s to 60 Mc/s and a 2 meter convertor were added to their range of products during the late '40s. In the early '50s they brought out their first transmitter, a rack-mounted 150-watt job with an 813 PA. The only example of this transmitter that I've ever come across is the one that was used at GB2SM, the permanent amateur station in the Science Museum at Kensington in London. It would be interesting to know what happened to it. Unfortunately, like the prototype of the British Heathkit TX-1U, it seems to have disappeared without trace! During the '50s, they also introduced a range of individual wideband couplers for 160 to 10m, an antenna switch, an SWR bridge, and various filters for reducing TVI. Towards the end of the '50s, they developed an optimum-spaced tri-band cubical quad without a boom, which was very popular amongst DXers in Britain, and was even advertised in QST during the early '60s. I don't know whether any were sold in the United States, though.

The LG300 was the second model of amateur transmitter that they produced, and was a radical departure from the old rack-mounted arrangement. It was first introduced to the amateur market at the London Amateur Radio Exhibition in November 1954. The RF unit was offered without the 813 PA tube to reduce the cost, and at the time there was no mention of the power unit/modulator. However, there was a matching power unit, which for some obscure reason was not widely advertised, that could be bought with the original LG300 for use on CW only. This was sold under the release number J9536, and provided 250 volts stabilised for the VFO, 300 volts for the low power stages, and 1000 volts for the PA. At this stage, they had designed the companion AM unit because early drawings of the companion modulator/power supply are dated September 1953, but obviously the production work on this unit had not been done in time to launch it with the RF unit. It could have been difficult to get the production effort for the power supply/modulator when it was required, because projects in other divisions took priority over amateur radio products by this stage in the development of the company. Labgear were getting into nucleonics at that time, and this had the potential for making far more money than the LG300. Anyway, for whatever reason, they wanted to get the main RF unit onto the market as quickly as possible, and thought that some amateurs might have the parts for a power supply and modulator already, and others may only want to operate CW, anyway. War surplus 813 tubes were plentiful at this time, and they must have felt that this was a good way to reduce the initial cost of the transmitter.

The original version was produced for less than a year. Although Labgear never referred to their first version as a Mk I, I'll use that to distinguish it from the later Mk II. Early advertisements for the LG300 show a prototype that had round meters. I think that if round meters were used on the very early production models, it was only for the first four, if at all. I've seen an LG300 Mk I with the serial number L005, and that has square meters just like the later Mk II models. It's very hard to distinguish the Mk I from some of the early Mk II LG300s, since they are so similar externally, and we don't know exactly where the changeover took place in the serial number sequence. However, from my research, I'd guess that fewer than 50 LG300 Mk I transmitters were produced. Exactly where the changeover between the Mk I and Mk II versions takes place in the serial number sequence has yet to be ascertained, but it was certainly sometime in late 1955 when the 'L' prefix was still being used in the serial number.

In November 1955, the Mk II version was launched at the RSGB Amateur Radio Exhibition in London. It was also announced with an advertisement on the front cover of the RSGB Bulletin that month, and this time it was offered with the matching power supply/modulator, though no picture of the companion unit was shown in the advertisement with the LG300 Mk II, which is strange since that was new and the Mk II LG300 looked pretty much the same as the old version! The first advertisement to show a picture of the new power unit/modulator did not appear until January 1956 - see **Figure 1**. This advertisement shows the RF unit on the left, and the companion power supply/modulator unit on the right. The price for the transmitter alone is given as 55 gns – the latter abbreviation is short for 'guineas.' A Guinea was a gold coin worth

21 shillings – 1 shilling more than a UK Pound. The prices of horses, antiques, paintings and large country estates were normally given in 'Guineas' in those days, so Labgear were making a statement about the pedigree and quality of their product! The price of the whole combination was the equivalent of nearly 400 US Dollars in 1956 money. In the USA at that time you could have bought a Johnson Viking II and the matching VFO for the same amount. Bear in mind, though, that Britain was still recovering from the economic effects of the war then, and wages here were less than half those of an equivalent worker in the United States. Only relatively well-healed amateurs could afford an LG300. Labgear (Cambridge) Ltd donated one of the new Mk II transmitter and power unit/modulator combinations to the Science Museum, to replace the old rack-mounted 813 transmitter that they had been using during the first half of the decade. The LG300 was probably the most popular transmitter of its power class in Britain in the second half of the '50s, but the sales of it had fallen by 1959 and Labgear introduced an instalment plan for buying the LG300 to try and revive sales. The well-healed amateurs, who could afford the high price of the LG300, were going SSB, and those who couldn't were buying DX-100Us from Heath-Daystrom. The LG300 continued to be advertised and offered until about 1962, but was then dropped from their transmitter range, and the remaining stock of LG300s was sold off at a discounted price. Sant, G2PU, was the managing director of Labgear by then, and as an active amateur he was well aware of developments in amateur radio. He had gone over to SSB on the HF bands in the '50s, so he could see where the market was going. He probably thought that there was a limited market for the LG300 with the growing use of SSB on HF, and decided to concentrate on the 160m AM market where there was still a demand for simple, commercial AM transmitters, particularly for mobile use, and no competition from Heath-Daystrom!

Readers of ER will be glad to hear that G2PU, himself, didn't completely abandon AM, and continued to operate 160m AM mobile up until the early '70s. During the latter half of the '60s, I used to chat with him on 160m AM while he was travelling between his home, just south of Cambridge, and his weekend retreat in North Norfolk. On that journey, he would pass within feet of the end of my antenna! I seem to remember that he used a 160 Twin in those days. Labgear Ltd – they had dropped (Cambridge) from the company name in late 1957 - abandoned the amateur market completely sometime towards the end of the '60s. From the early '60s onwards, they developed a range of low power transmitters and accessories that included the ***160 Twin*** for 160m mobile and fixed use, the ***Topbander*** with internal mains power supply for 160m fixed station AM/CW operation, and the ***LG50***, which was a self-contained 50W screen-modulated 6146 transmitter for 80-10m. In terms of circuitry, the LG50 was much like a Heathkit DX-40 with an internal VFO. However, Labgear only sold factory-wired equipment, so it was never offered in kit form, and never sold in the sort of numbers that the DX-40U did.

RF Unit – E5035

The RF unit of the LG300 comprises a 5763 Clapp VFO operating on 80m, a 4-stage, 5-band 5763 wideband multiplier, and an 813 PA with a KT66 clamp tube. The heater supply for all of the RF tubes is included in the RF unit. Referring to the photograph of the front panel of the LG300 shown in **Figure 1**, page 25, you'll notice that the VFO is located at the bottom of the RF unit and uses a standard Eddystone 598 dial, which has a

10:1 epicyclic reduction drive. The two jack sockets to the left of the dial are for keying the VFO and buffer stages separately. At the lower right-hand corner of the VFO dial is a small black knob for adjusting the drive level. The twin meters above the dial indicate PA grid current (15mA) and plate current (250mA). The switch between these two meters is for selecting the correct multipliers for the band in use. Above the grid current meter on the right-hand side is a drive peak control. There is a transmit indicator lamp above the plate current meter on the left-hand side. The PA pi-network tuning controls are the large, round, black knobs with metal skirts at the top of the unit. The pointer knob between the PA tuning and loading controls is the pi-network band selector switch. In view of the fact that they had gone to the trouble of providing wideband couplers to ease the number of tuning operations required after changing frequency, it's a pity that Labgear didn't gang the multiplier and pi-network band switching. In their advertising literature they make a special point of the fact that there is a minimum of controls, but that is not actually true – they could have reduced the number by at least one more, or possibly two! This would have increased the cost, of course, and the LG300 was already pretty expensive. So, you can see why they didn't do it. Immediately above the PA band selector switch is a pre-set capacitor that can be set to provide a notch on the local TV channel. Either side of this pre-set capacitor are two Belling-Lee coaxial connectors, one for the antenna and the other for monitoring harmonic levels.

In their sales literature, Labgear emphasised the shielding and harmonic filtering in the LG300. These features were particularly important in Britain in the '50s because the TV channels in use at the time were from 40 Mc/s to 70 Mc/s, and the second, third and fourth harmonics of the HF amateur bands fell right in this part of the spectrum! At this time, TVI was responsible for a great number of British HF operators giving up operation on 10, 15 and 20 meters, or at least restricting their hours of operation on those bands. In addition to the harmonic problem, some amateurs had to cope with neighbours' TV sets that had IFs in the amateur bands!

The circuit of the RF deck is shown in **Figure 2**, page 34. The Clapp VFO operates from 3.5 to about 3.85 Mc/s, whichever band is being used. The calibration marks on the dial stop at 3.8 Mc/s on 80 meters, and 29.6 Mc/s on 10 meters. The tuned circuit components are housed in an Eddystone diecast aluminium box, which is mounted above the chassis so that the tuning capacitor shaft aligns with the slow motion drive. The 5763 VFO tube is mounted separately on the chassis behind the tuned circuit housing. The main differences between the Mk I and Mk II versions are in the VFO stage. The Mk I version had no 20 pF NTC temperature compensation capacitor, and ran from 250 volts stabilised rather than 150 volts, as in the Mk II. The lower stabilised voltage for the VFO stage required the screen and plate resistor values to be changed, and consequently reduced the heat dissipated around the VFO stage a bit as well. I doubt whether this reduction in heat was significant enough to make a big difference to the stability of the VFO, but the NTC capacitor did reduce the drift quite a lot on the higher bands, though not quite enough in all cases. In some LG300s, it would probably pay dividends on the higher bands if different values of NTC capacitors were tried, because 20 pF may not be near enough to the ideal value for complete compensation in all cases. The 100 pF pre-set capacitor across the main tuning capacitor is usually set at slightly less than half its maximum value, so there is

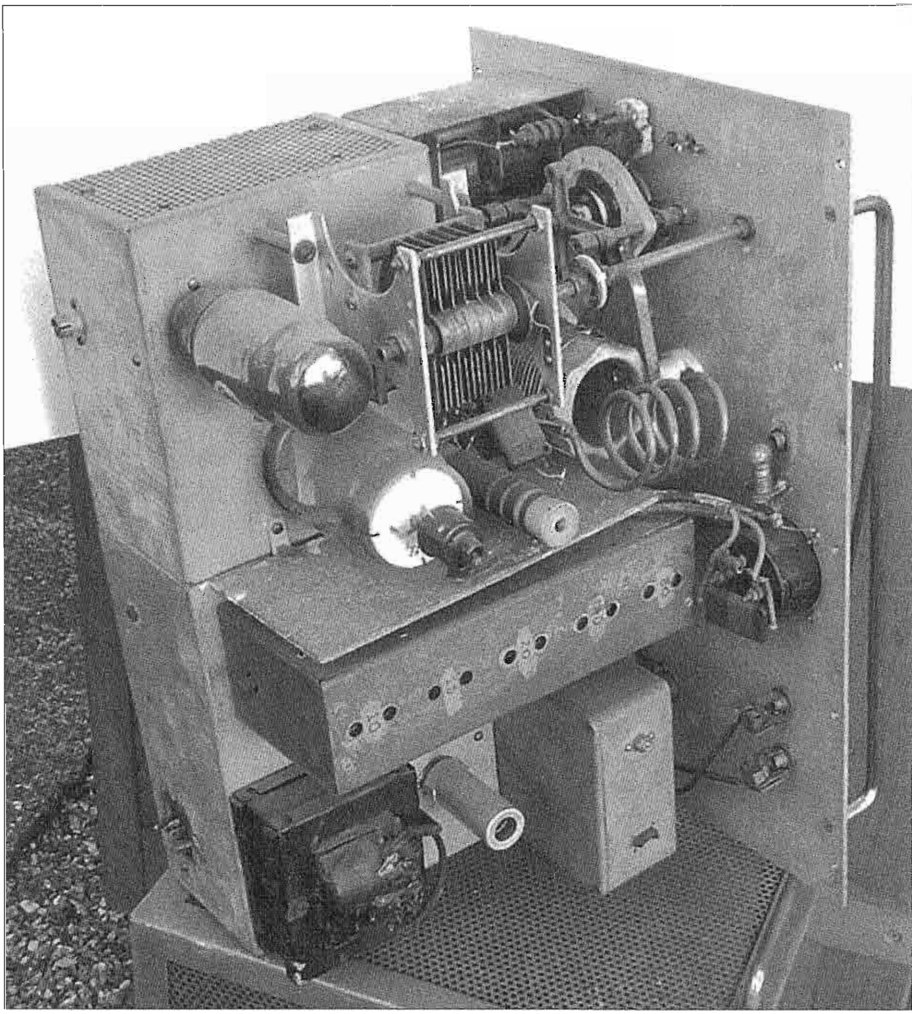


Figure 3: Photograph of the internal construction of the RF deck of a Labgear LG300 Mk II. This is a very early Mk II (late 1955), and has yet to be restored.

plenty of adjustment range in each direction that can be utilised, if required, and the VFO frequency can be re-adjusted to align with the dial calibration if other fixed values of NTC capacitor or combinations of NTC and PTC, or silver mica capacitors are found to work better. It ought to be possible to compensate the VFO more precisely over a greater range of temperatures with an individually selected combination of suitable small value capacitors of differing temperature coefficients.

The number of wideband multiplier stages selected depends on the band in use. On 80m it is one, 40m two, 20m three, 15m three, and 10m all four. An interesting feature of the wideband multiplier is the way the 7 Mc/s and 14 Mc/s 5763 stages have been triode connected to obtain a flatter drive response on these, and the higher bands. The screen grids of

V3 and V4 are driven directly with RF, along with the control grids, but DC biased separately by returning them to ground through the secondary of the wideband coupler transformer. Also, note that a 47-ohm grid stop resistor has been added to the drawing, after it was first drawn, to remedy an instability problem with V4. This grid stopper is another difference between the Mk I and Mk II circuits. In addition, the 28 Mc/s wideband coupler in the original Mk I was changed to a single coil in the Mk II version. There are also a few minor changes in the values of some of the resistors around the 21 and 28 Mc/s multiplier stages in the Mk II compared with the Mk I.

The 813 PA has a KT66 clamp tube to reduce dissipation when no drive is applied. It cuts the plate current down to about 20 mA under no drive conditions. This is required for CW operation where the VFO or the 3.5 Mc/s buffer stage may be keyed. Several keying options are possible on CW with this arrangement. It offers the possibility of break-in, with one or two stages keyed, or standard buffer-only keying. Alternatively, an external differential keyer circuit could be used with it, to give Johnson-like keying! You might have noticed that the PA has a drive peaking capacitor in its grid circuitry, and the last three multiplier stages also have pre-set 3–30 pF tweaking capacitors between grid and ground. This is so that the various wideband couplers and multiplier coils see the same terminating capacitance, no matter which stage they are driving. These tweaking capacitors are set at the factory, and the only one that is available for the operator to adjust is the one in the PA grid circuit. The output circuit is a pi-network using one of Labgear's standard multi-band, switched coil assemblies. This assembly, the E5033, has a separate heavy-duty 10 meter coil to improve the efficiency on that band. A monitor point (a Belling-Lee coaxial connector on the front panel), coupled to the output by a 4.7 pF capacitor, is provided for checking the level of harmonics. The pre-set capacitor mounted on the front panel can be used to adjust the series-resonant circuit in the output of the transmitter to null out any harmonics on the local TV channel. This can be done while transmitting at full power into a load, or antenna, by connecting a suitable wavemeter or receiver to the monitor point.

Figure 3 shows a rear view of the internal construction of the LG300 RF deck. Note that the chassis is vertical, and occupies the left-hand side of the unit looking in from behind. You can see the Eddystone diecast box that houses the VFO tuning components mounted on the chassis just behind the front panel in the lower part of the photograph. Behind the VFO box is the 5763 VFO tube, and in the left-hand corner behind that you can see the dark brown heater transformer. Above these is a metal enclosure that goes nearly all the way from the front of the chassis to the back. This is the wideband multiplier coil and switch assembly. The multiplier band switch goes out through the front panel just above the VFO dial. There are a series of holes in the enclosure for trimming the wideband coupler capacitors. You might notice that the back of the plate current meter is just visible between the multiplier assembly and front panel. The light-coloured plate just above the wideband multiplier, which looks like screening, is an asbestos sheet for shielding that assembly from the heat of the 813 PA and KT66 clamp tube. You can see the 813 PA just above the multiplier assembly, towards the back of the chassis. The top of the plate DC feed choke and the 10m PA coil can be seen between the 813 and the front panel. The end of the ceramic former that supports the PA tank coil is also visible through the turns of the 10 meter coil. The KT66 clamp tube and PA tuning capacitor are at the top of the chassis. What is not visible, because it's beneath the chassis, is the extensive filtering on the mains and power supply feeds, where they come into the RF unit. The filter components are housed in a separate enclosure within the chassis, which is, itself, totally enclosed with a bottom cover plate. Labgear had put quite a lot of effort into filtering out any RF that might leak down the interconnecting cables. Much of the wiring inside the transmitter that does not carry RF is also screened to reduce pick-up. The RF deck loafs along at the British legal limit of 100 watts of carrier on AM, and 150 watts output can be obtained quite easily on CW.

Notice that where standard Labgear components have been used in the transmitter, the Labgear part number is given next to the component symbol on the circuit diagram. These numbers always begin with the prefix 'E' followed by four figures. There is one notable exception to this practice of putting the Labgear part numbers on the circuit diagram, and that is the wideband multiplier. This unit is housed in a metal box with the band selector switch running up the centre. The wideband coupler coils and capacitors for all 5 bands are contained in this metal box with the band switch. Although Labgear produced a separate 4-stage, 5-band wideband multiplier assembly for home constructors, housed in an identical enclosure to the one used in the LG300, which was sold under the part number E5026, the circuitry is not the same as that used in the LG300 wideband multiplier, and therefore no 'E' part number is given for the entire multiplier assembly on the LG300 circuit diagram. It's a slightly different beast!

The Companion Power Unit/ Modulator – E5036

This unit is the same size as the RF deck, and can be used on the operating bench alongside it, or hidden away below the operating bench and remotely controlled. It provides a negative bias line for the modulator, 150 volts stabilised at 20 mA for the VFO, 300 volts at 200 mA for the low power stages, 600 volts at 250 mA for the push-pull 6146 modulator tubes, and 1000 volts at 180 mA for the 813 PA (this voltage is usually nearer 1100 volts). The entire push-pull 6146 modulator and modulation transformer are also included in this unit. At the time this modulator was developed in 1953/4, the 6146 tube was fairly new to the market. Considering that Labgear had used an 813 in the PA, it was surprising that they did not use 811s in the modulator. These were readily available on the surplus market at that time, and could have been used to further reduce the cost of the unit. It's hard to know what was in the minds of the designers or the marketing people at the time, but since they had already offered the RF unit without the PA tube to reduce cost, you'd have thought that they'd have done the same for the modulator. One reason for choosing the lower dissipation 6146 tubes for the modulator may have been to appease the authorities, who would have been alarmed if a legal 150-watt DC input HF transmitter could have been changed easily to 500 watts DC input by just 'beefing up' the 1000-volt power supply, and putting in a bigger modulation transformer! However, I doubt whether this was the only reason, because anyone with a mania for power could have bought a war surplus RCA ET4336, Hallicrafters BC610, or Wireless Set 53, as these were readily available at the time.

The circuit diagram of the modulator is shown in **Figure 4,** page 33. The claimed frequency response of the modulator is

350 to 5000c/s at –6dB. The speech amplifier is a pretty standard twin-triode arrangement using a 12AT7. The input stage, which is suitable for a crystal microphone, has a 2-Megohm grid resistor with a 22k/500pF RF filter. The audio gain potentiometer is between the two triode stages. In turn, they drive a 6N7 phase splitter, the balance of which can be adjusted using the 1-Megohm potentiometer across the grids of the 6146 modulator tubes. Note how the wiring around the modulation transformer and between the modulation transformer and the AM/CW switch is fully screened. The EHT leads to the transmitter and power supply are also fully screened using the same thick 75-ohm coaxial cable.

Negative DC bias to put the 6146 tubes into Class AB1 comes from a crude half-wave power supply using a selenium rectifier, which runs off one half of the secondary winding in the 300-volt power supply in early Mk II models, and a separate 100-volt winding on the heater transformer in later models. This bias supply has been responsible for wandering quiescent current and distortion problems, and most amateurs I know who use LG300s have put an improved, stabilised bias supply in place of the original. The 300-volt power supply for the low power stages is included on the upper chassis. This uses a 5R4GY rectifier, and also provides the 150-volt stabilised supply for the VFO, using a VR150/30 regulator tube.

The plates of the 6146s run at 600 volts, and the modulation transformer matches 7000 ohms plate-plate to 5600 ohms for the PA. This is only just adequate for 100% modulation with 1000 volts on the plate of the 813, but when the HT is nearer 1100 volts the modulator is liable to clip before 100% modulation is achieved. Really, the modulator supply could do with being nearer 650 to 700 volts, to allow reasonable headroom before clipping takes place. I think that all those who put out a decent sounding, well-modulated signal with their LG300s have done quite a bit of work on the modulator/power supply unit! The modulator and power supply unit are accommodated on two separate chassis stacked one above the other in the companion unit cabinet. The upper chassis contains the modulator with the 300-volt power supply, and consequently the modulation level control (left), microphone socket (centre) and AM/CW switch (right) all come out just above midway up the front panel. If you refer to **Figure 1**, page 25, you can identify the black knob of the modulation level control on the left. The prominent feature right in the middle of the front panel is a round lamp that is wired in series with the 600-volt feed to the modulator tubes, and acts as a modulation level indicator. Immediately above that is the microphone socket, and then the Labgear emblem all in a line, vertically.

The circuit for the combined 600 and 1000-volt power supply, which is on the lower chassis, is given in **Figure 5,** page 34. The row of three switches that can be seen at the bottom of the front panel in **Figure 1** are the ones shown in the power supply circuit diagram for turning the mains, exciter, and PA on and off. The power supply contains two transformers, one for the PA and modulator HT, and another for the rectifier and modulator heaters, with an additional 100-volt bias winding for the modulator that was added to models after September 1956. The 600-volt supply is derived from taps on the 1000-volt transformer, and the rectifier is a single 5R4GY. Note that the 1000-volt rectifiers are two 5R4GY's, wired so that the two halves in each tube are in parallel. These are being pushed pretty close to their PIV limit, but they seem to be reliable, amazingly enough! The remote control socket shown on the power

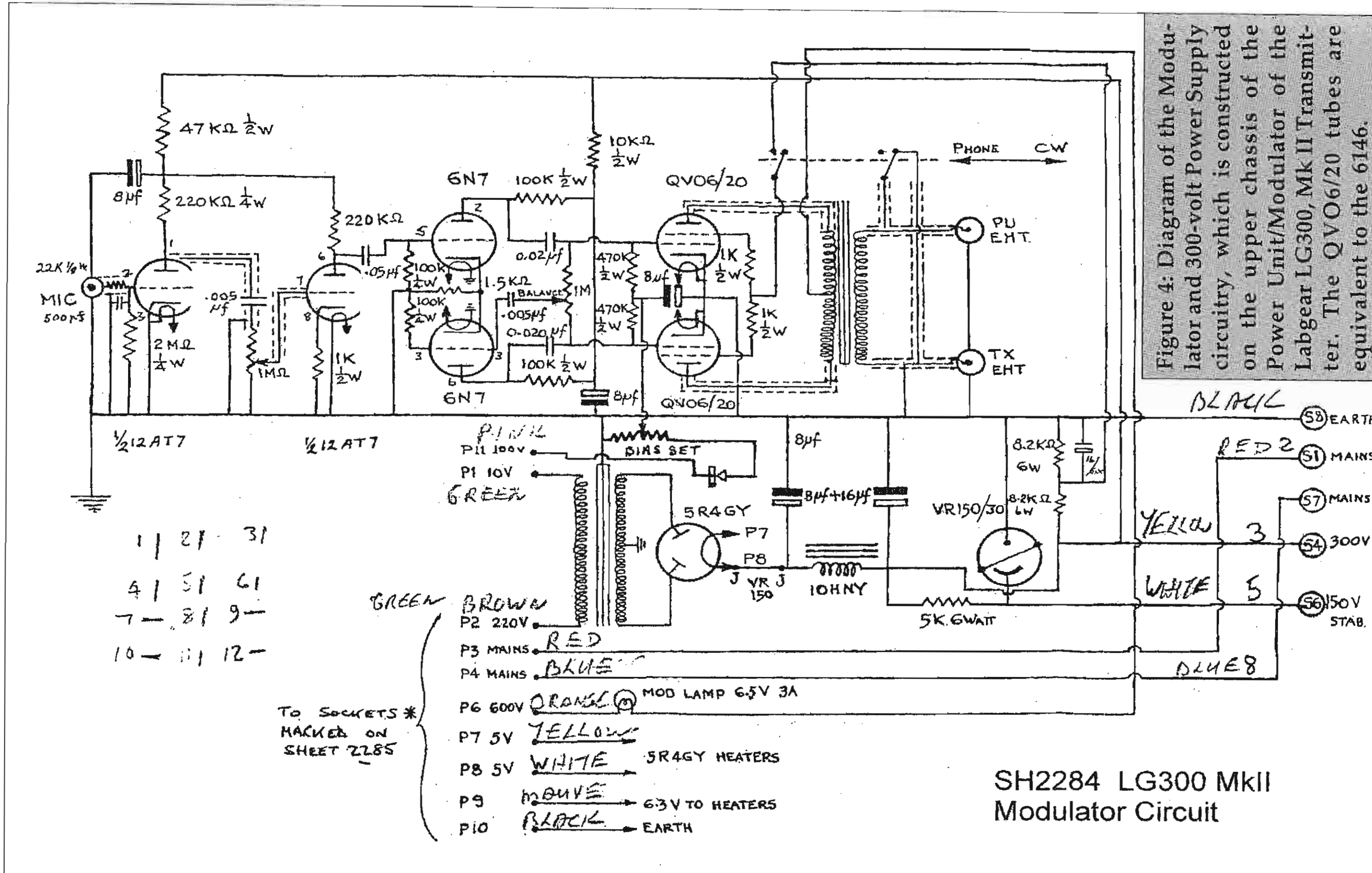
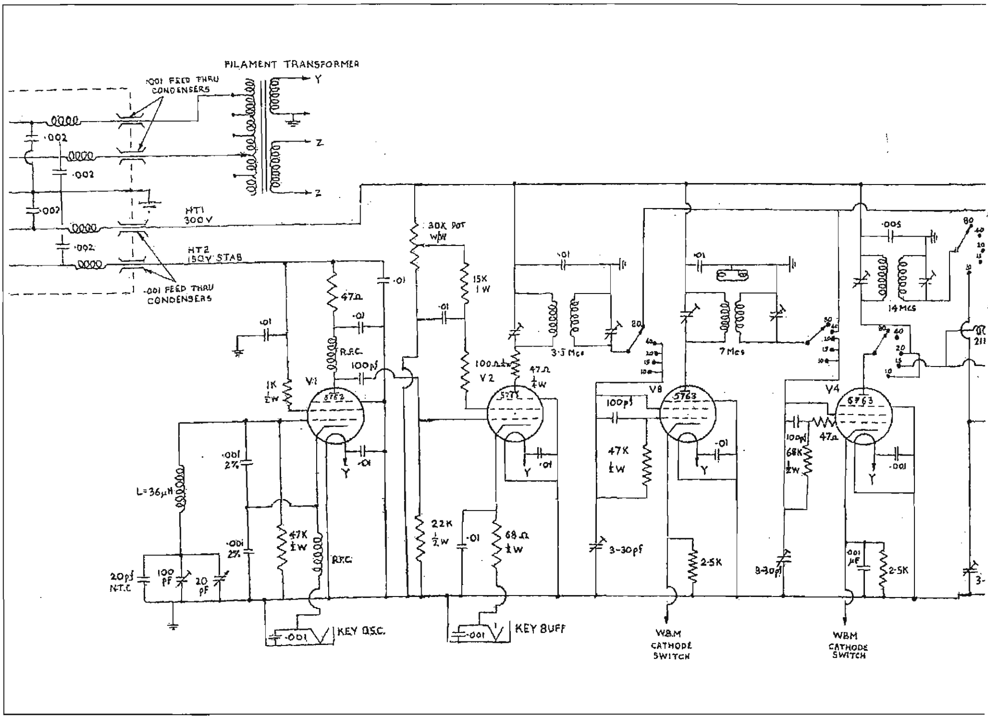
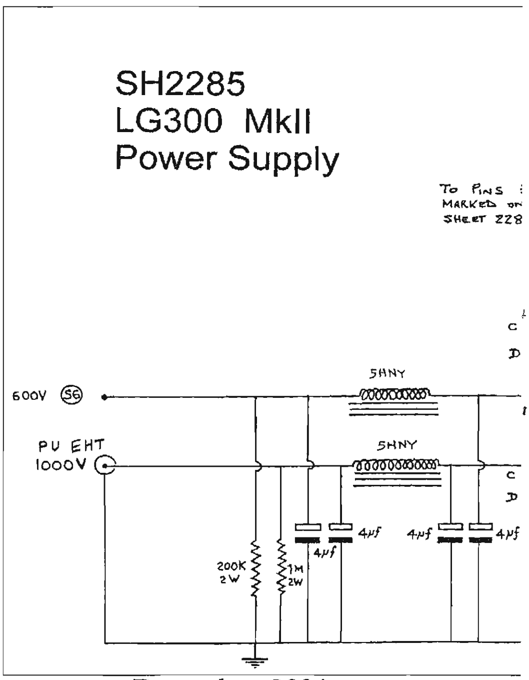


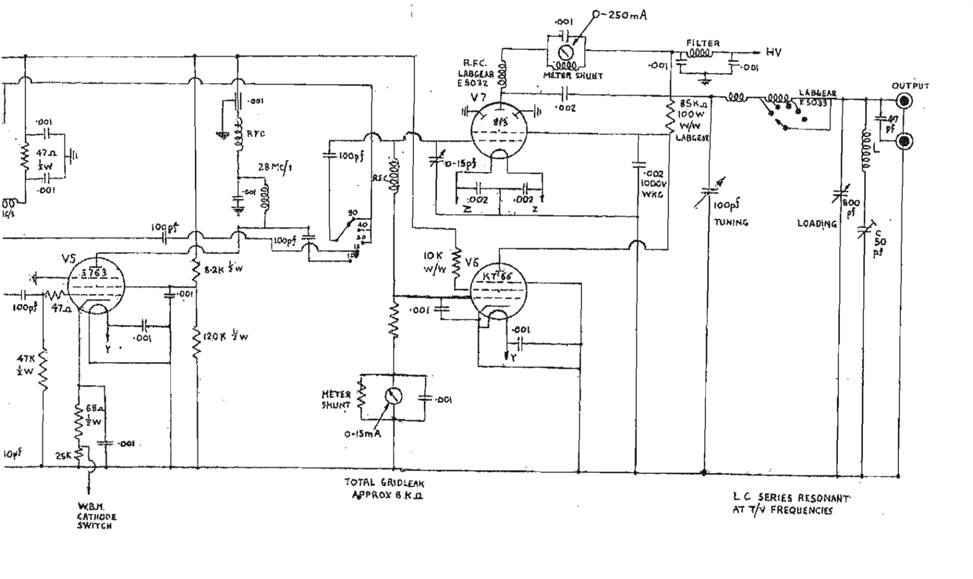
Figure 4: Diagram of the Modulator and 300-volt Power Supply circuitry, which is constructed on the upper chassis of the Power Unit/Modulator of the Labgear LG300, Mk II Transmitter. The QVO6/20 tubes are equivalent to the 6146.



Above: Figure 2, the complete schematic of the RF deck for the LG300 Mark II AM transmitter.

Right: Figure 5, Circuit diagram of the combined 600-volt and 1000-volt Power Supply contained on the lower chassis of the Power Unit/Modulator of the Labgear LG300 Mk II. The 100-volt bias winding was added to the heater transformer in September 1956 - early examples of the Mk II do not have this additional winding.




0-250mA
FILTER
HV
R.F.C. LABGEAR E5032
METER SHUNT
V7
813
OUTPUT
LABGEAR E5033
85K 100W W/W LABGEAR
28Mc/s
RFC
V5
5763
8.2K ½W
120K ½W
47K ½W
68Ω ½W
25K
W.B.H. CATHODE SWITCH
10K W/W
V6
KT66
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0-15mA
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TUNING
LOADING
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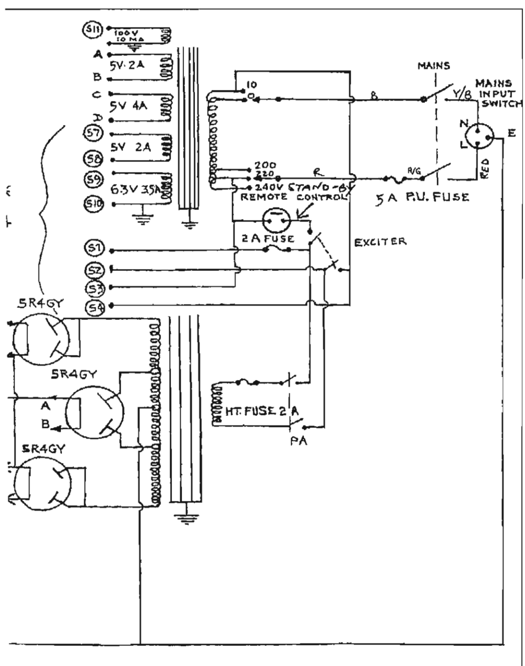
100V 10MA
5V 2A
5V 4A
5V 2A
6.3V 3.5A
MAINS
MAINS INPUT SWITCH
240V STAND-BY
REMOTE CONTROL
5A P.U. FUSE
2A FUSE
EXCITER
5R4GY
5R4GY
5R4GY
HT. FUSE 2A
PA

supply diagram allows an external switch or relay to apply AC power to the 300-volt transformer on the modulator chassis as well as the PA and modulator HT transformer. This provides the means of remotely switching on the transmitter. Note that the PA HT transformer switch is wired in series with the exciter mains power switch, so that the exciter can be on for netting purposes without the PA being powered.

The two chassis in the power supply/ modulator cabinet are connected with a multi-way cable that is terminated at the power supply end in a Jones plug. This carries 600 volts DC, the heater voltages, and the 230-volt mains supply to the modulator chassis from the power supply chassis. The 1000-volt supply is routed around the chassis, and between units, using 75-ohm coaxial cable.

The Competition and Sales

When the LG300 was first brought out in 1954, both Panda Radio and Minimitter already had table-top transmitters on the market. Their units were self-contained, big, and very heavy for a single unit. However, even these were much more convenient for people with little space than the old pre-war rack-mounted units. The Labgear approach was quite innovative, and not only provided units that were slightly more manageable to handle and could be used on a table top, but also allowed them to be purchased separately. This was a radically new approach at that time. It appears to have paid off to begin with, despite the high price of the units- that is until the Heath-Daystrom kits appeared on the market! The DX-100U took over the top spot within a couple of years of its introduction, and it stayed on the market for longer than the LG300. It was large and heavy, but was substantially cheaper as a kit than the ready-built LG300 – about 55% of its price. No sales figures are available for the LG300, unfortunately, but I would estimate that fewer than 800 LG300s were made, in total. Labgear used a letter in the serial number to indicate the year of manufacture. All the serial numbers of LG300s made in 1955 begin with the letter 'L'. After that they just worked their way through the alphabet, changing the letter each year and starting back at '001' for the numeric part. The youngest LG300 that I've come across has the serial number Q014, and was manufactured in 1960.

The LG300 is a very popular transmitter these days amongst British amateurs who are interested in vintage tube equipment and operating on AM. It runs the full legal limit in the UK, and is well made and quite reliable for a set that is 45 to 50 years old. Since it is split into two units it is easier to handle than many rigs of comparable power. It does have shortcomings, but don't all rigs? It has become 'the transmitter to have' in AM circles in Britain.

Acknowledgements

The author would like to thank Roger, G3VKM, for providing him with a copy of the circuit diagram for the Mk II RF Unit, Jim, G4XWD, for allowing access to his LG300 for a photograph of the internal construction, and also for providing him with copies of the modulator and power unit circuit diagrams, and Howard, G3RXH, who supplied the information on the registration of Labgear as a private limited company.

ER

The HB-2000, a High-Performance Ham-Band Receiver, Part 2: VFO Stability

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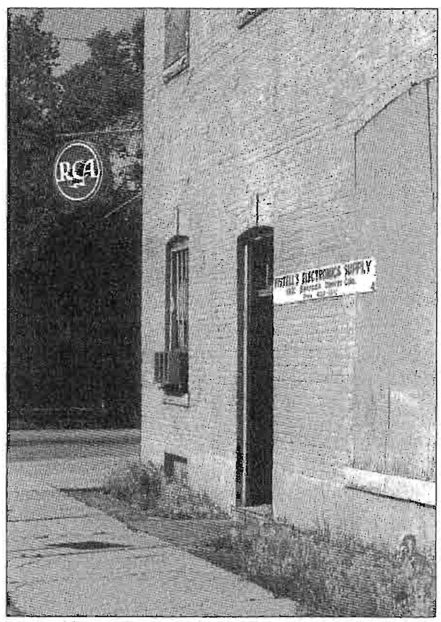
The first thing I learned about building high-frequency VFOs is how easy it is to build a poor one! Part of this is due to the nature of the project, and the other part is due to the lack of easy availability of the quality parts that are required to build a highly stable, free-running oscillator. Modern local oscillators are differing versions of phase-locked loops or direct digital synthesis, and all that is required to make one work is the ability to either connect the right ICs in the proper order to a keyboard and a display, or to have skills in programming a microprocessor. I think it is far more challenging to use traditional methods because not only does one need to understand the behavior of materials under heat transfer, but precision variable capacitors, high-quality coil forms, and temperature-compensating components have all but disappeared from view in a relatively short time. These handicaps made me even more determined to build a good VFO, and at the end I discovered that perseverance and attention to detail made the end result worth the many hours that were invested.

Construction Details

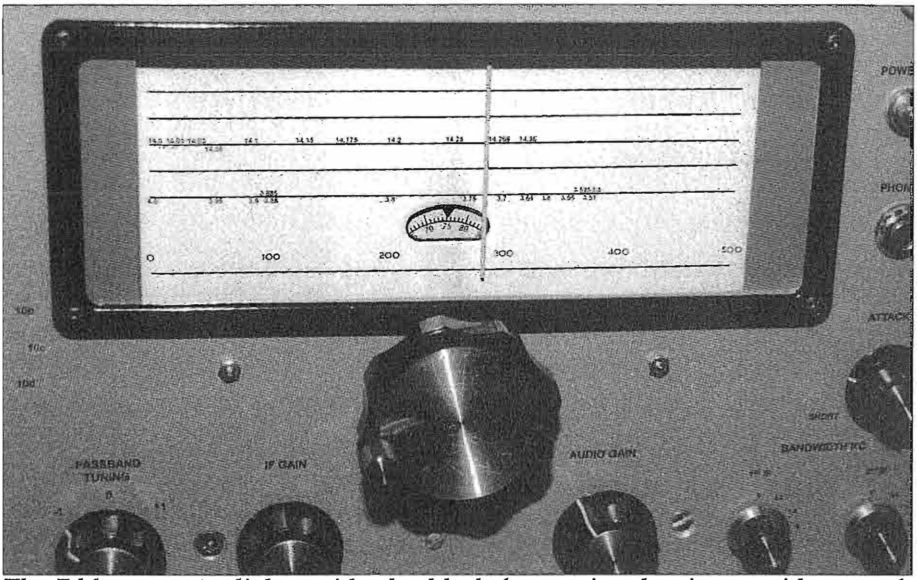
I used to visit an electronics store in downtown Denver during my lunch hour years ago. This store was established in the mid-1930s, and up until very recently they had thousands of vintage parts and tubes of all types. I was in there one day looking for some RF connectors for a project at work. I knew the store personnel well, and they would let me poke around in back if they were busy at the counter. On top of a shelf in the back of the store, covered in at least ¼ inch of dirt, was an Eddystone 898 dial in the original shipping box. I took it to the counter and asked for a price. Not having any idea how much to charge me for an item that had been in stock since 1963, they went away to find the store's owner, Dave Fistell. In a few minutes, Dave came out of his office, took one look at the box and said "Oh, you don't want that dial, that's for something real nice."

Dave knew the location of everything in that store, and I got the feeling that he really didn't want to sell it to anybody. I assured him that I did want the dial, and I promised to build something real nice with it. He finally gave me a price.

The HB-2000 receiver was built around the Eddystone dial and the VFO. As the



Fistell's Electronics Supply, the last Real Radio store in Denver, Colorado, as it looked in the late 1980s.



The Eddystone 898 dial provides backlash-free tuning, but is not wide enough for 1 kc resolution. It will be calibrated at convenient intervals and a lookup table will be used for closer readings. All lettering is made from laser printer decal paper available from Micro-Mark, see text for the contact information.

VFO was intended to be a master oscillator for a transmitter as well as a receiver local oscillator, a high degree of electrical and mechanical stability was required. Another item in my junk box was a beautiful Premier 22 x 15 x 14 steel cabinet with a hinged lid. This box was acquired from a Ham buddy, the sort of fellow who thought I was wasting my time with an SX-28A. He was loading it into his pickup to take to the dump, so I offered to take the cabinet there for him. It didn't make it any farther than my parts shed. This steel cabinet is one of the keys to a mechanically stable VFO because it keeps the combined front panel and main chassis rigid when the front panel is screwed into the mounting rails.

I began the project by placing a blank 19-inch rack panel vertically on my desk. I picked out a good looking, large tuning knob and found a comfortable height for it that wouldn't cause me "wrist freeze" like so many mass-produced rigs do. I made a mark on the panel with a red felt-tip marker, and that became the center line of the VFO tuning shaft and the basis for positioning everything else.

I had a general idea of the electrical and mechanical design I would be using, and the approximate number of tubes required. I discovered that vertical and horizontal positioning of the hardware and the four sub chassis modules would be critical if everything were to fit inside the Premier cabinet. Scrounging some stiff 1/8 inch cardboard, I made models of the front panel, the main chassis and all four of the sub chassis. The cardboard models were held together with masking tape and glue stick. This allowed me to poke the tube pins directly into the cardboard at estimated positions, and to find the positions all of the switch shafts centered in the cardboard panels. Then, I could find the right height for everything simply by cutting the bottom of the cardboard mock-up with a knife and scissors. I positioned the front-panel knobs with drafting tape to make sure the layout was reasonably nice looking, and that the knobs and rear-panel controls would clear the future panel braces and other obstructions. I like big Dakaware knobs from Chicago, USA, the style with silver centers that I can get a grip on. Some of the modern radios have little tiny flimsy knobs on *plastic* shafts and I find them irritating to use for any length of time.

The main chassis is a standard Hammond .05 inch thick aluminum chassis, 17 x 14 x 2 inches. I would have rather used a 3-inch chassis, but I didn't have room for one, based on what I learned from the cardboard model. I made a trip to a scrap metal dealer and found a few pieces of T87 aluminum sheet, 1/8 inch thick. This type of aluminum alloy is heat-treated in solution, aged artificially, and cold worked to improve its strength. It has high strength, but is easy to cut and drill because it makes small chips of material and doesn't heat as much when you work it as does soft aluminum. It takes a drill tap easily with light lubrication. Chips from soft aluminum, as typically found in standard rack panel material, will bind a tool as it heats up when you work it. The T87 panel was cut to fit the inside bottom of the main chassis and held down with 8-32 screws and lock washers at the center and each corner. I got some hard zinc-plated steel angle braces at the hardware store and cut them down to fit underneath the chassis. These were fastened to the front panel and chassis with 10-32 flat head steel screws. This makes a rigid, vibration resistant chassis and front-panel assembly that is easily drilled for access holes or threads. Threaded stand-off posts and tie strips can be positioned underneath the chassis whereever required.

The VFO shield box was also made from the T87 material. It is easy to cut aluminum panels to size with a saber saw and blades made for metal. Carbon steel blades with 12 teeth per inch cut aluminum like it is butter. A few C clamps, a solid work surface and some eye protection and you're ready to go. The outside dimensions of the VFO box (6 x 9 x 4 inches) were transferred directly from my cardboard model to the metal panel with a red felt-tip pen and cut to size with the saw. After the cut was finished, I used my machinist's square and a mill file to make sure the cuts were square. The finished panels were held in a vice, and with a Unimat drill press I made 1-72 tap and clearance holes so that the VFO box could be assembled as a unit. The lid fits flush and inside of the top of the side panels. This was not as difficult as it sounds because the dimension of the panel to be fit up was scribed on the outside panel, and the location of the clearance hole was marked with a small automatic center punch. By using steel screws in the hard aluminum, and lubricating the threads, the box can be taken apart as many times as necessary to work on the electronics inside.

The box is mounted to the main chassis on six support pillars made of acrylic plastic which are 1-inch diameter. The required height of the pillars was also known from my cardboard model. It was quite a bit of work to make them all square and the right height, actually more time consuming that building the shield box because the acrylic is harder to work. They were drilled and tapped for 8-32 screws at each end. The reason for the acrylic supports was to provide thermal insulation against heat transfer along the main chassis. The outside of each VFO panel was brightly polished with steel wool, and finished with Krylon® Crystal Clear coating. The purpose of this is to reflect infrared heat away from the VFO rather than having it absorbed. Both the acrylic posts and the polished outer panels provide increased resistance to heat transfer from the heat sources within the cabinet to the sensitive components inside the box. I knew that a good assortment of temperature compensating capacitors would be hard to find, and without knowing the drift characteristics in advance, I decided to make it hard for heat to reach the tank circuit in the first place.

With the exception of the bottom and rear panels, the other 3 sides and the lid have 1/8 inch Plexiglas® inner walls spaced about 3/16 from the aluminum walls. The Plexiglas® inner panels are mounted with nylon hardware to avoid transferring additional heat. Between the Plexiglas® and the outer walls there is fiberglass insulation. This is the thin stuff that is sold as wrap-around water pipe insulation. The purpose of the insulation is to provide additional thermal resistance.

At the front of the VFO box is a ground strap made from 3/16 copper braid that grounds the box to the main chassis.

The VFO Design

Figure 1 is a schematic diagram of the VFO in the HB-2000. The 7543 is an industrial version of the 6AU6 and is controlled for hum and noise. It was used in many of the later Collins S-line VFOs and seems to be a very stable, quiet tube in VFO service. By "quiet," I mean that it doesn't have excessive grid emission which is known to produce a wide noise bandwidth. Its plate circuit is coupled into the pentode grid of a 6U8A which is an untuned buffer amplifier with a net gain loss. Its job is to isolate the VFO from load changes and greatly improves its stability. The VFO tunes from 5.0 to 5.5 Mc. It uses regulated DC on the heater to keep heater voltage fluxuations and AC-coupled noise from affecting stability. Inside the shield box are heaters and a thermostat from the R-390A PTO. The thermostat is adjusted so that it operates its minimum setting, and the heater elements are powered from 12.6 VAC. The DC filament for the 7543 and the heaters run when the main power is switched off by a switching relay arrangement in the external power supply. The VFO is stable without the heaters, but the short-term stability during use is better when the VFO has been preheated. By "short-term" I mean that during any 5-minute period, after an initial 15-minute warmup, the drift is 40 cycles rather than 20 cycles if the VFO is preheated. I found that keeping the VFO any hotter than 'just barely warm' makes the stability worse. The heaters need to be switched off when the VFO is on to avoid noise modulation of the VFO by the AC field across them.

The plate and screen supplies of the 7543 are regulated, as is the screen of the 6U8A buffer.

All of the VFO components are mounted inside the shield box on a piece of ¼-inch brass plate. Not only does the brass plate provide a firm foundation for the parts, but it is actually part of the temperature compensation, as will be discussed later. The VFO design is a very high-C, conventional, electron-coupled Colpitts oscillator. I could see no reason to reinvent the oscillator. Most stable tube-based oscillators use this form. I did experiment with some rather exotic oscillator circuits, but they all required more parts than the Colpitts does, and I could see no real improvement in stability. Every time you add an additional component to an oscillator, you have added a new source of differential expansion, and hence drift, that must be accounted for. All of the components, and the methods of mounting them, were selected to provide stability. I used #16 soft-drawn, tinned copper wire to connect the parts. Everything connected to the tank coil, and everything around it, is a part of the tuned circuit. If you calculate the resonant frequency of the inductance and capacitance, you will find that it will not be close to the actual tuning range of this VFO. This is because of the extra capacity introduced by the shield box and everything inside of it. If this VFO is built in some other configuration, or at some other frequency, the component values are going to need changing.

Many different Colpitts circuit configurations were tried. In my project notes I have at least 10 discarded designs. I've tried air-wound coils placed vertically and horizontally, coils placed on bakelite and phenolic coil forms, ceramic coil forms, slug-tuned coils, and torroid coils. I found out that the best coil I could build was on a 1-inch ceramic form originally designed as the VFO tank coil for the TMC GPT-750 transmitter. It came from Fair Radio Sales years ago. It uses a hollow ceramic core with grooves to hold the coil wire. It came with short ceramic

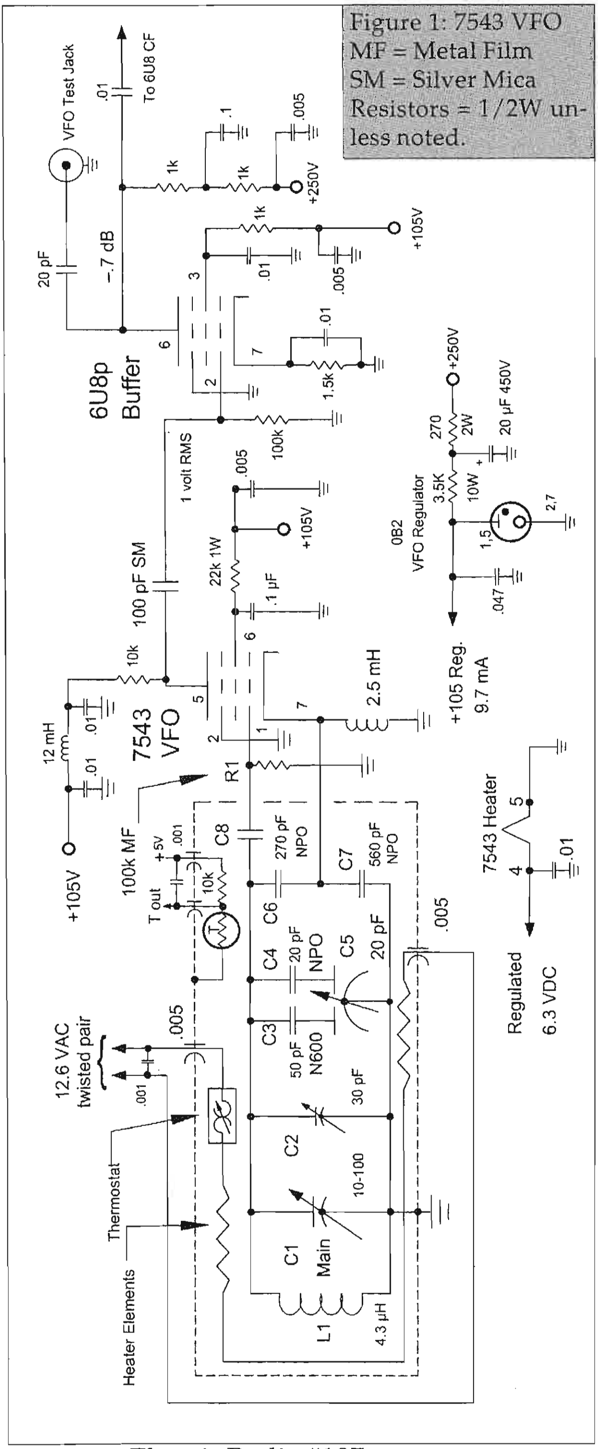
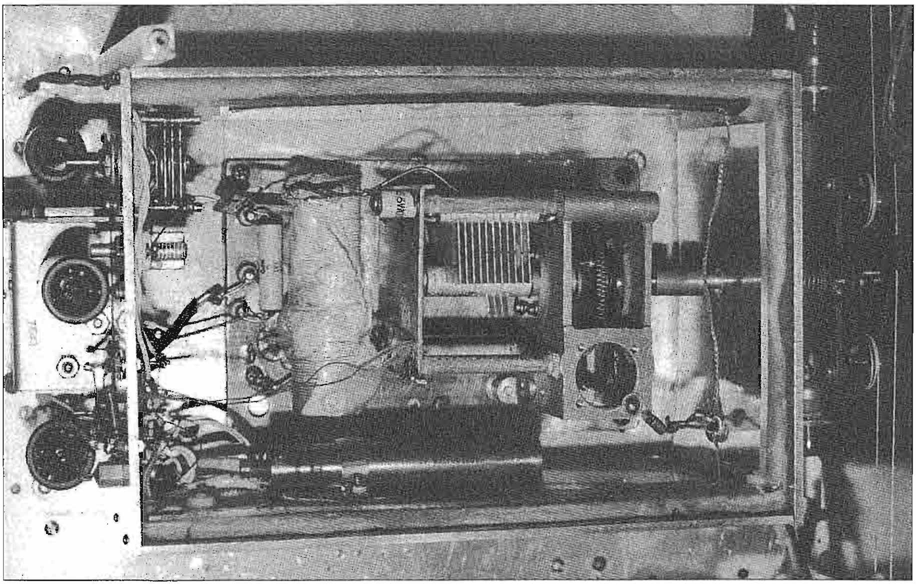


Figure 1: 7543 VFO
MF = Metal Film
SM = Silver Mica
Resistors = 1/2W unless noted.

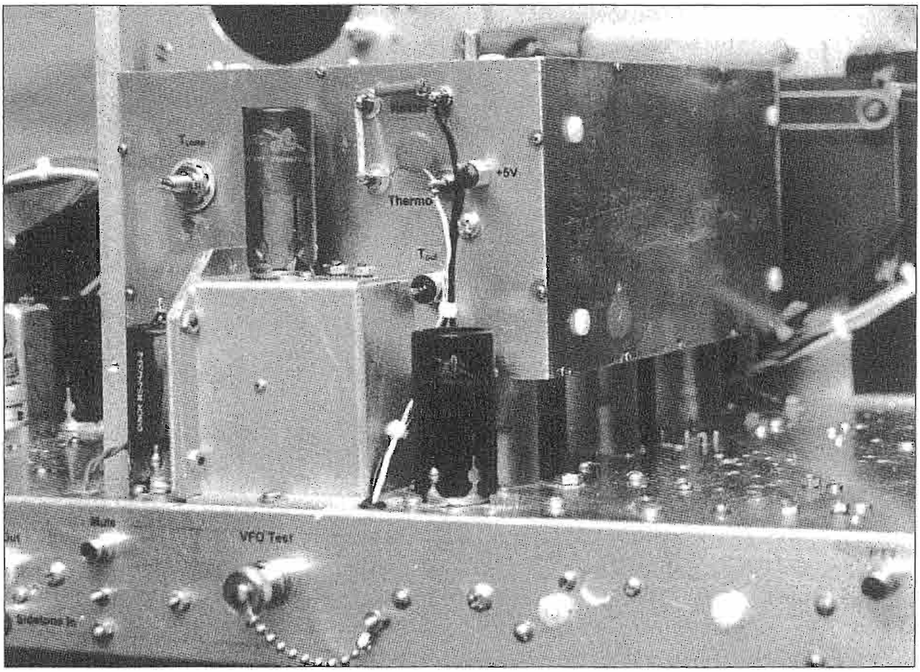
threaded posts that I have fastened to the brass mounting plate. There were 10 original windings that were already securely fastened to the form and covered with MFP varnish. To these windings, I added 2 ½ additional turns and left the original windings alone. A new piece of #20 tinned copper wire was silver-soldered to the end of the old winding. I placed the coil form and the new wire in the kitchen oven at about 150° F. for an hour. Using gloves and a bench vise, the new coil windings were wound onto the form under heat and tension, and the end was quickly soldered in place at the new "cold" end of the coil. After the coil reached room temperature, I again placed it back into the oven for two more heat-and-cool cycles to stress-relieve the new parts. After everything was back at room temperature, I coated the entire coil with super glue and let it set. Then, it was coated with CR-900 High-Strength Casting Resin. This is a two-part epoxy-based material that is used for model-making purposes. It is available from Micro-Mark, 800-225-1066, part #82659. The finished coil won't win a beauty contest, but those coil wires are not going to be moving when they heat up! After the final location for the tank coil was determined, the screws holding the ceramic pillars to the brass were sealed with Loctite® thread sealer to prevent them from working loose.

The main tuning capaci-



A view inside the VFO box shows the BC-221 main tuning capacitor in the center, and the tank coil is behind it to the left. The thermostat is at the bottom. Around the sides, the insulation and Plexiglas® inner panels are visable. The padding and compensation air variables are mounted on the rear wall, which has no insulation. The 7543 VFO tube is centered at the rear.

tor is also special. High-quality tuning condensers have all but vanished, and I have no known source of new straight-line condensers that are stable enough to use in a VFO. The one I used here is out of a BC-221 frequency meter. No, I didn't scrap a '221 for the part. Someone else did the deed; I found it in a box of junk at a Hamfest. These capacitors are extremely precise, and were hand made during WWII. The rotor, stator, and the rear frame are made from an Invar alloy. Invar is an alloy of steel with about 36% nickel, which has a rate of thermal expansion approximately one-tenth that of carbon steel at temperatures up to 400°F. It is used for applications where dimensional changes due to temperature variation must be minimized. One of its first uses was in precision mechanical clocks, most notably in the Shortt master clock. Today, resonant cavities that are used in VHF, UHF, and microwave systems use various Invar alloys. The BC-221's rotor is supported at two places with precision steel ball bearing races, which are in turn mounted to a machined aluminum casting and the bearing races use cover plates to keep dirt out. The stator plates are insulated from the frame by glass balls. The rotor was modified by removing 9 plates so that the condenser would tune from 10 to 100 pF. The only problem I had with it was the hardened lubricant in the ball bearing races. It had solidified, and I used many applications of solvent and compressed air to get it all out. I relubricated the ball bearings with synthetic 10W motor oil which will last longer than I will! The Eddystone dial is backlash-free, and when it is properly lined up with the BC-211 condenser shaft, the dial will race from one end to the other by giving the knob two spins. I use a flexible coupler from an R-390 BFO tuning unit between the dial and the tuning cap. I actually think the tuning system could use a little more friction. It



This is a view from the rear of the VFO box, showing how it it mounted on the Acryllic stand-off posts. The 7543 VFO is built on a piece of aluminum scrap metal that was cut out of an old chassis. The padding and compensation adjustments are on the rear panel of the VFO, and the 6U8A buffer is at the right.

has a tendency to pick up vibration and move on its own because the tuning knob is not balanced. This vibration can be noticed in the VFO frequency plot on page 45.

C2 is the band-set padding condenser. It is used to set the low end of the VFO at 5.000 Mc. Although air variables have an NPO coefficient, you can't just use any small air variable in a VFO. You have to find one that is solidly built, and which has the rotor shaft firmly mounted to the end frame. The one I used came from a junked VHF exciter and has a machined frame and stator plates.

The 7543 stands up on a piece of scrap aluminum at the rear, as seen in the photo above. The grid and cathode leads enter the VFO box thru ¼ inch holes, but the tube chassis does not touch the VFO box. The screen bypass capacitor, grid bias resistor, and cathode choke for the 7543 are mounted directly at the tube socket. The grounds from these parts go to a single point. The plate and screen dropping resistors are mounted underneath the main chassis to isolate their heat from the VFO.

VFO Temperature Compensation

Capacitors C3, C4, and C5 make up the variable temperature compensation (TC) network. C5 is a 20 pF differential trimmer, and the only source I know of at this writing is at the RF Parts Company, 800-737-2787. C3 and C4 are uncased ceramic TC capacitors. My only known source is Surplus Sales of Nebraska, 800-244-4567. Another way to find these parts is to look for junked tuning units at Hamfest and radio swap meets. There were thousands of different tuning units made over the years that used high-quality TC capacitors.

It is more work than it's worth to try compensating a excessively drifty VFO, or one that won't reset very well. Lack of resettability is usually due to the characteristics of modern NPO capacitors. Although they have NPO temperature characteristics, many times they are made from ceramic material which is not suitable in an accurate VFO. Also, even though you may find some nice temperature-compensating ceramic capacitors, these have a tolerance in both capacitance and temperature compensation characteristics and they might not behave as you expect.

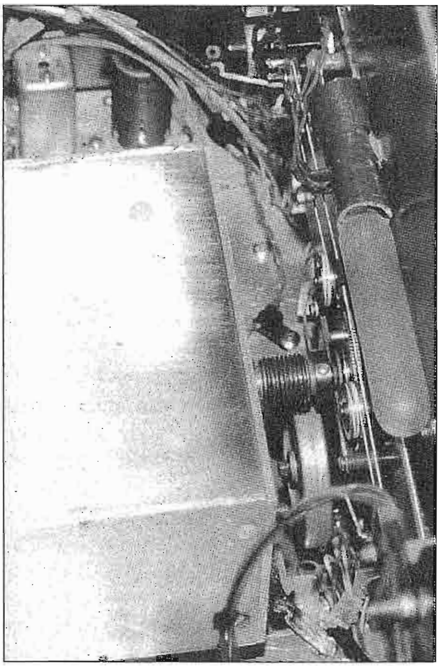
The temperature coefficient of the dielectric constant in these capacitors is a function of the molecular structure of the material used to make it. For any particular type of dielectric, the temperature coefficient is definite and reproducible. In a ceramic capacitor, the electrodes are fired directly onto the dielectric and that is what makes them stable. However, the relationship between temperature and capacitance is not linear, in general. Every such capacitor has a stated coefficient and an *actual* coefficient which is valid only between two temperatures, typically 25° C to 85° C, or 77-186° F. Outside of these limits the coefficient is unpredictable. The choice of a temperature compensating capacitor should ideally be made not on only its rated capacitance, but on its capacitance tolerance at 25° C, its temperature coefficient, and it temperature *tolerance* coefficient. The problem is that you can't order such capacitors any more, and surplus lots or capacitors clipped out of junked tuning units are usually not marked with both temperature coefficient ratings.

It is tempting to obtain TC values in between values on hand by combining them in parallel and series combinations. The equations for doing this are given below. The problem is that the total parts count goes up, and every time you add a part to an oscillator you add a variable with an unknown coefficient.

Compensation of the warm-up drift is the goal, but the temperature of all the components acting as a whole must be considered as a function of time. Good capacitors alone may not produce the desired compensation. It is sometimes necessary to add mass to the VFO components to get the compensation going the right direction. For example, in my original VFO design, I used a thick piece of 3/16-inch Plexiglas® as a mounting base for the parts inside the shield box. Most of the negative frequency drift in oscillators is due to expansion of the inductance. I found out that I had made my tank coil so rigid that the oscillator had a considerable positive frequency drift. In this case it was useless to add negative TC capacitors because they would make the positive drift worse, and positive TC capacitors have vanished from the planet. What I did to cure the problem was to add mass to the interior of the VFO in the form of the big brass plate. This additional mass absorbed just enough additional heat that was in turn transferred to some form of inductance, either the tank coil or wiring, expanding it somewhat, and that gave the oscillator a negative frequency drift which could then be compensated.

To get efficient compensation, which is compensation with the minimum amount of parts, the TC caps have to be located where their time-temperature curve is the same as that of the components you are trying to compensate. In other words, the TC cap and the coil should reach their maximum temperature at the same time. The thermal mass of the capacitor is usually less than that of the part being compensated, which usually leads to overcompensation during warm-up if it is not located in the optimum spot. The optimum spot is found by experiment, but a magic wand wouldn't hurt either!

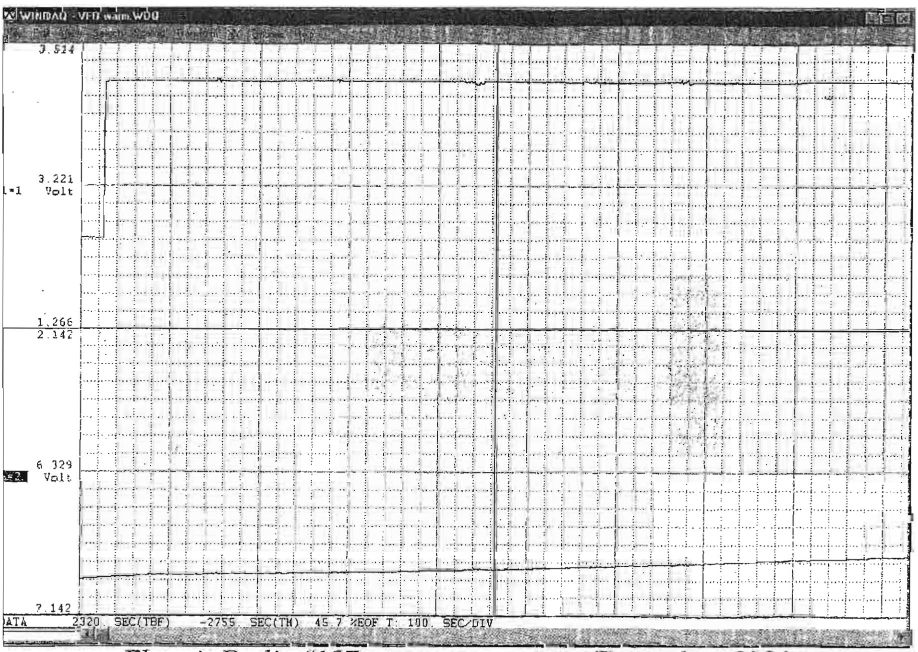
C6 and C7 are the voltage divider capacitors across L1. Although they only produce about 1 volt RMS at the grid of the 7543, they are big 1 kV epoxy-dipped ceramic NPO caps mounted directly on the brass plate with Duco® cement. The large 1-inch sizes of these caps provide thermal mass that matches the other VFO components, and are stable during warm-up. These two caps were special-order



Behind the HB-2000 front panel.

To the left is bird's-eye view looking down at the rear of the tuning dial. It shows the flexible coupling for the VFO shaft and a home made dial lamp assembly. The lamp has a screw-type base from the hardware store, and an old phenolic insulating tube of an unknown origin. The lamp's brightness is adjustable from a small Variac on the power supply chassis.

The chart below was made on a computer with the help of an external analog-to-digital converter made by Dataq. VFO frequency and temperature plotted against time on the horizontal scale. The upper trace is the DC output from a homebrew frequency-to-voltage converter, and each large vertical division on the frequency graph is 100 kc. The bottom trace is the voltage drop measured across a thermistor network that is mounted to the rear of the main tuning capacitor frame. It shows a temperature rise of 21° C to 42° C. Each horizontal division is about 1.5 minutes.



items from Maida Development Company in Hampton, VA, 757-723-0785. They are made from a ceramic substrate with known NPO characteristics, Maida style number D70C0G561M1KV.

To compensate your VFO you will need a frequency counter and some way of measuring temperature inside the VFO box. I found a small electronic thermometer at the hardware store that can be switched between °C and °F, and it has a remote sensor. The sensor was placed inside the VFO.

The first job is to make the VFO resettable, and then to see if the drift is always the same amount and is going in the same direction. If the drift characteristic is erratic you have a problem with capacitor stability or your soldering job. You have to be realistic about resettability. One person might be OK with 1 kc resettability, and another might think that 500 cycles is too much. Establish your limits, and be prepared for some experimentation. I suggest starting by using an N750 capacitor at C3 and an NPO at C4, the exact TC value is not important right now. Let the VFO warm up several hours, and then make a note of the reading on your frequency counter. Shut the unit off, and the next morning start it up and log the frequency after 5 minutes. Do this about 5 or 6 times to get an average idea of how resettable the VFO is. If it is within your goal limits, you're done. If it is not, you are going to have to experiment with different capacitors until you find some that are stable. Contrary to popular belief, some silver-mica capacitors are very stable, and some polystyrene capacitors are terrible. Also check all the solder joints, and you may want to use silver-bearing solder in assembly of the VFO.

To find the right amount of temperature compensation to use, you will need to make a series of warm-up runs with the thermometer and your frequency counter. You'll have to make a chart of temperature VS frequency every five minutes for at least an hour. Do these runs six or seven times. For each run, calculate the rate of change in terms of parts per million per degree Centigrade and average the results. The equation to use is:

$$PPM = \frac{(F1 - F2)(1^6)}{F1}$$

where PPM = parts per million, F1 = your starting frequency in cycles, F2 = your ending frequency in cycles.

If the components in the VFO are reasonable high quality you will probably have a negative drift close to the same amount every time. At the end of this work you will know the rate of change and the amount of temperature compensation required.

Not every VFO will compensate correctly with an N750 at C3 and an NPO at C4. This network must be considered as two series-connected TC capacitors in parallel when the differential trimmer is centered. Some simple equations are used to find the total value of the C3-C4-C5 network:

$$TC_{s1} = C_t\left(\frac{TC_3}{C_3} + \frac{TC_5}{.5C_5}\right)$$

$$TC_{s2} = C_t\left(\frac{TC_4}{C_4} + \frac{TC_5}{.5C_5}\right)$$

$$TC_p = \frac{C_{T1}(TC_{s1}) + C_{T2}(TC_{s2})}{C_{T1} + C_{T2}}$$

C_{t1} and C_{t2} are the total capacities of each series pair. They are calculated from the standard equation for series capacitance:

$$C_t = \frac{(C_1 C_2)}{(C_1 + C_2)}$$

"TC" is always in units of parts per million, for example, –750. TC_{s1} is the temperature coefficient of the series-connected capacitors C3 and ½C5. TC_{s2} is the temperature coefficient of the series-connected capacitors C4 and ½C5. TC_p is the final number you are after, and is the temperature coefficient of the paralleled series combinations. To find the total range of available temperature compensation, it will be necessary to work the equations twice, once with 3 pf as the first value for C5, and again with 10 pf as the second value. If the result shows that you can't hit the range of compensation required, you will have to use some other value of TC capacitance. A hand-held scientific calculator may be programmed with these equations, and many different combinations can be quickly evaluated. Paper and pencil are almost as easy, though.

It is easy to adjust temperature compensation when you have the right fixed values in place. Turn on the VFO, and after 5 minutes, write down the frequency. Wait about ½ hour, and after it has started drifting simply tweak C5 until the frequency is back to the starting point. Do it again after about an hour, and that should be it. After you're satisfied with the compensation, set the C2 padder to zero the VFO. This should not affect temperature compensation because air variables are NPO.

Part 3 of this article will discuss the VFO filter, the injection mixer, and the signal mixer.

ER

AM Calling Frequencies

160 meter band: 1885, 1945 kc. In the Midwest, listen on 1980 and 1985 kc.
80 meter band: 3870, 3880, 3885 kc. In the Midwest also try 3891.
40 meter band: 7200, 7290 kc national calling frequencies. Also 7295 in the Midwest.
20 meter band: 14.286 Mc
15 meter band: 21.400 to 21.450 Mc. Try CQ on 21.4, move up for QSO
10 meter band: 29.0 to 29.1 Mc
Try CQ on 29.0, move up for QSO
6 meter band: 50.4 Mc
2 meter band: 144.450 Mc

Vintage CW Calling Frequencies

80 meter band: 3546 kc
40 meter band: 7050 (+/- "Fists" club)
30 meter band: 10120 kc
20 meter band: 14050 kc

[Editor's note: Additions have been coming in, and that's great. I'd like to keep the frequency list as accurate as possible because many newer AM'ers are not familiar with the traditional gathering spots.]

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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

VINTAGE NETS

Arizona AM Nets: Sat & Sun: 160M 1885 kc @ sunrise. 75M 3855 kc @ 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: Sat. mornings @ 8 AM PST on 3870 kc.

California Vintage SSB Net: Sun. mornings @ 8AM PST on 3860 +/-

Colorado Morning Net: Informal AM'ers on 3875 kc Mon, Wed, Fri, Sat, and Sun@ 7 AM MT. QSX KØOJ

Canadian Boatanchor Net: Daily 3725 kc (+/-) @ 8:00 PM ET. Hosts are AL (VE3AJM) and Ken (VE3MAW)

Collins Collectors Association (CCA) Nets: Tech./swap sessions every Sun. on 14.263 Mc @ 2000Z. Informal ragchew nets meet Tue. evening on 3805 kc @ 2100 Eastern time, and Thu. on 3875 kc. West Coast 75M net is on 3895 kc 2000 Pacific time. **<u>10M AM net</u> starts 1800Z on 29.05 Mc Sundays, QSX op 1700Z.** **<u>CCA Monthly AM Night</u>**: First Wed. of each month, 3880 kc starting @ 2000 CST, or 0200 UTC. All AM stations are welcome.

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

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

Drake Users Net: Check 3865 kc, Tue. nights @ 8 PM ET. QSX Gary (KG4D), Don (W8NS), and Dan (WA4SDE)

DX-60 Net: Meets on 3880 Kc @ 0800 AM, ET on Sun. QSX op is Mike (N8ECR), with alternates. The net is all about classic entry-level AM rigs like the Heath DX-60.

Eastern AM Swap Net: Thu. evenings on 3885 kc @ 7:30 PM ET. Net is for exchange of AM related equipment only.

Eastcoast Military Net: Sat. mornings, 3885 kc +/- QRM. QSX op 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 @ 7 PM ET on 50.58 Mc. Another long-time net, meeting since the late '50s. Most members use vintage or homebrew gear.

Gulf Coast Mullet Society: Thu. @ 6PM CT, QSX op Charles (K4QZO) in Pensacola.

Gray Hair Net: One of the oldest nets, @44+ years ,160 meter AM Tue. evening 1945 kc @8:00 PM EST and 8:30 EDT. Also check www.hamelectronics.com/ghn

Hallicrafters Collectors Association Net: *Sun.*, 14.293 Mc, 1:15 PM EST/EDT. *Sat.*, 7280 kc, 1:00 PM EST/EDT. *Wed.*, 14.315 Mc, 6-8:00PM EST/EDT. QSX op W8DBF.

Heathkit Net: Sun. on 14.293 Mc 2030Z right after the Vintage SSB net. QSX op 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 14.286 Mc running daily for 25+ years. Check 5:00 PM Pacific Time, runs for about 2 hours.

Midwest Classic Radio Net: Sat. morning 3885 kc @ :30 AM, CT. <u>Only AM</u> checkins. Swap/sale, hamfest info, tech. help are frequent topics. QSX op is Rob (WA9ZTY).

<u>Mighty Elmac Net:</u> Wed. nights @8PM ET (<u>not</u> the first Wed., reserved for CCA AM Net), 3880 +5 kc. Closes for a few summer months QSX op is N8ECR

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

Northwest AM Net: AM daily 3870 kc 3PM-5PM winter, 5-7 PM summer, local. 6M @50.4 Mc. Sun., Wed. @8:00 PM. 2M Tues. and Thurs. @ 8:00 PM on 144.4 Mc.

Nostalgia/Hi-Fi Net: Started in 1978, this net meets Fri. @7 PM PT, 1930 kc.

Old Buzzards Net: Daily @10 AM ET, 3945 kc in the New England area. QSX op George (W1GAC) and Paul (W1ECO).

Southeast AM Radio Club: Tue. evening swap, 3885 @7:30 ET/6:30 CT. QSX op Andy (WA4KCY), Sam (KF4TXQ), Wayne (WB4WB). SAMRC also for Sun. Morning Coffee Club Net, 3885 @ 7:30 ET, 6:30 CT.

Southern Calif. Sun. Morning 6 Meter AM Net: 10 AM on 50.4 Mc. QSX op is Will (AA6DD).

Swan Nets: User's Group Sun. @4PM CT, 14.250 Mc. QSX op Dean (WA9AZK). Technical Net is Sat, 7235 kc, 1900Z. QSX op is Stu (K4BOV)

Vintage SSB Net: Sun. 1900Z-2000Z 14.293 & 0300Z Wed. QSX op 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 Sat. @ 2130 Pacific Time on 3980 kc +/- QRM. QSX op Dennis (W7QHO).

Wireless Set No. 19 Net: Meets second Sun. every month on 7270 kc (+/- 25 Kc) @ 1800Z. Alternate frequency 3760 kc, +/- 25 kc. QSX op is Dave (VA3ORP).

CLASSIFIEDS

Advertising Information

Subscribers receive 1 free 20-word ad per month. **Extra words are 20 cents.** Here is how to count the words in your ad: "For Sale" or "Wanted" and your contact information counts as 7 words. Hyphenated words count as 2 words. **Please count the words in your ad as described above, and if you are over 20 words, send payment for the extra words at .20 each.** Note: Not all readers use email, so it is a good idea to include phone numbers. Non-subscribers: $3.00 minimum for each ad up to 20 words. Each additional word is 25 cents. Email ads are fine.

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Deadline for the January, 2005 issue: Friday, Dec. 31

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

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

FOR SALE/TRADE: Original manuals: Hammarlund, Hallicrafters, Collins, National, Drake, Swan, Johnson, Lafayette, TenTec, Gonset, Heathkit. NI4Q, POB 690098, Orlando, FL 32869. 407-351-5536 ni4q@juno.com

FOR SALE: Model 28 teletype machine in nice condx. Pickup desired. Robert Enemark, W1EC, POB 1607, Duxbury, MA 02331 781-58-6233

FOR SALE: Original calibration book for the AN/ART-13 transmitter. Ted Bracco, WØNZW, 203 E. Main St., Teutopolis, IL 62467. A.C. 217-857-6404 ext 306, braccot@hotmail.com

FOR SALE: Hallicrafters SX25 $100 +ship. Yeasu FRG7, perfect! Box, manual, fine tuning, insp tag, $250 + ship. Ken Kolthoff, K8AXH, work #913-577-8422

FOR SALE: Collins 75A-3 with 2 filters, restored by Howard Mills. Virgil, W4OLJ, 847 Old Sweetwater Rd, Sweetwater, TN, 37874

FOR SALE or TRADE: Prewar Xmtrs; Collins 30FXR (1936) working & on 160, $4K; WECO 353-E1 working & on 160, $7K. Collins 16F/TDO with 2 remotes and spare parts, $4K. Gary, WA9MZU, 209-286-0931 or ghal@ix.netcom.com

FOR SALE: Military whip antennas, EH Scott RBO-2 Navy receiver, needs can capacitor $250. Bruce Beckeney, 989-595-6483

FOR SALE: Heath HW16, rough, needs work or for parts, w/manual. $50, Rex, 812-282-4824

FOR SALE: New 4D32 $40. Hallicrafters TO Keyer $50. Ranger I parts unit $50. **WANTED:** B&W 850 or 851 pi-net bandswitch. Richard Cohen, 813-962-2460.

FOR SALE: Heath DX100B, VG, $350. SB200 160 to 10 meters, good, $225. HT37, VG, $175. Pickup. Cliff, WA9SUE, 608-625-4527 after 6 PM CT.

FOR SALE: BC-610H, BC-614, BC-939 All FB shape $850. Collins R-388 in cabinet $385 FB shape. National HRO-60 with A,B,C,D,E coils and matching speaker $750. **WANTED:** EF Johnson Navigator. Jeff KEØMT 303-424-4055.

FOR SALE: 160M KW. Rare opportunity, Gates BC-1 recently removed from service. Commissioned restoration and 160 conversion will include remotes and VFO to owner's specs. JeRB K8WPI, 269-226-8873 or oldbugger@earthlink.net

FOR SALE: R390-A, Motorola built 1954 contract, Ser. No.173. Works well, 2 minor

mods: better tubes and ant. conn. Have reg. tube to return to orig. condx. Asking $350.00 or trade for 6M gear and cash. What have you? 636-207-0508, or e-mail; k9idb@juno.com

FOR SALE: QUALITY LETTERPRESS QSLs LIKE IN THE OLD DAYS!

Samples $1. Smokey W9STB, 8679 Pinkhurst Drive, Minocqua, WI 54548.

FOR SALE: Nice Drake TR-4 with power supply, speaker & manual $175.00. Hallicrafters HT-32A with manual $300.00. All items in great condition. Bob W1RMB 508- 222-5553.

FOR SALE: McElroy S-600, chrome, teardrop shaped bug, $600; Vibroplex J-36 bug, $150. Richard Prester, 131 Ridge Road, West Milford, NJ 07480. 973/728-2454. rprester@warwick.net

FOR SALE: Grab bag of 25 misc WW2 aircraft radio connectors, $20 + shipping. Mike Forgensi, 916-630-0932

FOR SALE: Regency MR-10 Monitoradio $30.00, Hallicrafters S-53A $65.00. Mark Castonia 920-494-0787, markcastonia@itol.com

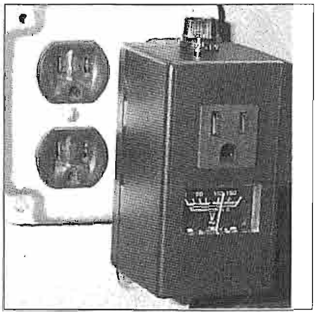
FOR SALE: Two GR-874 20dB 10X attenuators, $18. Audio transformer 500 ohm CT to 16 ohm CT $8. Ross Wollrab, 229 N. Oakcrest Avenue, Decatur, IL 62522-1810. 217-428-7385. rewollrab@aol.com

FOR SALE: R390A NOS power micro switches. $11 each postpaid. Dave, WØNBZ, 13020 Lakeview, Burnsville, MN 55337. w0nbz@juno.com

Inrush Current Limiters are now available from the Electric Radio store! These inrush limiters were reviewed in the September, 2004 issue of Electric Radio and are available in two versions:

ModelAB-1M (With Voltmeter) $34.95
Model AB-1 (With Pilot Light) $29.95
Priority Shipping $4.95

The Inrush Limiter provides a gentle, slow startup for your vintage equipment in the 150 watt range, and also reduce the line voltage to original design values. They come with a full money-back guarantee.



FOR SALE: Old books: Electronics and other subjects. Send SASE for list. John Martin, POB 14, Paloma, IL 62359 217-455-3003.

FOR SALE: National coil boxes; 3-hole, exact mechanical and dimensional reproductions; 1-coat water-based paint; very limited quantity. $55 ea plus $5 shipping. Kelley, W8GFG, 9010 Marquette St., St. John IN, 46373, 219-365-4730

FOR SALE: QRP transmitter kits. Step-by-step instructions. Wood model, up to 5 watts 40/80M $15. "Tunatin" one watt 40M $10. You furnish crystal and power. Robert Larson, 1325 Ridgeway, Medford, OR 97504 W7LNG@arrl.net

FOR SALE: 3-year old colonial home on 2 acres of land, 3,500 sq. ft. zoned for tower, finished basement with station and shop area, both wired for 120/240 volts. Near IBM in Poughkeepsie, NY. Asking price 495,000. Call Charlie, WB2ZKS, for additional details, or to arrange a visit. 845-223-8392.

FOR SALE: Gonset Communicator III, nice, works, $80. Fred Clinger, 417 Beechwood Dr., Galion, OH 44833 419-468-6117 after 6 PM.

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

FOR SALE: General Radio lab equipment, over 250 pieces, manuals, write wants, SASE. Stuart T. Carter II, W4NHC, 680 Fernwood Dr., Melbourne, FL 32904, 321-727-3015

FOR SALE: FT243 Crystals: 1815, 1822, 1885, 1945, 1985, 3535, 3560, 3579, 3875, 3880, 3885, 3890, 7035, 7045, 7050, 7143, 7280, 7285, 7290, 7293, 7295, 8400, 10106, 14286 kHz. Many others available. See list at: http://www.af4k.com/crystals.htm or call Brian, AF4K on 407-323-4178

FOR SALE: Command Xmtrs: 2 ea. 7 to 9.1Mc, rcvrs 2 ea. 3-6Mc, 2 ea. cntrl boxes. Best offer. Hal, K6DPZ, 718-847-3090

FOR SALE: R-390A's, R1051's, Harris RF-550's, URM-25D signal generators, military 28VDC gas generators, AS-2851 antenna kits. Call, Lots more stuff! S. Daniels, 636-343-5263

FOR SALE: 60" rack, Globe Champ, HT-37, Apache, Scout 680, RME-4350. Herb, K9GTB, 618-362-6539For Sale, Military RS-6 survival/spy radio set, still in pouches, with data, VGC, $150 plus shipping. 864-855-9570 or k4deejim@aol.com

FOR TRADE: 1 set B&W type BVL coils, 10, 20, 40, 80 meters with swinging jack bar...PLUS: 1 B&W type BCL turret with coils 10, 20, 40, 80 on ceramic switch. Offered in trade for 1 Westinghouse Aeriola Sr. 1-tube radio in operating condition. Roland Matson/W1CSO, POB 956, Lake Panasoffkee, FL 33538 1-352-568-1629 after 5PM

REPAIR! Radio repair reasonable charges. Manuals for sale. I buy Radios. J. Dan Rupe 998 Whipple Ave, Grayland, WA 98547 360-267-4011 W7ddf@yahoo.com

PARTS FOR SALE: Request free vintage flyer. USA only. 50 years of mail order electronics. Bigelow Electronics, POB 125, Bluffton, OH 45817-0125

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

FOR SALE:. Heathkit 100kc xtal calibrator, excellent. $15 ppd. Len Gardner, 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

TUBES FOR SALE: Tested good globe 201A $14, 226 $15, 227 $10 and others.

Slightly weak tubes guaranteed to work in early radios ½ price shown. Write or e-mail: tubes@qwest.net for a new price list or see www.fathauer.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281, 480-968-7686. Toll Free 877-307-1414

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

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

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

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.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028

TUBES FOR SALE/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

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

EQUIPMENT 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

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, fixer7526@wmconnect.com

PARTS FOR SALE: Ships radio room clock repros, boatanchor mugs and t-shirts, more. http://www.cafeshops.com/amradio.amradio2 1-877-809-1659

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

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, w4pnt@highspeedlink.net

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: ARRL Antenna Compendium #4 (out of print). George Sensibar, W9RR, POB 280, 3300 Fence Rd, Dacula, GA 30019

WANTED: Information and references on the US Army use of the Choctaw language during World War 1. Louis L. D'Antuono, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

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 Bartkowski, 708-863-3090

WANTED: Sonar CB transceiver model J23 mobile set. Ed, WA7DAX, 1649 E. Stratford Ave., Salt Lake City, UT 84106. 801-484-5853

WANTED: Dial bezel with/without mounting bolts for BC-348Q rcvr or junk BC-348Q with bezel. William Mandale, W2WHW, 371 Prussian Ln, Wayne, PA 19087, 610-687-0917, w2whw@msn.com

WANTED: Vintage Icom 502 6-meter radio, prefer good condition. Rod Black, N6HVS, 714-546-0251

WANTED: United Motor Service radios 32VDC schematic & service info model 3205 "Ryder 7-31" 40-49 model "Ryder 4-10" will pay reasonable cost for copies. Don Kuhn, N8KPD, POB 686, Marion, OH, 43301 740-383-5744

WANTED: Audio output transformer for Hallicrafters SX28 part No. 55B009: 10000Ohm C.T. Primary, 100-500-5000 ohm secondary: email to i3dan@libero.it

WANTED: LS-7 Speaker for GRC-9.Lee at N2UDF@netzero.com.

WANTED: BC-454 aircraft receiver, MC-237A control unit, adapter FT-260A, parts cables for SCR-274N. G. Kalisz, AC7YF, 2300 Mt. Ararat Rd, Winslow, AZ 86047

WANTED: Working or not, parts sets: Collins R-389 and RYCOM R-1307A "VLF Receivers", Motorola made R-390 "non A", SP-600 "with ceramic disc caps", Nems Clarke and D.E.I. VHF receivers. Dan Gutowski KD8AMS (licensed last month!) 9753 Easton Rd. Dexter, MI 48130 734-433-1354

WANTED: Microphone and large 4 pin mic connector for Courier 23 CB radio. Ed Fluehe, WA7DAX, 1649 E. Stratford Ave., Salt Lake City, UT 84106. 801-484-5853

WANTED: General Radio Type 1493 precision decade transformer in good functional condition. Ross Wollrab, 229 N. Oakcrest Avenue, Decatur, IL 62522-1810. 217-428-7385. rewollrab@aol.com

WANTED: Solid State product detector for my R-388 as advertised in ER several years ago. Phil LaMarche, W9DVM, 4227 Lake Ave, Palm Harbor, FL, 727-944-3226

WANTED: Test leads for Simpson 355 Midgetester. Joe, K2MZE, 603-652-4873 or joek2mze@aol.com

WANTED: HP4815/4193A probe. Says "Caution 50 VDC Max" on probe body. Mike Zuccaro, 858-271-8294, mjzuccaro@aol.com

WANTED: Pwr supply for Swan 350. Broadcast Mikes. K. Poling, N8EIJ, POB 142, N. Olmsted, OH 44070 440-777-8785

WANTED: 23-channel, tube-type CB radios, also 23-channel mobile sets. Ed, WA7DAX, 1649 E. Stratford Ave., Salt Lake City, UT 84106. 801-484-5853

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: TCS & TBY Navy radios. Ken Kolthoff, K8AXH, PO Box 215, Craig, MO 64437. Work #913-577-8422.

LEEDS RADIO

FOR SALE: 11 pin plugs and sockets (for R-390) - $2.50 each, Sprague 0.1 mfd 500 volt ceramic caps - $0.25, octal tube sockets - $2.10, 7 pin min tube sockets - $1.10, 5654 (6AK5W) tubes - $1.75, "chickenhead" knobs - $1.00, National HRP knobs - $1.00, Thousands and thousands of other parts and tubes. Leeds Radio, 68 North 7th Street, Brooklyn NY 11211, 718 963-1764, www.leedsradio.com

WANTED: PYE, Fairchild, Syncron, Langevin. Richard P. Robinson, PO Box 291666, LA CA 90029 323-839-7293 richmix@erols.com

WANTED: ARC-5 rcvrs, racks, dynamotors. Jim Hebert, 900 N. San Marcos Dr. Lot 15, Apache Junction, AZ 85220

WANTED: Still need audio amps w/ 6V6, 6K6 or similar. Condx not critical, I can repair. DB-110 owner, need your phone, address. Charles Graham, 914-666-4523. 4 Fieldwood Dr., Bedford Hills, NY 10507

WANTED: Sideband converters TMC CV-1758, TMC SBC-1, Kahn CV-1982/TSC-26, Kahn RSSB-62-1B, or Delta Electronics ISB-1. working or not, parts sets. Dan Gutowski KD8AMS (licensed last month!) 9753 Easton Rd. Dexter, MI 48130 734-433-1354

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

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: 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

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 Walling St., Sayreville, NJ 08872. 732-238-8964

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Produced by Floyd Soo, W8RO (ex-KF8AT)

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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:.Looking for information on radio and radar equipment aboard the Navy PB4Y-1. Warren, K1BOX, NC, 828-688-1922, k1box@arrl.net

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

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

WANTED: Incarcerated ham seeks correspondence. w/others on mil (R-390's &backpacks) & tube radios. Also copies of postwar-90's surplus catalogs, backpack specs & photos. W.K. Smith, 44684-083, FCI Cumberland Unit A-1, POB 1000, Cumberland, MD 21501.

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

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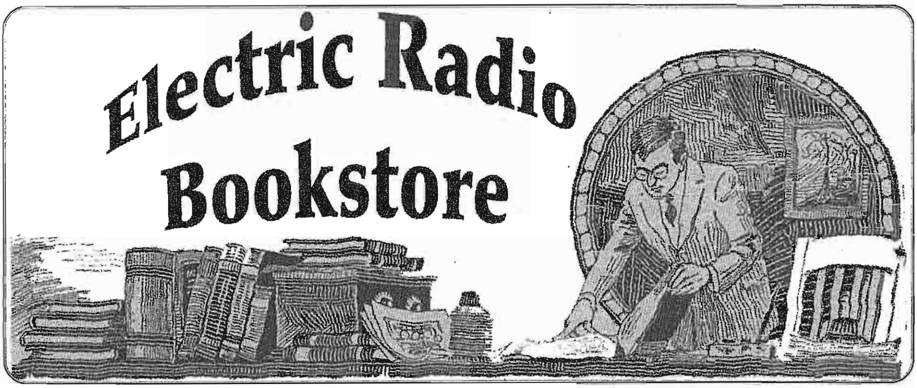

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