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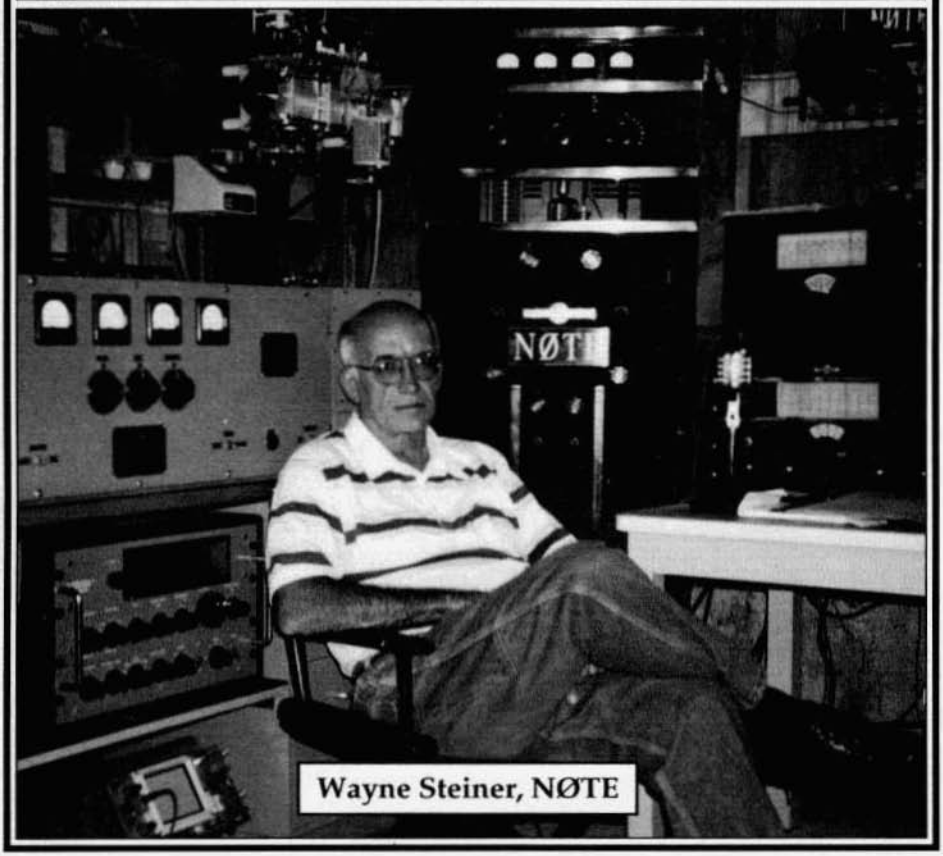
ELECTRIC RADIO

celebrating a bygone era

Number 89 September 1996



Wayne Steiner, NØTE

ELECTRIC RADIO

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

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

Regular contributors include:

Walt Hutchens, KJ4KV; Bill Kleronomos, KDØHG; Ray Osterwald, NØDMS; John Staples, W6BM; Dave Ishmael, WA6VVL; Jim Hanlon, W8KGI; Chuck Penson, WA7ZZE; Jim Musgrove, K5BZH; Dennis Petrich, KØEOO; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Rob Brownstein, NS6V; Dick Houston, WØPK; Andy Howard, WA4KCY; Skip Green, K7YOO; George Maier, KU1R; Albert Roehm, W2OBJ; Steve Thomason, WB4IJN; Don Meadows, N6DM; Bob Sitterley, K7POF (photos) and others.

EDITOR'S COMMENTS

Amateur Radio is at another crossroad. Over the next few years we may see dramatic changes in our hobby. One of the changes that's being talked about is the removal of the CW requirement for licensing on the HF bands. Although the ARRL says that they are "just studying" the proposal for the upcoming WRC-99 conference, I suspect that they have already decided to work toward this change.

I don't really know who would benefit or what the rationale is that pushes this no-code idea, but it is out there. Maybe the idea is to expand our ranks at any cost. This idea could only come from the ARRL. Maybe the equipment manufacturers do want to see the ranks of hams grow - at any cost. But I don't think the idea is from the grass roots of Amateur Radio.

Most older hams are against the CW change. In the summer issue of the QCWA Journal President Lew McCoy, W1ICP and Vice-President Jack Kelleher, W4ZC, wrote an editorial warning the membership that a change in the regulations regarding CW might be forthcoming. They suggested that if the requirement for a knowledge of CW for a license to operate on the HF bands were removed that it would be detrimental to Amateur Radio. They asked for comments. Over 600 letters were received with only 3 being in favor of the change. It's clear that the officers and directors of QCWA have received a mandate from the membership to fight the change and I'm sure they will.

I know where ER readers stand on this issue. I hope that we - AM'ers, Vintage Enthusiasts, etc - can fight this change vigorously like we've fought other detrimental changes in regulations in the past.

I think that about all we can do at this point is write to the ARRL officers and our regional directors. We can also become informed regarding where the candidates in the upcoming ARRL elections stand on this issue and vote accordingly. N6CSW

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My First 80-Meter AM QSO

by Horst Geipel, WAØNUH
2231 Hampshire Rd.
Fort Collins, CO 80526

Even though I have been licensed since 1965, my first 80-meter AM QSO took place as recently as July 10, 1994. I was using a two-tube homebuilt 2E26 transmitter (ER #47) with a breadboarded 6L6 Heising modulator. The carrier power was a whopping 10 watts and the receiver was a Hallicrafters S-76. My contacts were WØLOB in Denver and WØZUS in Edgemont, South Dakota.

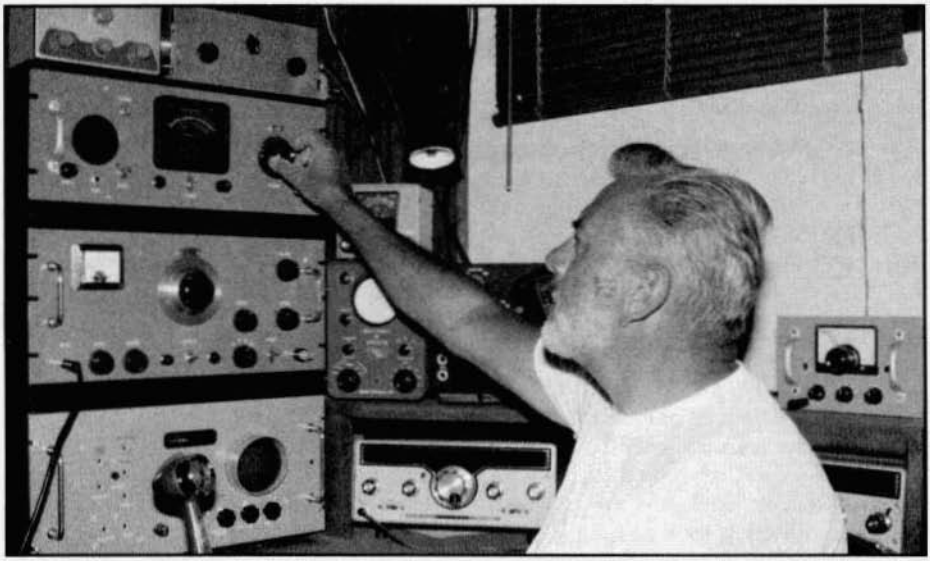
Did I just catch myself telling a lie? Well, yes and no. Yes, my first legal 80-meter AM QSO did take place as described. No, it was not my first 80-meter AM QSO! That one dates back forty-six years.

I was then still living in Germany, where the minimum age for a ham radio license was eighteen. I was only sixteen years old and had built a two-tube regenerative receiver for the 80-meter band. It used two RV12P2000 tubes (ER #59) and a selenium rectifier. I enjoyed listening to the local hams on AM and was looking forward to my eighteenth birthday to qualify for a ham license and join the fun. My friend was a year older than I and had already joined the DARC (German Amateur Radio Club) in anticipation of his eighteenth birthday and a license. He let me read his DARC magazines called *"Das DL-QTC"*. One of the issues showed a schematic for a Heising modulated VFO to be used as a low power emergency transmitter on 80 meters. It looked so simple! I just had to build one even though I could not legally put it on the air.

I had only one tube in my possession besides the two RV12P2000's in my receiver. It was a 6K7 I had found among a pile of tubes in the trash bin of a local radio shop. It was the only tube in that pile that tested good in an emission checker, but showed a cathode to filament short. By banging the tube hard on the table I had been able to dislodge the short and had, therefore, kept the tube. I also found an 80 pF variable capacitor and a variometer from a WW II German army antenna tuner in my meager parts box. I had no tube for the modulator, but did find a DC smoothing choke I could employ for the Heising modulation. Then I noticed the Volksempfaenger (People's Receiver) I used for listening to the local radio station and AFN (American Forces Network). It was a simple two-band regenerative receiver with a triode detector, transformer coupled to a tetrode driving a magnetic speaker. It did not need an output transformer. Why not hook a microphone to the grid of the Volksempfaenger's triode, replace the speaker with the choke and use the Volksempfaenger to power and modulate the VFO? It should work and I decided to give it a try.

I built the oscillator using the 6K7 in a Hartley circuit with the variometer and a fixed capacitor in the plate circuit. I had no microphone, so the dynamic speaker I used with my 80-meter regenerative receiver had to serve double duty. The primary of the output transformer was alternately connected to the plate of the receiver's output tube or the grid of the Volksempfaenger's detector tube.

To test the transmitter, I connected a record player to the Volksempfaenger and then tuned my receiver to the transmitter's frequency. There it was!



WAØNUH at the controls of his homebrew 80M AM station. The bottom unit is a repackaged BC-1031I-C panoramic receiver.

Very loud, but clear, the music was coming from the receiver's speaker. My friend, who lived about a mile from my apartment building, was intrigued. He too had a Volksempfaenger and a regenerative receiver for the 80-meter band. Why not also build a VFO so we could start talking to each other? And so he did. His box of parts yielded two variable capacitors, two large ceramic coil forms and a RENS 1204 pentode, an antique tube even back then. He built the VFO with that tube using a capacitor tuned output circuit rather than the permeability tuned output circuit my VFO used. We both had thirty meter long end-fed wire antennas for our regenerative receivers. We capacitively coupled those to our VFOs without regard to impedance matching. Despite the impedance mismatch and the very low power, the call "6K7, this is 1204, do you copy?" came in loud and clear. I replied: "1204, this is 6K7. I read you loud and clear." My first (and illegal) 80-meter QSO was in progress.

My friend and I had had several "QSOs" and we were in the process of having another one, when my father opened the door to my shack. He had heard my friend's voice but knew that he was not with me, so what was going on? I proudly demonstrated my "rig" to him and when it was my turn to transmit, my father leaned forward into the speaker/microphone and with a stern, loud voice said: "This is the Oberpostdirektion (German equivalent of the FCC). We have been monitoring you and know your location. Cease operation immediately!" Then he made me shut the rig down, plugged in the soldering iron and said. "Take this thing apart, now!" He did not leave the shack until I had removed several of the components. A little while later the doorbell rang. When I opened the door, there stood my friend, his face white with fear: "Did you hear the warning? We got caught!" I nearly rolled on the floor laughing as I explained my father's warning And his order to dismantle my transmitter.

The year was 1950 and that's the way it was. ER

The Collins R-389/URR Receiver

Low Frequency Specialist

Part 4: IF Amplifier Subchassis

by Ray Osterwald, NØDMS
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Pine, CO 80470

The next challenge for Collins was to design the IF subchassis, which is common to the R-390 and R-389 receivers. As mentioned in part one of this series, over 1500 hours was spent on the IF circuit design, and after reading through the fine details of what went on, I can understand why it took so long. IF amplifier design work was completed September 23, 1952.

The R-390 specification called for six selectivity positions, established by variable coupling in the IF transformers, and a single-crystal filter for the 100 cycle and 1 kc positions. It's interesting to note that the 100 cycle position has a quoted -6 to -60 dB shape factor of 1:48, which is genuine rotten selectivity. I don't know why they even bothered with it, except for maybe that's what the army wanted. There were certainly better CW filters around in '52. The only point on the curve with a 100 cycle bandwidth is at -6 dB, and the thing is actually broad enough to copy phone signals. This is why the sharp audio filter was included for the narrow-band modes. That high-Q audio filter is extremely tiring to use for long periods because it rings so much. I'd rather use almost any other receiver, including a regen, for CW. The wider positions, on the other hand, are really nice for AM phone or broadcast. The 8 kc position has a 1:1.91 shape factor and 16 kc has a 1:1.82 factor. This makes for high selectivity, but the ringing associated with high-Q mechanical or crystal filters is gone. I'd rather use the R-389/R-390 for AM-type reception than anything else. The widest bandwidth available was originally set up at 20 kc. This was later changed to 16 kc, but no mention is made of why the change was made.

The army also included a specification for envelope phase delay through the IF amplifier. It was originally thought that R-390s would be used in direction finding applications, so they wanted to control phase shift. Envelope phase delay is a critical parameter one finds when working with data circuits, but inclusion into a general coverage HF receiver specification is unusual. The "envelope" is whatever frequencies are passed within the -6 dB bandwidth of an amplifier, and the "phase delay" means that this group of frequencies should not be shifted in phase after passing through the circuit by no more than the prescribed amount. The actual requirement was that a 150 cycle modulating signal at the IF would not vary by more that 1/4 degree (4.63 microseconds) over the top 3 dB bandpass. They wanted this tight requirement in the 2 and 4-kc positions, but it was shown mathematically to be impossible, so the specification was rewritten for the 2-kc position only.

The IF amplifiers were entirely designed on paper before being tried out experimentally. The experimental results met the design perfectly, leaving very little to be determined by trial and error. Widely published universal design curves of the period showed that 30 (!) critically-coupled transformers

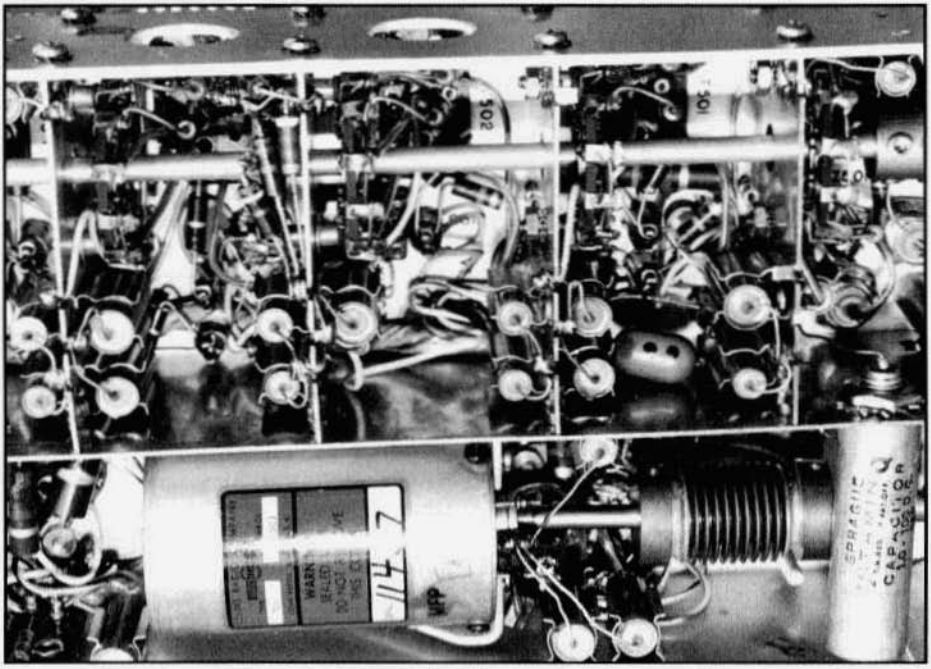

Figure 1. Bottom view of the IF subchassis. Notice the use of Sprague "Vitamin Q" capacitors for all of the bypass points. They are secured with separate clips which are screwed to the side walls. Although I'm sure there have been failures, I've never found a bad Vitamin Q cap in any equipment I've ever worked on.

would be required to get a shape factor of 1:1.9 at an 8 kc bandwidth. Other engineering work at Collins had shown that it only requires 4 transformers coupled at 3 times critical to get the same shape factor. The final design included four transformers at .6 times critical coupling for shape factor, and one critically-coupled "fill" transformer to meet the phase delay specification. To properly design an IF amplifier to meet some phase delay specification, the phase shift must be calculated to four or more decimal places over all five transformers. This type of work was extremely time consuming in 1952, as digital computers were not yet available. Previous work at Collins by an engineer named R.E. McCoy produced an empirical design method based on numerical equivalence between single-tuned and double-tuned circuits. Using McCoy's method and other graphical solutions, the exact design of the IF transformers was arrived at, and the lab breadboard version met the goals. Not too bad for a wooden calculator and a piece of paper, huh?

The IF amplifier gain requirement was set at 91 dB into the detector. To compensate for component aging, overall IF gain could be varied 20 dB with a pot located in the cathode circuits of the 3rd and 4th IF amplifiers. The design specs called for a linear output in the manual gain position for a 20 dB rise in voltage from "normal" levels. The 6AK6 pentode will handle a relatively large voltage input swing without being forced into grid current, and that's why they used it at the last IF amplifier position instead of another 6BJ6. The overall signal gain from antenna to detector is roughly 105 dB.

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The IF transformers were another special design, and the coils were produced entirely at Collins (see figure 2). The windings were high Q, high impedance pie-type coils built up of many turns. The army insisted that the coils stand up to a 48 hour session in a chamber at 95% relative humidity and temperatures ranging from 20 to 65 degrees C. Many waxes, cements and casting resins were tried out in an attempt to seal the coils against this abuse. The report lists 16 different materials which were evaluated, and the best formulation was apparently a type of casting resin called "Araldite Resin F". Being a resin, two chemicals had to be mixed up in a batch before they could be used. The coils had to be hot dipped in this goop above 140 degrees F. A long cure time of 48 hours at 212 degrees F was required. I'm sure this was a smelly, dangerous process but the result was outstanding resistance to moisture in the coil assemblies which lasts to this day. After everything was assembled and the IF deck was in final test, it was found that any detuning caused by environmental changes was in iron core permeability, not in the coils! They were tested at 95% relative humidity and between -104 and +140 degrees F. Kids, do not try this at home!

Also located on the IF chassis is the 3TF7 ballast tube which regulates filament current by controlling the filament temperature of the oscillator tubes in the R-389, R-390, and the R-390A. This tube has been the subject of much controversy. The engineering report has the following to say about the 3TF7: "... Considerable work was done with Amperite Corp. in designing this special ballast tube which feeds a constant 300 mils to the two 6-volt, 300-mil oscillator tubes used in the VFO and BFO. These three tubes are connected in series across the 26-volt filament supply. The ballast tube (3TF7) operates on a current of 290 to 330 mils and holds this current within +-10 mils for input voltage variations of +-15%. This reduced the 15% variation to approximately 3%. There is some question if a filament regulator is necessary in these receivers since the oscillators are very good even without regulation. However, since the stability was a big factor in this design and since the factor of tube aging was not known, the regulator was included."

I guess that settles the question of whether or not the 3TF7 was designed specifically for the R-390.

The R-389 suffers from the same AGC attack time problem as do the '390 and '390A receivers. Originally, they used AGC on the two RF stages and the first two IF amplifiers. Bias was adjusted so that the audio output level only increased 6 dB (twice as loud) for a 106 dB increase in signal level. That's not too bad of an AGC control range. Unfortunately, it was found that strong signals were reducing the signal-to-noise ratio. Remote cutoff pentodes are noisy, and really strong signals would increase the bias so much that the"shot noise" in the amplifier chain was much more noticeable. To correct the situation, AGC control was moved from the second to the fifth IF amplifier. The first RF amplifier was changed to a 6AJ5 to reduce cross-modulation, but that tube has different AGC characteristics. These changes resulted in a loss of AGC control at signal inputs over .1 volt RMS. A tenth of a volt is a heck of a strong signal, roughly 60 dB over S9. This input level is rarely found except when your station is co-located with adjacent transmitters. The designers were therefore more concerned with the total range of AGC control rather than the attack time problem when listening to weak CW signals in the presence of strong ones. In any case, these receivers were mostly used in point-to-point service with constant-carrier transmissions.

The reason an AGC amplifier was used was simply to isolate the devel-

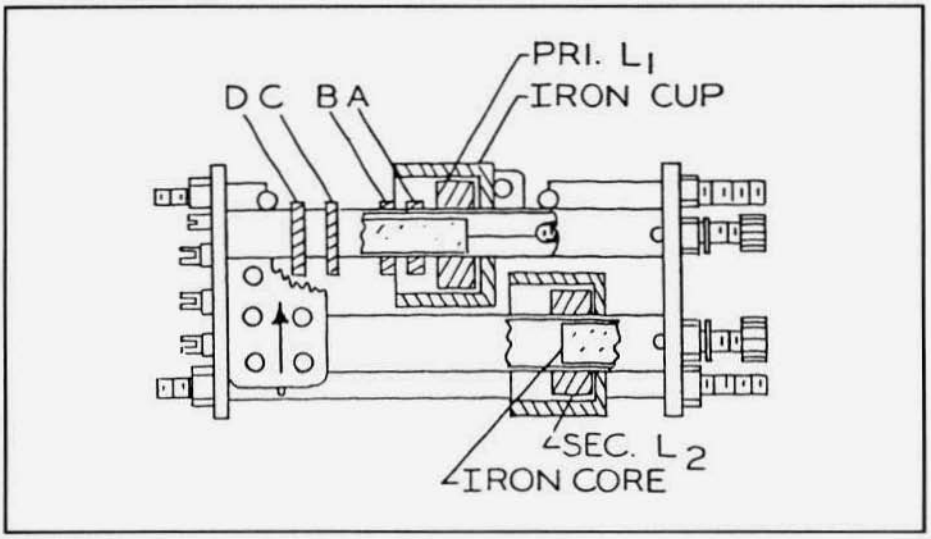

Figure 2. Engineering drawing of an interstage IF transformer. The letters A thru D are not identified.

oped AGC voltage from BFO injection.

No AGC was ever used on the mixers because their bias voltages had been carefully adjusted for the best spurious rejection ratio. Users restoring R-389s should carefully check these bias values to make sure they are within the 10% specification. Also, if spurious response problems are found and the operating voltages seem to be correct, try swapping out the mixer tubes with other new ones.

Restoration

I was lucky with my receiver in that it needed nothing major to get it going. The ballast tube was open (of course), but other than that it needed only routine cleaning, lubrication, and alignment. I didn't even have to replace any other tubes. I repainted my control knobs and meter housings with jet black Krylon.

Correct lubrication is critical on the R-389. The front mechanism plates carry 12 ball bearings which accept the tuning shaft journals. These bearings must be very clean and properly doped with load-bearing lubricant. Following the good advise of KDØHG, I've used Mobil Oil Company's synthetic automatic transmission fluid with very good results. Synthetic lubricants are far superior to petroleum-based oils, and should last forever in radio equipment. If the entire tuning system isn't free to turn, the motor drive life will be shortened, and you will need the motor. Just try to find a replacement if you burn it out! Some owners I've talked with have units with chronically stiff tuning mechanisms. This is due largely to years of neglect, and the ball bearings have gotten rusty. The only way to restore this kind of problem is to entirely dismantle the two front plates and have a machinist remove and replace the bearings. They are standard machine sizes, but an arbor press is used to change them. After lubrication, keep the receiver covered when it's not in use.

If the bearings are clean and lubed but there is a bind over a portion of the tuning range, there probably is an alignment problem between the front panel and the mechanism plates, or some other kind of mechanical damage.

There is a cast aluminum drive box attached to the tuning motor. It is actu-

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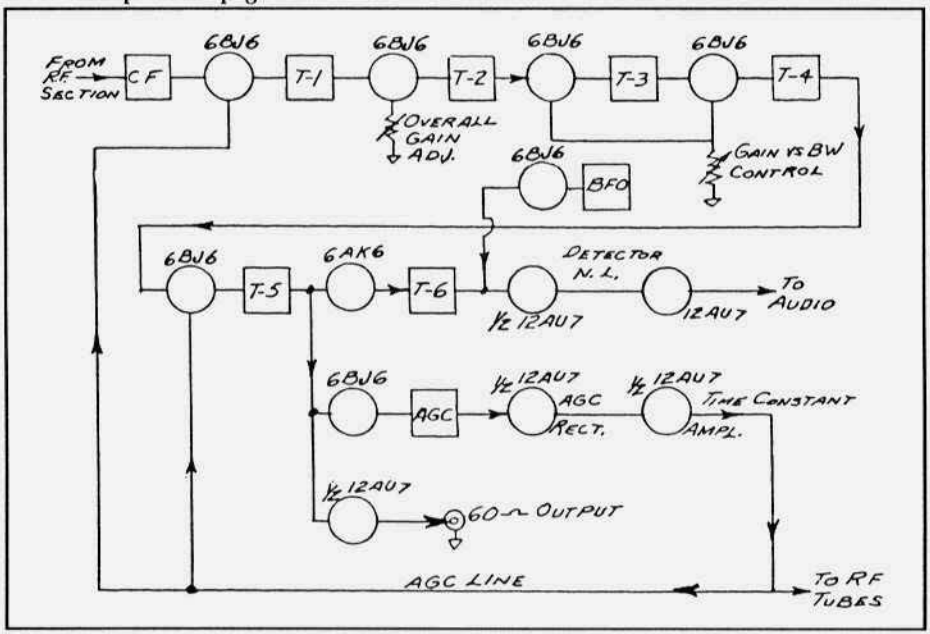

Figure 3. IF subchassis block diagram.

ally a differential drive, and is filled with lubricant and sealed up. I wanted to change the lubricant and check it out mechanically, but I couldn't get the cover off by removing the screws and gently prying at it. The sealant they used in production is really tough stuff, and everything I ran into said "stay out". Unless you really want trouble, I'd advise against tearing into the drive box under any circumstances!

Another likely area of trouble is in the selenium rectifier stack used for the bandswitch motor power supply. These old rectifiers can get kinda tired after 40 years. One of their favorite tricks is to not produce the same amount of DC after they warm up as when cold. The stack can be replaced with silicon diodes, but series resistors must be included so the DC voltages come out correct. The diodes can be disguised with heat shrink and hidden behind the old rectifier so that the unit at least looks original.

The mechanical alignment is extremely tedious. The manual calls out a procedure where a thin wire is stuck through holes in the tops of the vertical drive shafts to check slug rack positioning at certain frequencies. Doing this procedure nearly caused me to go permanently cross-eyed, but I found three bands where someone had managed to mess up the alignment.

Accurate RF alignment is important. It's hard to see much of a change on a VTVM when the RF alignment procedure is followed, but persistence is necessary in order to get everything tracking properly, the right amount of gain, etc. It helps to use a frequency counter to make sure the generator is where the dial says it is, unless you've got a newfangled one that's synthesized.

Modifications

If I did have any modifications for the R-389, I'd sure never publish them. I only modify command sets and R-390As.

Performance

I've heard the R-389 called the "Holy Grail" of medium-wave DX'ers. I never really knew what that meant until I

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LETTERS

Dear ER

It's what makes horse races and explains the plethora and menagerie that vintage radio collectors "collect" and use in the hobby. I am referring to opinion and preferences. More specifically, I am referencing David Kuraner's (K2DK) article on the National Radio HRO-500 receiver (August 1996, issue #88).

As a proud new "papa" of a HRO-500, I read this article with great interest. My impression of this receiver differs greatly from the author's and his resources. My rig was indeed recently purchased "new in the box and crate" (series #102-187, dated 1967) from a local ham. Possibly, as my receiver is new, I have not encountered the disturbances and dysfuntions that Mr. Kuraner describes from his sample of "three in various states of operational status". I trust that these problems will not surface as the receiver ages.

I do not mean to sound like a "protective father", but I do take issue with some of the author's comments (at least as it applies to my rig). The author reports that..."SSB reception is distorted and this appears to be a design flaw". I don't hear this as my receiver sounds very warm and "tooooooby" (surprising for a solid-state device).

The proof is in the pudding!! I have replaced my 75S-3B with the HRO-500 in transceive operation with the 32S-3 and more surprisingly, it has replaced a superb Collins R/E 51S1 as my front-line SWL receiver. To each his own!!

Phillip W. Harris PhD, WB6MYL

Dear ER

My dad bought a Hallicrafters SX-42 receiver in 1949, and that wonderful radio became part of my growing up as it introduced me to shortwave listening and eventually amateur radio. We all enjoyed the radio, but it soon became apparent that its sound had a subtle distortion (mild audio clipping). I noticed it first, but I then persuaded my dad that it was there, and that we ought to get it fixed.

A local service shop could find nothing wrong with the set, and we eventually took it to Chicago, where my dad carried it up four flights of stairs to the service department on the top floor of the Hallicrafters factory. They also could find nothing wrong with the radio.

A decade passed, during which I learned some electronics, and I decided to look at the radio myself to see if I could fix the distortion. I discovered that a tube socket in the IF circuit had a supposedly unused lug that was being used as a tie point, but that the particular tube plugged into that socket in fact was internally connected at that pin. To fix the problem, I installed a one-lug terminal strip next to the tube socket and transferred the tie point from the tube socket to the terminal strip. When I finished, the distortion was gone.

I subsequently gave the radio away to a friend, who then dropped out of sight, so both the radio and the evidence of my solution to its problem have vanished.

I now would like to document this problem as a practical lesson for other radio enthusiasts, but I can no longer remember which lug on which tube socket was improperly used as a tie point. If any readers of Electric Radio can help, please contact me. (I have already contacted Chuck Dachis, and his advice was to send a letter to Electric Radio.)

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The Radio VT Fuze

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One of the best kept secrets of WW II was the VT fuze also known as the proximity fuze. This device was used in various forms on rockets, antiaircraft shells and antipersonnel bombs - both those dropped from airplanes and those fired from howitzers. A typical VT fuzed artillery shell contains a miniature CW radar system which senses that the bomb is near enough to its target (about 30 feet) to be effective and then triggers the detonation. See Fig. 1. British scientists conceived the idea in 1940 and passed it on to the Americans who developed the technology and brought these weapons to fruition in time to play an important role in WW II in both the European and Pacific theaters.

Fortunately for our soldiers and sailors, the Germans didn't have VT fuzes. One author[4] says the reason for this is that the German engineers were too smart - they felt it would be impossible to make a radio tube that would withstand the extremely high acceleration (about 20,000G) experienced by an antiaircraft shell at the moment of firing or the centrifugal force (800-3000G) due to axial rotation imparted by the rifling of the cannon barrel.

Ruggedized Tubes Developed

The components requiring the most intensive research were the tiny vacuum tubes. Subminiature tubes were already in existence having been developed for use in personal hearing aids. After redesign and extensive testing, a set of tubes was developed to be able to meet the demanding needs of the VT fuze. These included triodes, pentodes and thyratrons. Fig. 2 shows three subminiature tubes (two triodes and a pentode) alongside a 1T4 7-pin miniature tube for size comparison. The pentode, weighing about half the weight of a U.S. nickel, would weigh 110 pounds at 20,000G acceleration.

Each component part used in these tubes was designed using stress and strain analysis like that used in designing bridges and skyscrapers. The tubes were then subjected to rigorous tests, first by computation and then by actual mechanical means such as in a centrifuge or by firing them out of a cannon after being mounted in dummy shells. These shells would then be dug out of the ground, the tubes recovered and then analyzed for signs of weakness or failure. Most of the tubes were manufactured by Sylvania Electric Co. By war's end, production reached 500,000 per day. Total production was about 130 million tubes.

Basic VT Fuze Circuit

A representative circuit is shown in Fig. 3. The first tube, V1, is a simple regenerative detector similar to those used in early amateur radio receivers. As is well known, these regenerative detectors radiate a radio signal when they are adjusted so as to oscillate. The VT fuze is provided with a nose cone made of hard plastic which encloses an antenna element in the shape of a small metal cone. This, together with the metal body of the shell constitutes or forms an unsymmetrical dipole antenna. This antenna serves two functions. It radiates the radio wave that intercepts the target and it also receives the much weaker reflected wave and applies it to the detector. Thus V1 acts as both the transmitter and the receiver. The re-

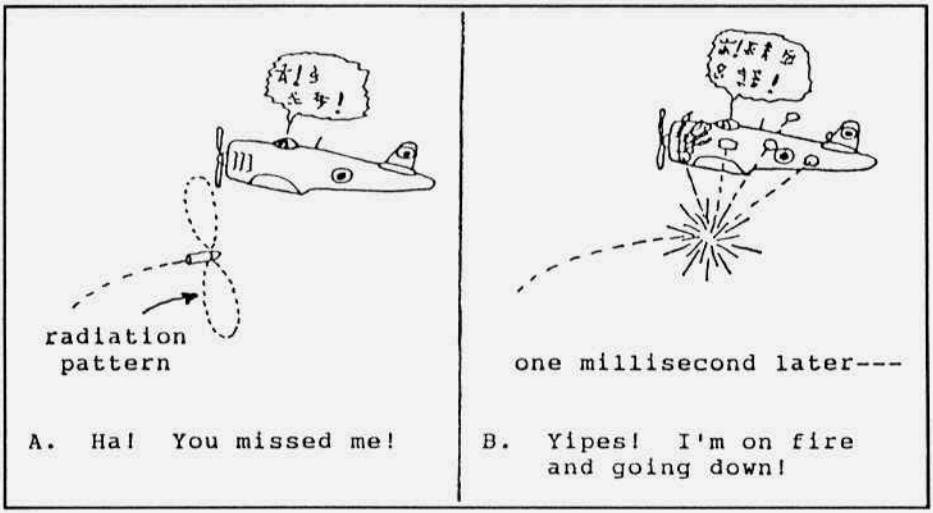

Figure 1. With a VT fuze, a near miss is a hit.

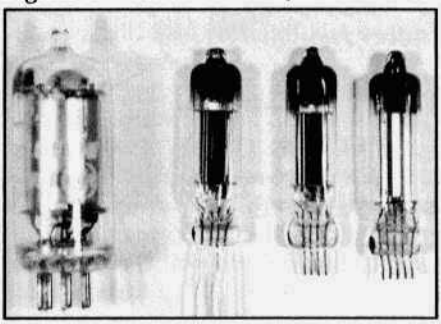

Figure 2. Subminiature tubes compared with 7-pin miniature tube.

ceived wave has a changing phase relation with respect to the emitted wave depending on the velocity of the shell relative to the target. These two signals produce an audio beat frequency in the plate circuit of V1. This is a result of the well-known Doppler effect which will be discussed later in more detail in Fig.6.

After suitable filtering to remove RF, noise and microphonic components, this audio signal is amplified by V2 and V3 and applied to the grid of the thyratron, V4. Normally, V4 is biased negatively and no plate current flows. When the VT fuze is within optimum striking range, the signal is strong enough to fire the thyratron. The gas becomes ionized and the plate resistance drops to a very low value. Then C_F discharges through a 10 ohm resistor imbedded inside the squib - a small capsule containing heat-sensitive explosive. The resulting explosion sets off a more powerful explosion in the detonator which in turn triggers the explosion of the main charge. All this occurs in less than a millisecond.

Sensitivity Pattern

As stated before, the nose cone antenna acts in conjunction with the body of the shell as a dipole antenna. The radiation pattern of a dipole antenna is familiar to radio amateurs and is shown in Fig.4A. This figure shows the pattern in a vertical plane containing the antenna. The complete pattern is in the shape of a torus or doughnut generated by rotating the pattern of Fig.4A 360° around the axis of the antenna. The sensitivity of the antenna as a receiver of RF has exactly the same shape. Thus the net, overall sensitivity pattern of the VT fuze (radiation plus reception) is found by squaring the radiation pattern and thus appears as shown in Fig.4B.

If the shell is mis-aimed so that it will pass over or under the target, the Doppler frequency will progressively de-

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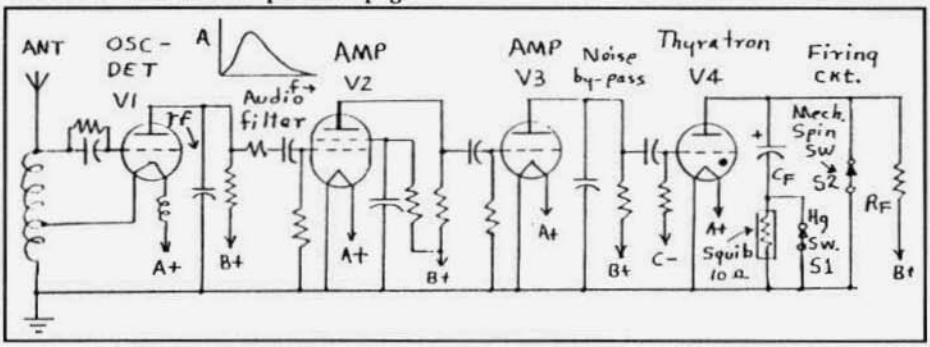

Figure 3. Representative circuit portraying basic elements in a VT fuze.

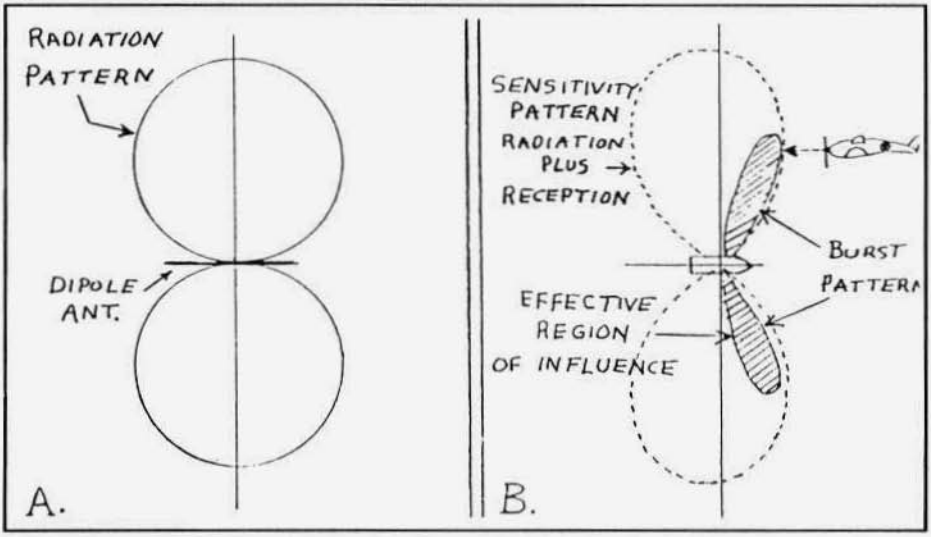

Figure 4. A. Radiation pattern of a dipole. B. Sensitivity and reception. Shaded area - see text.

crease and would drop to zero at the point of closest approach. By properly adjusting the frequency response of the audio amplifier, the effective detection sensitivity pattern can be modified to nearly match the burst pattern of the exploding shell. This is shown by the shaded area of Fig.4B It will be observed that the VT fuze is 'blind' looking 'dead ahead'. Thus if the shell is on a collision course with the target, it will not go off prematurely but will wait till it impacts the target.

Circuit Assembly

Figure 5 illustrates the arrangement of components in a VT fuze. At the top is the antenna protected by the hard plastic nose cone. Just below this is the oscillator-detector coil. Next come the tubes and their associated resistors and capacitors. Each tube is fitted into a rubber shock-absorber. The tubes, resistors and capacitors are laid out flat during assembly and wiring and then rolled up into a cylinder for installation into the fuze. Surrounding all of this is capacitor C_F that fires the squib. Capacitor C_F is rather large (1 uF) and so is formed into a cylinder that wraps around the inner electronics bundle. This capacitor is said[7] to be the first capacitor to use mylar as the dielectric.

After final testing, the electronics bundle is embedded in a potting compound.

The Battery

At the beginning of development, dry batteries were used but these had limited shelf life especially when used in tropical regions. This led to the development of a unique wet battery in which the electrolyte was kept away from the electrodes until the shell was fired. The construction of the electrodes is reminiscent of the old Eveready 'layer-built' batteries. Here the elements are circular discs which fit around a central ampoule which holds the electrolyte. At the instant of firing, this ampoule is smashed open when it is driven against the 'crusher'. The electrolyte then quickly diffuses through the battery electrodes, being driven by centrifugal force.

At the bottom of the stack are 60 elements which give 90 volts for the B supply. Above this are three sets of elements connected in parallel to provide filament current. Finally, the top five elements provide 7.5 volts bias for the thyratron.

In bombs dropped from aircraft and those attached to rockets, the power source is an AC generator attached to a wind-driven propeller. A rectifier-filter converts the AC to DC for the plate supply. The filaments are heated with AC and special feedback circuits are employed to cancel the resultant AC hum. These bombs differ in several other aspects and space does not permit further discussion. See references 2 and 4 for more details.

The Doppler Effect

The Doppler effect [4,5] was mentioned earlier. This is explained in more detail in Fig. 6. In simplest terms, V1 acts as both a radio transmitter and a regenerative receiver. A beat note between the sent and received signals will occur in the plate circuit of V1 and build up in amplitude as the missile approaches the target. In the sample calculation shown in Fig. 6, if the relative velocity (missile to target) is 500 m.p.h. and the oscillator frequency is 160 MHz, then the Doppler frequency will be 238 Hz. This signal is amplified by V2 and V3 and used to trigger V4. By proper adjustment of amplifier gain and thyratron bias, the fuze can be programmed to detonate when the shell comes close enough to the target to be effective. (See section on sensitivity testing).

Safety Devices

The shell shown in Fig. 5 has several safety features built-in which greatly reduce the possibility of accidental or premature explosion. For example, if a gunnerman accidentally drops a shell onto the steel deck inside a gun turret and the capsule holding the battery electrolyte breaks, the shell must not be allowed to explode. And if the enemy invents a countermeasures device designed to detonate the shell immediately after it leaves the canon, a time delay needs to be incorporated so that the shell will be a safe distance away from the ship before it is fully armed. The safety devices take the following forms:

1. The batteries are not activated until the shell is fired. The ampoule breaks and centrifugal force diffuses the electrolyte.

2. The mechanical spin switch shorts C_F and prevents it from charging until the shell is rapidly rotating.

3. It takes time for C_F to charge sufficiently to fire the squib.

4. A mercury switch shorts the squib until the shell is rapidly rotating.

5. The powder train between the squib and the detonator is not aligned until the shell is spinning.

Sensitivity Testing

How do you test a VT fuze to make sure its sensitivity is properly adjusted so it will detonate at the desired distance from its target? A test firing range was built near Albuquerque, N.M. Two

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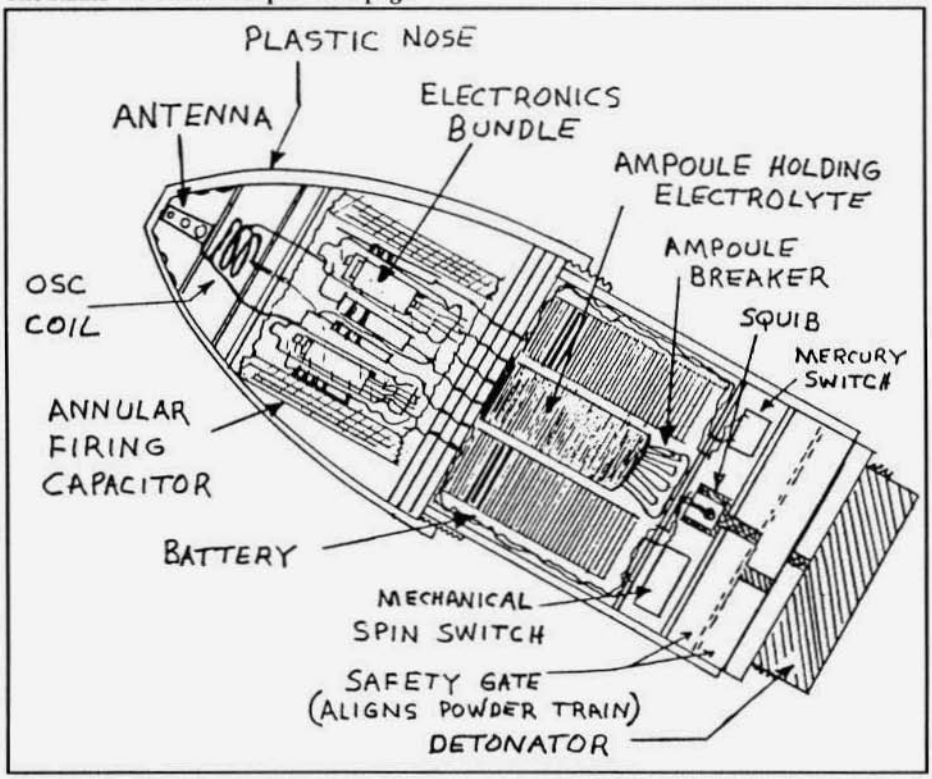

Figure 5. Cross-sectional view of military type VT fuze.

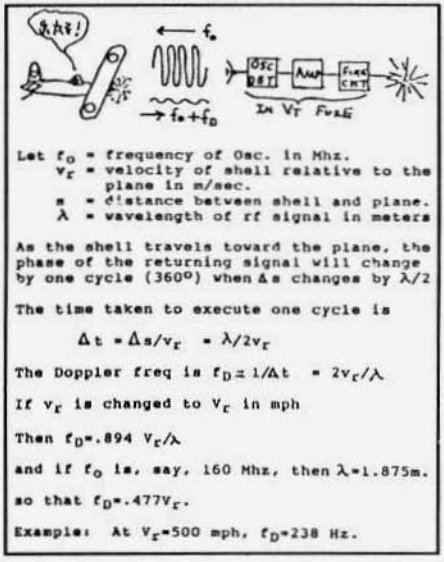

Figure 6. Showing how the Doppler frequency is found.

tall towers were erected several hundred feet apart. By means of ropes running between these towers, the test airplane was suspended high above the ground. High speed motion pictures could then record such details as average intercept distance, the polar sensitivity and burst pattern and its effectiveness in damaging the airplane.

Uses in World War II

The first use of the VT fuze in Europe was at the Battle of the Bulge. The VT shells exploding about 30 feet above ground cut the tops off all the trees as though a "giant had been at work with his scythe"[4]. The German troops were left with no place to hide. A foxhole or a stone wall is of no use as a shelter when a VT shell explodes 30 feet above you. Without the VT fuze, a shell might burrow into the ground and then explode. If you're in a foxhole, you might

be shell-shocked, yet survive. But the VT fuze makes warfare a whole new game. After WW II, General George Patton said that when both sides have the VT fuze, we'll have to devise a new method of warfare.

I was Radar Material Officer on the USS Willard Keith, DD775. When our ship reached the Philippine Islands in May 1945, we received the new 5" AA shells equipped with the VT fuzes. When we got to Okinawa, we were assigned to radar picket station 15, about half way between Okinawa and Japan. Our job was to find the Japanese Kamakazi (suicide) planes by means of radar and then direct the marine aviators circling overhead to intercept and destroy them. In one battle, our ship brought down two enemy planes thanks to the VT fuzes. The VT fuzes are claimed to be five times more effective than the older mechanical fuzes. In the time it takes to load and fire five salvos, a Kamakazi pilot could be flying his plane into your forward boiler room.

Our sister ship, the Hadley, DD774, was at picket station 15 the week before we arrived. She and her support vessels were attacked by about 100 Kamakazi planes. Two or three of these planes managed to plunge through the ensuing barrage and severely damaged the Hadley so that she had to be towed back to Okinawa. Without the VT fuzes, she surely would have been sunk with great loss of life. When I saw the Hadley a few days later, her bridge was decorated by dozens of emblems of the Japanese rising sun flag - one for each plane shot down. We envied her achievement and valor and were thankful that she had rid the sky of so many Zeros. Incidentally, these Kamikaze pilots were given lots of sake just before takeoff, their shoes were wired to the foot pedals and the cockpit canopy was padlocked to foil any last minute loss of courage.

Countermeasures[9]

At least a half-dozen foreign counties now have VT fuzes. Thus it was necessary for the US to develop a device that would protect our troops. This instrument, nicknamed Shortstop, was developed for use in the Persian Gulf war but that war ended just as production got underway. However, some of these devices have now been sent to Bosnia for use there.

Shortstop detects the RF signal emitted by a VT fuze and then radiates a strong false return signal which initiates a premature explosion. The Shortstop device can protect an area at least the size of a football field. It does this by causing the projectile to detonate when it is still 200-300 meters away from the Shortstop unit.

The newest generation of Shortstop devices being developed now will be available in three styles. There will be a small, lightweight soldier's backpack unit. Then there will be a larger unit for use in vehicles such as the Humvees and Bradley Fighting Vehicles. Finally, there will be a still larger unit for field use which will have a tripod mounted antenna.

Conclusion

I think we owe a debt of gratitude to the scientists and engineers who developed the VT fuze. This invention surely helped to shorten WW II and undoubtedly saved the lives of many Americans, including my own!

Acknowledgments

The author would like to thank the following people for their assistance in locating the references: Ludwell Sibley, R. G.Thomas and Wm. E. Denk. I am especially indebted to Dr. Harner Selvidge who was a member of the original VT fuze development team. He provided answers to several questions that were not covered in any of the references. ER

References.

1. Proximity Fuze: Electronics War Report, Electronics, pg. 110, Nov. 1945

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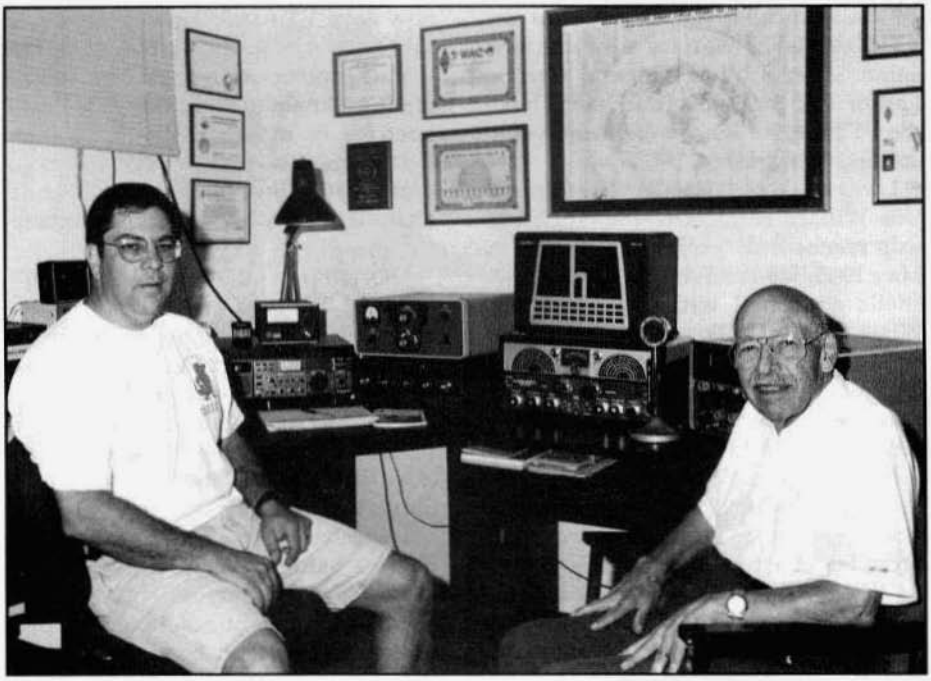
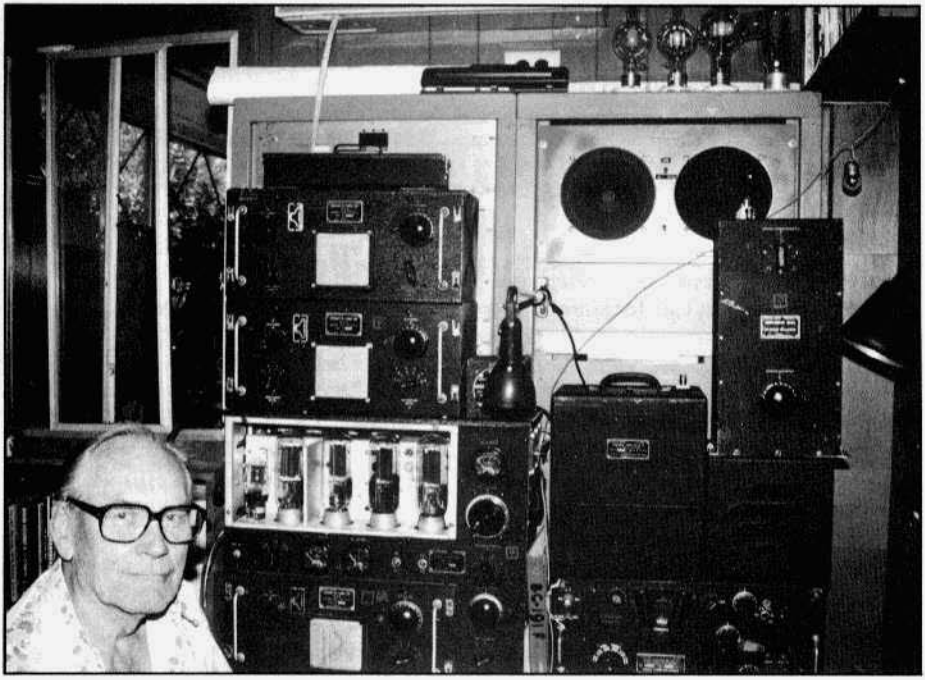


Dave, WB2PMP and Dad (OM) Jerry, WA2GEX, enjoying some reflections of 35+ years of ham radio together. The photo was taken in Dave's hamshack.

Bob Peters, K1JNN, proudly operates his Collins gear from his home in Mesquite,Texas. ***Photo by Jay Miller, KK5IM.***



Clifford Kurtz, N6ZLI, operating his BC-191/BC-342 station. In WW II he operated this equipment in the South Pacific.

At the Cedars of Lebanon 'Fest August 25th. Left to right: Don, K4KKYV; Hoisey, W4CJL; John, KN4ME & Kasey, W4HYG. All ardent AM'ers. The 75A-1 in the trunk didn't sell. *Photo by Hank Clark, W2IQ.*

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R-390A Survey/Order Number List

by Les Locklear
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During the winter of 1994, a telephone call from a friend in California about a R-390A that was manufactured in 1984 started a project that seems to have no end in sight.

Since the first article in ER #71, March, 1995, information has come in from all corners of the world regarding the R-390A/URR contract/order numbers. And when Tom Marcotte, N5OFF, started the serial number survey, the amount of information increased overwhelmingly! With this article, the overall picture has become much clearer with respect to who built them, how many were built and a more accurate list of contract/order numbers. The EXACT number of R-390A's built will probably never be known. However, I'm working on it. The enclosed information on numbers built should be very close. Any estimates on total produced are on the low side.

Wally Chambers, K5OP, has had extensive conversations with an engineer who retired from EAC, then went to work for the Department of Defense in signal intelligence. He related the following: EAC received many small orders (25-100) for R-390A's from the signal intelligence branches of the government, both civilian and military in the 60's and 70's. On a related matter, a close friend (who shall remain anonymous) recently received several R-390A's from the NSA in Fort Meade, Maryland, for alignment and repairs. It appears some senior operators prefer the R-390A over the multi-buck digital readout micro-processor wonders! But we already knew that when it comes to a quiet receiver the R-390A is at the head of the class.

One reason that none of these smaller contract/order numbers have surfaced is because the government in their infinite wisdom decided not to allow these receivers on the surplus market. Many of these had special modifications. The U.S. Navy had a Lockheed Super Constellation that would fly at low altitudes over the Mediterranean Sea and these R-390A's and other ancillary would be relegated to "Davy Jones Locker".

Many of you wrote and asked who built the PTO'S. Well, only six companies manufactured the Collins designed permeability tuned oscillator, they are:

1. Collins Radio Co.
2. Motorola
3. DuBrow Electronics Industries
4. Progressitron Corp.
5. Raytheon
6. Cosmos Industries

I won't go into the technical aspects of the PTO in this article, as it has already been done by Ray Osterwald, NØDMS in his inimitable style in ER Nos. 30 and 31. The Progressitron PTO's are easily identified by the peeling blue decal, many times their name is completely missing. Thankfully, Progressitron's PTO's were far superior to their decals. Many of you who wrote said the Progressitron PTO was the best they had used. In my humble opinion, it is one of the best ever made.

Much has been written and discussed regarding the performance characteristics between the various manufacturers. To put it simply, "they all had to meet the same specifications". Enough said!

The two numbers for the 1967 EAC contracts can be confusing, the order number is the FR-36 number while the contract number is DAAB05. Both of these numbers appear on some receivers. This is the same contract. Many of the followers of these articles will no-

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VINTAGE NETS

Westcoast AM Net: Meets informally, nightly on 3870 at 9:30 PT. Wednesday at 9:00 PM PT they have their formal AM net which includes a swap session. Net control rotates.
California Early Bird Net: Saturday mornings at 8 AM PST on 3835.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3835
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net control is Andy, WA4KCY. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 4:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control varies with propagation.
Arizona AM Net: Meets Sundays at 3 PM MT on 3855. On 6 meters (50.4) this group meets at 8 PM MT Saturdays.
Colorado Morning Net: An informal group of AM'ers get together on 3808 Monday, Wednesday and Friday mornings at 7AM MT.
DX-60 Net: This net meets on 7290 at 2 PM ET, Sundays. Net control is Jim, N8LUV. This net is all about entry-level AM rigs like the Heath DX-60.
Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is usually Walt, KJ4KV, but sometimes it rotates to other ops. It starts at 5 AM ET Saturday mornings on 3885.
Westcoast Military Radio Collectors Net: Meets Fri. at 2200 local on 3990 and Sat. at 0800 local on 3990 + or - QRM. Net control is Tom, WA6OPE or Andy, KD6TKX.
Grey Hair Net: The oldest (or one of the oldest) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:30 PM EST & EDST
Vintage CW Net: For CW ops who enjoy using vintage equipment. This is not a traffic net; speed is not important. The net meets on 14.037, Sundays at 7 PM Eastern. Net control is Tracy, WB6TMY.
Vintage SSB Net: Net control is Chuck, N5SWO. The group meets on 14.293 at 1 PM CT, Sunday afternoons.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet at 0100Z Tuesday nights on 3805 and on Thursday nights on 3875.
Drake Users Net: Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; Rob, KE3EE and Huey, KD3UI.
Heath Users Net: A new net started by Marty, WB2FOU/5. Net control is shared by Fred, AA5LW. It meets on 14.275 at 4 PM CT Sundays. Check in on either AM or SSB.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern California Sunday Night 6 Meter AM Net: 8 PM Sundays on 50.4. Net controls are Dan, KV6I and Scott, K6PYP. Informal, supports restoring old gear and using it on the air. Loan gear available for those wanting to join in.
Westcoast 40-Meter Sunday Net: Net control varies. The group meets on 7160 starting at 4PM PT.
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.
Old Buzzards Net: Meets daily at 10 PM EST on 1945. This is an informal net in the New England area .

TheHewlett-Packard 200CD Wide Range Oscillator

Another Classic

by Kurt H. Miska, N8WGW
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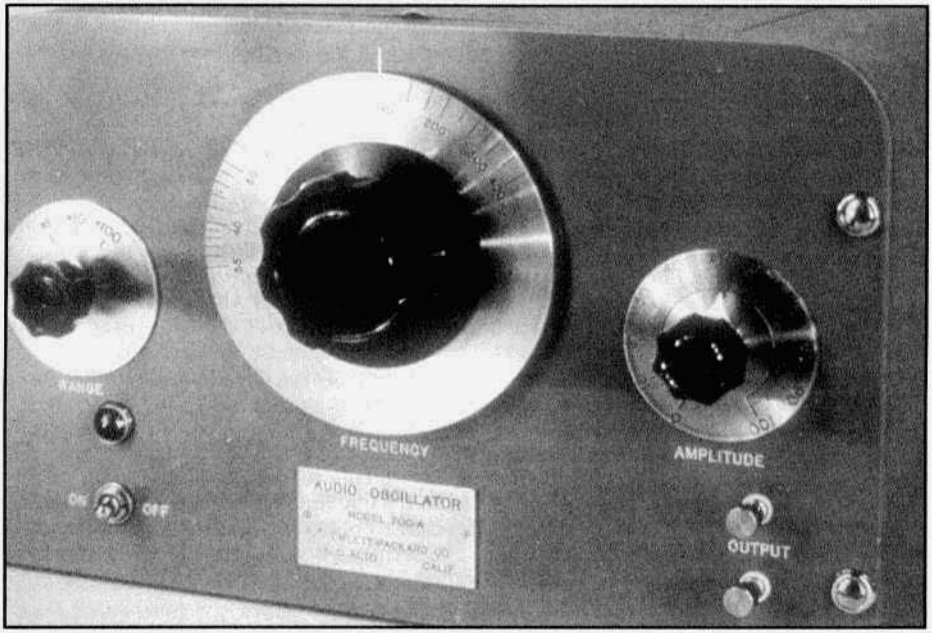
Ann Arbor, MI 48103

This summer, while browsing in a bookstore near the University of Illinois at Urbana where my son was attending the Aerospace Institute, a week of some pretty serious classes in aerospace technology for selected high schoolers, I found a wonderful book called *Analog Circuit Design* edited by Jim Williams. It is a collection of articles that appeared in the trade magazine *EDN*, which, I'm guessing, stands for Electronic Design News. One of the first articles in this interesting book contains considerable information on the development of the Hewlett Packard Model 200CD Wide Range Oscillator before getting down to the business of designing a similar instrument but with the use of modern op amp technology. The article prompted me to take another look at my own 200CD, one of my many taken for granted analog laboratory instruments.

A Little History

Shortly before the second World War, William Hewlett and David Packard started this now multi-billion dollar company in the proverbial garage. An audio oscillator was their first product. This particular audio oscillator was an outgrowth of William Hewlett's masters degree thesis at Stanford University. Also, incidentally, it was easily their longest lived product. The H-P 200



Hewlett-Packard's first product, an audio oscillator, was used by Walt Disney Studios to test sound equipment for the movie "Fantasia."

Dave Packard (left) and Bill Hewlett (right) developed an innovative audio oscillator in a Palo Alto, Calif. garage in 1939.

series was sold by Hewlett-Packard until the mid 1980s, a production lifetime over almost 50 years.

For another, and very colorful, introduction to the 200CD, I turn to Jim Williams' improbably titled article "Max Wien, Mr. Hewlett and a Rainy Sunday Afternoon" in *Analog Circuit Design*. Max Wien, you will recall, is the inventor of the Wien AC bridge. Anyway.....

"The H-P 200, directly descended from Hewlett-Packard cofounder William R. Hewlett's 1939 master's degree thesis, is not simply a great instrument. Nor was it mighty H-P's first product. This machine is history. It provided a direction, methods, and standards that have reflected in Hewlett-Packard products to this day. There is a fundamental honesty about the thing, a sense of trustworthiness and integrity. The little box is a remarkable amalgam of elegant theoretical ideas, inspired design, careful engineering, dedicated execution, and capitalism. It answered a market need with a superior solution. The contribution was genuine, with the rewards evenly divided between Hewlett-Packard and its customers. The H-P 200 is the way mother said things are supposed to be - the good guys won and nobody lost."

I found my equally appreciated 200CD at the Dayton Hamvention in 1994 for a paltry $20. It joined me in perfect working order and has already distinguished itself innumerable times with superior service on my chaotic workbench. So, how do four electron tubes generate virtually flawless sine waves over such a wide range?

An Instrument of Substance

The Model 200CD is a truly remarkable instrument in that it reliably delivers the most beautiful sine waves from 5 Hz to 600 kHz in five ranges. It does it with a minimum of fuss and only three simple front panel controls, these being range, frequency and amplitude. I did a little checking of my own 200CD using

continued next page

The H-P 200CD from previous page

Hewlett-Packard Model 200CD Wide Range Oscillator

an H-P counter 5328A, a Tektronix 516 oscilloscope, and an H-P 400D AC VTVM. The counter checks the frequency, the scope checks the quality of the sine waves and the VTVM measures the output level.

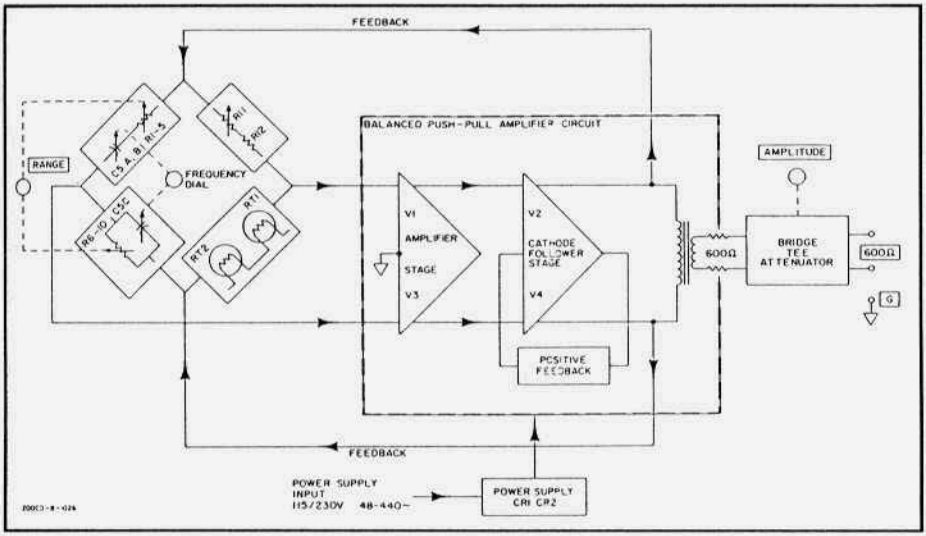
I determined that its calibrated range is from 4.7 to 635,542 Hz. Going beyond the last graduation on the dial (64), the instrument still delivers the same quality sine waves at 676,192 Hz. The quality of the sine waves is completely uniform throughout. At the 4.7 Hz end of the range, maximum output is 14 volts and a very generous 21 volts at the high end. Minimum voltages are in the neighborhood of 0.035 to 0.08 volts. When I need an audio signal source, I like to use 1,000 Hz and when I set my 200CD to the 10 mark (x 100) on the dial, the counter will indicate 997 Hz. All around, not too shabby for a very old instrument that cost me all of $20...

In highly simplified terms, the 200CD Wide Range Oscillator is probably the ultimate development of the vacuum tube Wien bridge oscillator. The 200CD uses a balanced (push-pull) oscillator circuit from which the output is taken directly, avoiding the complication and possible distortion of an isolating amplifier. Reaction of the load on the oscillator is avoided by the use of a zero source impedance output stage. This arrangement results in a simple, trouble-free circuit having low distortion and high stability over the entire frequency range.

Functionally, the circuits of the Model 200CD include a frequency-controlling Wien bridge and balanced push-pull amplifier (a pair of 6AU6s; sharp cutoff pentode) which comprise the oscillator circuit (a pair of 6CW5/EL86s; power amplifier pentode), an output circuit which may be connected either for balanced or unbalanced operation, and a solid-state power supply circuit. These are shown in the accompanying block diagram. (If you'd like a copy of the complete schematic, send me a self-addressed stamped envelope.)

Frequency Controlled Bridge

The frequency-controlling circuit is arranged as a floating bridge, symmetrical with respect to ground. With no connection to ground on any terminal of the bridge, stability of calibration is assured since any stray capacity or leakage to ground present at the bridge output terminals does not shunt either the frequency-controlling or amplitude-stabilizing arms of the bridge. The fre-



Model 200CD block diagram.

quency-controlling components (resistance-capacitance networks which are selected with the RANGE switch and frequency dial) comprise two arms of the bridge, while the amplitude-stabilizing components (a voltage divider which includes a thermally-sensitive resistance) comprise the other two arms. Amplitude is stabilized at such a level that the amplifier tubes are operated in the substantially linear portion of their characteristics, which, together with the large negative feedback at harmonic frequencies, results in a very pure sine wave oscillation.

The bridge is driven by the balanced voltage developed at the cathodes of V2 and V4 (6CW5/EL86) in the output of the balanced amplifier. The output of the frequency-controlling branch of the bridge is applied to the grid of V3 (6AU6) and the output of the amplitude-stabilizing branch is applied to the grid of V1 (6AU6).

The lamps RT1 and RT2 in the cathode circuit of V2 and V4 provide a resistor whose resistance increases with increase of current. The lamps and a potentiometer provide negative feedback which automatically adjusts (by reason of the varying lamp resistance) to reduce the gain so that the required amplification is just obtained, to meet the conditions of oscillation. The potentiometer is included for adjustment of the amplitude-stabilizing branch of the bridge if, after replacement of lamp RT1 or RT2, that less or more than rated voltage is being delivered to the output terminals.

Variable capacitors C3, C6, and C7 are adjusted at the factory for optimum calibration and amplitude stability with frequency. They should not require adjustment unless the RANGE switch is replaced.

Amplifier

The oscillator amplifier is a balanced push-pull circuit including a voltage amplifier (V1, V3) and a special cathode follower (V2, V4). Crisscross positive feedback is used in the cathode-follower stage to provide an essentially zero output impedance as seen by the cathode-to-cathode load. The feedback paths are from the plate of V2 to the control grid and screen of V4, and from the plate of V4 to the control grid and screen of V2. The degree of the positive feedback is a function of the load and in-

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The Meissner 150B Transmitter

by Wayne Steiner, NØTE
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During WW II, the Meissner Manufacturing Company located in Mount Carmel, Illinois, produced a 344 pound, 150 watt (output) phone and CW transmitter for the U.S. Army Signal Corps. This transmitter, covering a frequency range of 1.5 Mc to 12.5 Mc, was known as the 150B and was comprised of two units - the 02433 exciter and the 02520 transmitter. Apparently the transmitter was not assigned the usual 'T' or 'BC' number, e.g. T-368, BC-610, etc., and was simply called "Model 150B Transmitting Equipment". The Signal Corps order number was 13759-PHILA-43 dated Oct. 18, 1942.

The 150B is a very simple straight forward design which would have been typical of an amateur design, circa 1940. In fact, the 02433 exciter portion of the 150B is basically an amateur design. It is simply a militarized version of the prewar Meissner model 9-1058 Signal Shifter; otherwise, dubiously known by some as the "Signal Drifter". The amateur version was advertised in the ARRL handbook and *QST* prior to WW II. The military version of the Signal Shifter has continuous general coverage for the 1.5 Mc to 12.5 Mc range and a taller cabinet which allowed room for a plug-in coil storage drawer at the bottom.

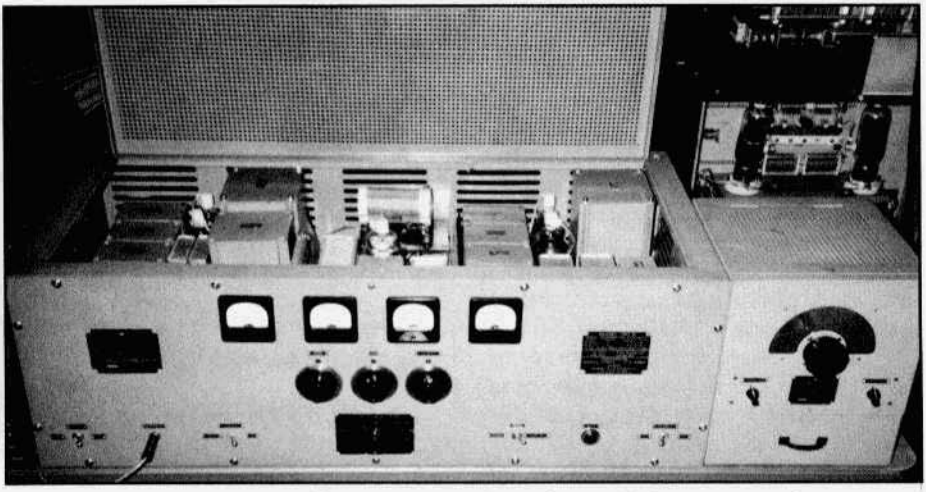
The tube line up in the transmitter starts out in the exciter with a 6F6G VFO/doubler driving a 6L6G amplifier/2nd doubler which is link coupled via a short balanced line to the grid coil link of the 813 final amplifier which uses a pi-net output. The 813 is plate modulated by a pair of 811s in class B which are driven by a pair of 6V6Gs which in turn is driven ay a 6J5 and T-17 carbon mic.

There are two complete low voltage power supplies. One supply is for the modulator speech amp and 813 grid bias. The other is for the exciter unit. They both use 5U4 rectifiers and the supply for the exciter has a VR105 and a VR150 as regulators. There are two complete choke input dual choke high voltage power supplies each using a pair of 866 mercury vapor rectifiers.

According to the 75-page instruction book, the 150B is capable of "rapid" selection of frequency between 1.5 Mc and 12.5 Mc. This is done by changing plug-in coils for the 6F6G grid, 6F6G plate, 6L6G plate, and 813 plate. There are 18 coils for the exciter and seven coils for the amplifier plate for a grand total of 25 coils. The only really rapid part of changing frequency would be the swish of the VFO knob and changing the six position 813 grid circuit band switch, which does save having six more coils!

Since the transmitter seems so much like an amateur rig, and the Signal Corps order date was less than a year after the U.S. entered WW II, I suspect that the 150B or something similar might have been something Meissner would have come out with for the amateur market if the war hadn't come along. This would probably have been in direct competition with the Hallicrafters HT-9, another awkward and heavy tabletop rig.

Apparently the transmitter manufacturers of the late 1930s and mid 1940s must have determined that the market wanted large horizontal, heavy table top transmitters because in addition to the 150B, the HT-9, and the earlier HT-1; there was the post war Supreme AF100 and the Temco 75GA. I am sure



The Meissner 150B is a "tabletop" transmitter that weighs 344 pounds.

that the Meissner 150B was the heavyweight of the bunch.

The 150B hit the surplus market nationally via an ad by Surplus Radio Inc. in the Dec. 1946 issue of the *CQ* magazine. It was advertised as a 250-watt transmitter in the original shipping crate, brand new, less tubes, for $325 or with tubes for $349.50. Quite a lot of money in 1946! I have seen 150B "for sale" ads in recent years and have talked to other AM enthusiasts who have them or know of others who have them; so there seems to be a few of them out there in circulation. However, I have yet to work a station actually using one in service and most hams that I work, including old-timers, have never heard of the Meissner 150B. Considering the fact that the Signal Corps didn't assign a normal nomenclature number and it is not well known make me suspect that relatively few were produced.

In my opinion, the 150B exemplifies the term "boat anchor" better than any other piece of old radio equipment for which I have ever had any experience. It is true there are bigger and heavier "boat anchors" such as the T-368, BC-610, etc., however we know that and have come to expect a couple of strong men or more to move them, and table-top "boat anchors" like the AR-88, DX-100,etc., can be moved by one man with a good back. The 150B though is a table-top rig and it still takes two men and a boy to move it around! Truly a transmitter that is a "boat anchor".

The 150B that I acquired (SN 127) was in pretty good shape. I felt fortunate that all 18 plug-in coils for the exciter were present, however only one of the seven final tank coils was with the transmitter and it was plugged in ready for service. The other six final coils no doubt got lost in the shuffle when the 150B was being sold for a widow. I have no doubt that the coil storage drawer in the exciter is the reason I got all 18 exciter coils. The one final coil I did get was for the frequency range of 2 Mc to 3.6 Mc. It would have been a simple matter to tap down on that coil for 75 and 40-meter operation, however I decided to leave it intact and instead found a National XR10 pre-wound coil in my junk box. The coil was used in an old Wilcox 99 transmitter and covered the range of 2.8 Mc to 8.5 Mc, just right for use on 75 and 40 meters.

My 150B came with three modifications; the lid power interlock switch was removed, the antenna ceramic feed through insulator was replaced with an

continued next page

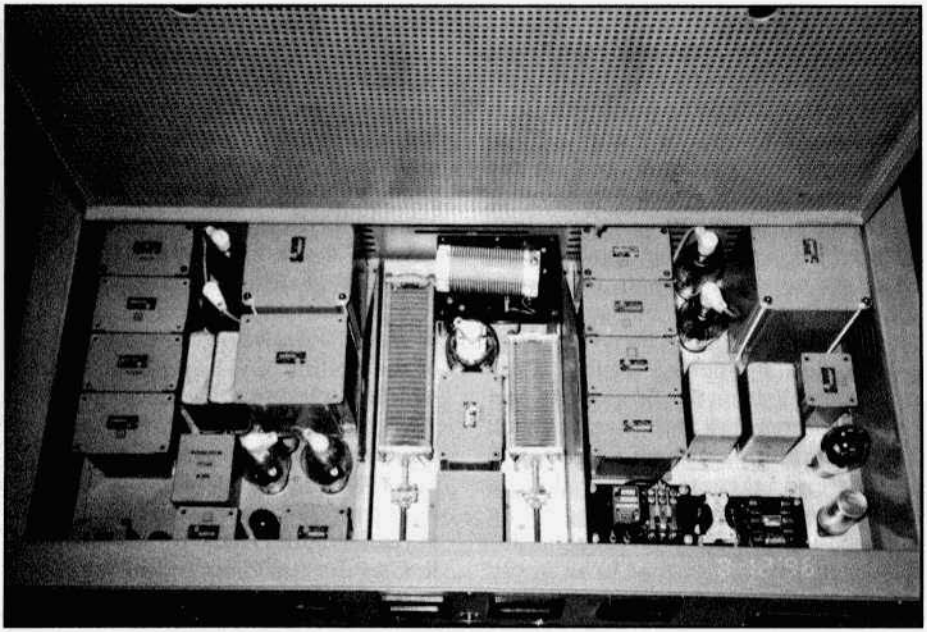
SO-239 connector and the modulation transformer was isolated from ground by lifting it from the chassis and remounting it on large ceramic insulators. I didn't feel the need for the interlock switch so I left that as is. I probably would not have removed the antenna feed through insulator but since the SO-239 was already mounted with holes drilled I decided to leave it. It is convenient and practical. The modulation transformer being insulated seemed like a good idea especially after I read an early 'QST' article indicating that some 150B owners were experiencing modulation transformer failures.

A tabletop unit weighing over 300 pounds would probably not be the easiest thing to work on and do maintenance on, however the 150B was not as bad as I thought it would be. After the transmitter is taken out of the cabinet, it can be broken down into four pieces - three separate chassis and the front panel. This can be done without desoldering one wire! The reason for this is a single horizontal wiring harness running from one end of the cabinet to the other with large rectangular plug connectors under each chassis. With a screw driver and a nut driver one can dismantle the whole thing in under 15 minutes.

After the amplifier and exciter were dismantled, the meters and nomenclature plates were removed from the front panels. I took everything down to the car wash for a bath and after a couple of hours in the hot dry Kansas wind I put everything in a location of dry heat for several days. I then touched up a few nicks and chipped areas with flat gray paint and after drying gave the cabinets and panels a brushed on coat of a 70/30 mixture of paint and thinner. Just when this mixture started to become tacky I rubbed most of it off with a rag leaving just enough paint residue to give the surface a uniform appearance yet taking off enough to keep the wrinkle intact. This procedure does wonders with a nicked, scratched, stained or discolored wrinkle finish giving it a nearly new looking appearance.

Before any voltage was applied, I replaced all paper and electrolytic capacitors, checked all resistors (which were found to be in tolerance), gave the AF gain control and rotary switch contacts a shot of WD-40, cleaned the meter cases inside and out and checked the meter movements. The bakelite meter cases and knobs were polished with NEVER-DULL.

After getting everything back together, the exciter was the first thing to be checked out. Since it receives its 120 VAC from the amplifier unit, I connected a temporary 120 VAC source so the exciter could be checked independently. The exciter has three trimmer capacitors, two for the 6F6G and 6L6G outputs and one for the 6F6G oscillator frequency calibration. These three capacitors must be shared by six sets of coils! I was a little wary of this and expected the worst, however I was pleased to find that after setting the oscillator to 3880 kc to match the dial and adjusting the output trimmers for maximum output on 75 meters; very little adjustment was needed when the 40-meter coils were installed. Actually I just split the difference between the 75 and 40 meter calibration and now the dial calibration accuracy is within a few kc on each band which on the exciter dial is hardly discernible. I zero beat using the station receiver anyway, so the exciter dial really is for "ball park" adjustment. I think Meissner did a good job in determining the number of coil turns, spacing, and taps so that six sets of coils could be used with just one set of common trimmers! Another thing that pleased me very much was the fact that after about 25 minutes of warm up time the exciter did not become a "Signal Drifter"! After an initial warm up time the exciter settled down and be-



Top view, lid opened.

came very stable.

I found three more modifications for the 150B in early *QST* articles. The May 1947 issue carried an article by W1BNN which described a doubler stage using a 6L6G to be used between the exciter and amplifier which would then allow 20 meter operation. His article also described a simple 6SJ7 speech amplifier to replace the carbon mic input transformer so that a hi-Z mic could be used. The May 1948 issue had an article in the Hints & Kinks section by WØARH which described an improvement for CW operation which amounted to adding a 6Y6G clamp tube for the 813 and keying the 6F6G oscillator instead of the 6L6G doubler. In an unmodified 150B during CW operation, the oscillator runs all the time with the key up and the 813 screen voltage soars to near 800 volts because its source is from a dropping resistor divider network connected to the 813 plate voltage. The 150B, unmodified, is not the best CW transmitter!

I decided to go ahead with a similar speech amplifier modification except I would use a miniature tube which would fit the opening left by the vacant carbon mic transformer better than a 6SJ7. Before I had a chance to start the modification, I attended a ham fleamarket in Kansas City and found a $5 treasure in the form of a P & H model AFC-2 speech compression amplifier. I decided to use this amplifier instead of making the modification. A unique feature of this little unit was that it has both high and low impedance inputs and outputs which could be matched or mixed. Actually the low impedance section was meant to be used between the 3.2 ohm output of a receiver and it's speaker for enhanced audio. I used the high impedance input for the mic and connected the low impedance output to the four ohm winding of a reversed connected audio transformer (another junk box item). The primary of the audio transformer, now the secondary, is a 600-ohm winding which is now connected through a matching resistor to the 150B carbon mic input. I left the

continued next page

carbon mic voltage intact so that if I wished, the T-17 carbon mic could be used to demonstrate the "original" sound of a 150B. When using a high impedance mic and the P & H AFC-2, the audio "rides" on the DC carbon mic potential with no ill effect. Before firing up the amplifier the time delay relays for the 866s needed to be checked and set. I was not familiar with these particular relays made by Advance Electric Company and since they were over 50 years old, I expected trouble. They are adjustable from 5 to 60 seconds and after experimenting with them to check their operation, I set them for about 45 seconds and staggered their timing a little. I needn't have worried, they worked just fine. They give a solid audible click indicating that I can apply high voltage to the 866s.

With 75-meter coils installed in both units and a vintage 75-ohm 250 watt Ohmite dummy load connected to the output, initial testing began. The exciter came up as before with no problems and I set it to 3880 kc. I got a good peak on the 813 grid current meter as the grid was tuned to resonance and I then readjusted both exciter tank trimmers for maximum 813 grid current. The correct grid current is then set by detuning the 813 grid circuit. I have never liked this method of excitation control.

With the front panel switch labeled "POWER", plate voltage for the 813 can be reduced from 1600 volts to 900 volts for initial tuning and then set back to 1600 volts for final touch up. This is accomplished with a tap on the primary of the 813 high voltage transformer.

The 813 plate tuning went without any problems except for erratic operation of the RF ammeter which I suspect has an intermittent remote thermocouple unit. In addition to the 350 mmFd variable loading capacitor, three fixed mica capacitors of 300, 600, and 1200 mmFd can be added to the variable capacitor in any parallel combination. These mica capacitors are fitted with banana plugs which allow them to be plugged into a jack field just behind the 813 tank coil. This means for safety, one must turn off power before a mica capacitor is removed or added until the correct loading capacity is obtained. Maybe I should have put a lid power interlock switch back in service! Anyway I think it is an awkward procedure, however it does remind me somewhat of the Collins 32V-1 except the Collins people provided a capacitor switch.

With everything checking out OK on the dummy load, I was anxious to put the 150B on the air for a real test. I would do something with the erratic RF ammeter later. After getting the 150B loaded up to a 75 meter quarter wave vertical, I soon made contact with W2JBI in New Jersey for a five nine plus report using the T-17 carbon mic. We had a nice QSO in which he told me that there were some active 150B users in the military net. I made a dozen or more contacts in the next week or so using the T-17 with only about half of the contacts saying that they could detect that I was using a carbon mic. After getting the P & H compressor hooked up, my carbon mic has remained dormant although available. Audio reports while using the P & H compression amplifier have been very favorable.

The 811s and the 813 are just loafing at 150 watts output. Actually I am running closer to 170 watts output at the rated plate current of 175 mA which really means that the transmitter is running with an estimated plate current of about 135 mA because the plate current meter is in the 813 high voltage transformer center tap return thus indicating screen current also. The 813 high voltage power supply components are rated at only 183 mA. If one wanted to gamble on the hope that the power supply components have a high safety factor he could easily let the 813 load up to

an actual plate current of about 200 mA which would give an output close to 250 watts! I suspect the value of 250 watts in that early Surplus Radio Inc. ad was derived from what the 813 was capable of at 1600 volts rather than what the instruction book dictated or what the ratings in the parts description indicated. I also suspect that those who did run their 150Bs at an output of 250 watts may have been those who experienced failures as mentioned in the early *QST* articles.

The 150B is ripe for modifications. If I had found this transmitter some years ago, before I appreciated restoration, I would have taken the three individual chassis and mounted each one behind a standard 19" rack panel for vertical installation much like a Globe King, except in a deeper cabinet. In addition to the *QST* keying and 813 clamp tube modifications, I would install an excitation potentiometer in the screen of the 6L6G, add a band switch to tap down on the 813 tank coil, and replace the plug-in loading capacitors with switched capacitors.

In spite of what I said about modifications, changing coils, and some awkwardness, I enjoy using the Meissner. It certainly is a conversation piece. Some might ask why anyone would want a transmitter that puts out about the same power as a Valiant yet is both three times heavier and bigger. All I can say is that some of us are "boat anchor" enthusiasts or gluttons for punishment, maybe both! I realize beauty is in the eye of the beholder and not everyone appreciates the same things. The 150B has some of the physical characteristics that appeal to me such as the nickel silver dials.... the wrinkle paint (I prefer black).... the black bakelite meters.... the nomenclature and dial plates all over the front panel.... hmmm .... now if it just had chart frames! **ER**

1996 Fall Classic and Homebrew Radio Exchange, September 29-30, 1900 UTC to 0400 UTC.

The Classic Radio Exchange, "CX," is a celebration of the older commercial and homebrew equipment that was the pride of our ham shacks a few decades ago. Object is to restore, operate and enjoy older gear with like minded hams. A Classic Radio is at least ten years old, an advantage but NOT required to operate CX. YOU CAN USE ANYTHING, although new gear is a distinct scoring liability and not as much fun.

Exchange your name, RST, QTH, receiver and transmitter type (homebrew send final amp tube or transistor) and other interesting conversation.

The same station may be worked with different equipment combinations on each band and each mode. CW call "CQ CX," phone call "CQ Classic Exchange." Non-participants may be worked for credit. Suggested frequencies: CW 3560, 7060, 14120, 21180, 28240; phone 3880, 7290, 14280, 21380, 28320; Novice/Tech 20 kHz up from lower band edges. 7060 and 3560 CW tend to be the most popular CX frequencies.

SCORING: Multiply total QSOs (all bands and modes) by the following sum: (total number of different receivers plus transmitters plus states/provinces/countries worked on each band and each mode). Multiply that total by your Classic Multiplier, the total years old of all receivers and transmitters you used, three QSOs minimum per unit to qualify. If equipment is a transceiver, multiply age by two. If homebrew, count as 25 years old unless actual construction or design date is older.

Certificates are awarded every now and then for the highest score, exotic equipment, best excuse, and other unusual achievements. Send logs, comments, anecdotes, pictures to Jim Hanlon, W8KGI, POB 581, Sandia Park, NM 87047. Include TWO-stamp SASE for next CX Newsletter.

Collins S-Line and KWM-2 Tubes Cross Reference Guide

by Ed Schaad, W3WDF
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San Antonio, TX 78266

Vacuum tubes are still available to meet most of our needs. In addition, foreign tubes have infiltrated the market place. However, some type tubes appear to be getting a trifle scarce.

It is believed that Collins collectors/users and others would appreciate a cross reference tube guide to widen the aperture for the recognition and selection of those tubes available that may be used to keep those grand old rugs running. The acquisition of some selections may prove to be a far better tube in performance as to longevity and sustained reliability.

The main advantage of the guide is to determine what the four digits reflect as to the prototype tube involved. The other advantage is to identify common place tubes to work as substitutes that will function until the most appropriate tube is found.

A special thanks to the General Electric Company, Essential Characteristics Publication; Sylvania Electronic Products, Inc.; Howard W. Sam's Tube Substitution Handbook (which is quite old and probably not found on the book shelves anymore) and George Carle, N7ARY, for his assistance in layout and production of this article.

Vacuum Tube Cross Reference
***Collins S-Line, KWM-2, 516F-2, 30L-1, 30S-1**

Substitution & Primary	Primary	Reliable, Premium, Etc., Types	Where Used
0A2*		6073, 6626	32S-3
6AH6*		6485	32S
6AH6V	6AH6	(6485-6AH6)	
6AL5*		6663, 5726, 6058, 6097	32S, KWM-2
6AQ6	6AT6	(6066-6AT6)	
6AT6*		6066	75S

Vacuum Tube Cross Reference
*Collins S-Line, KWM-2, 516F-2, 30L-1, 30S-1

Substitution & Primary	Primary	Reliable, Premium, Etc., Types	Where Used
6GH8	6U8A	(6678, 7731-6U8A)	
6GJ8	6U8A	(6678, 7731-6U8A)	
6GN8	6EB8		
6HF8	6EB8		
6HQ6	6CB6	(6676, 7732-6CB6)	
6HZ8+	6EB8		
6JE8	6EB8		
6KD8	6U8A	(6678, 7731-6U8A)	
6U8A*	6EA8	(6678, 7731)	32S, KWM-2
12AT7*		6679, 6201, 6060, 6671, 7492, 7728	32S, KWM-2
12AX7*		6681, 5751+, 7025, 5721, 6057, 7494, 7729	75S-3
12AZ7+	12AT7	(6679, 6201, 6060, 6671, 7492, 7728-12AT7)	
12DF7	12AX7	(6681, 5751+, 7025, 5721, 6057, 7494, 7729-12AX7)	
12AD7+	12AX7	(6681, 5751+, 7025, 5721, 6057, 7494, 7729-12AX7)	
12DT7	12AX7	(6681, 5751+, 7025, 5721, 6057, 7494, 7729-12AX7)	
12BZ7+	12AX7	(6681, 5751+, 7025, 5721, 6057, 7494, 7729-12AX7)	
12DM7+	12AX7	(6681, 5751+, 7025, 5721, 6057, 7494, 7729-12AX7)	
5R4*		(see notes on tube types suffixed)	516F-2
12AL5*			Early 30S-1
3B28			30S-1
ECC81	12AT7	(6679, 6201, 6060, 6671, 7492, 7728-12AT7)	

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Vacuum Tube Cross Reference
*Collins S-Line, KWM-2, 516F-2, 30L-1, 30S-1

Substitution & Primary	Primary	Reliable, Premium, Etc., Types	Where Used
6AU6*	6BA6	7543, 6136 (5749, 6660, 7496-6BA6)	75S, 32S, KWM-2
6AU8+	6EB8		
6AU8A+	6EB8		
6AV6	6AT6	(6066-6AT6)	
6AW6	6DC6	(6672, 7732-6CB6)	
6AX8	6EA8	(6678, 7731-6U8A)	
6AZ8*			KWM-2
6BA6*	6AU6	(7543, 6136-6AU6) (6660, 5749, 7496-6BA6)	
6BE6*		5750, 7502+, 5915, 7036	KWM-2
6BF5*			75S
6BK6	6AT6	(6066-6AT6)	
6BN8*			KWM-2
6BT6	6AT6	(6066-6AT6)	
6BZ6	6CB6	(6676, 7732-6CB6)	
6CL6*		6677, 2014, 6197, 6297	32S, KWM-2
6CB6*	6DC6	(6676, 7732-6CB6)	32S
6DC6*	6CB6	(6676, 7732-6CB6)	
6CF6	6CB6	(6676, 7732-6CB6)	
6CX8	6EB8		
6DE6	6CB6	(6676, 7732-6CB6)	
6DK6	6CB6	(6676, 7732-6CB6)	
6EA8*	6U8A	(6678, 7731-6U8A)	32S, KWM-2
6EB5	6AL5	(6663, 5726, 6097, 6058, 6AL5)	
6EB8*			KWM-2

Vacuum Tube Cross Reference
*Collins S-Line, KWM-2, 516F-2, 30L-1, 30S-1

Substitution & Primary	Primary	Reliable, Premium, Etc., Types	Where Used
ECC83	12AX7	6681, 5751+, 7025, 5721, 6057, 7494, 7729-12AX7	
7543*	6AU6	(6136, 7543-6AU6) (5749, 6660, 7496-6BA6)	32S, KWM-2
6146*		8298A, 7212, 6146A, 6146B, 6146W	32S, KWM-2
811A*	572B	(the earlier 811 can be installed horizontal)	30L-1
572B	811A		
EF-93	6BA6	(5749, 6660, 7496-6BA6) (6136, 7543-6AU6)	
5U4*		5931 (see notes on tube types suffixed)	516F-2
4CX1000A*		8168	30S-1
3B28*			30S-1
5AS4A	5U4		
5AR4	5U4		

NOTES: * Collins primary tubes as used in the S-Line, KWM-2, 516F-2, 30L-1, 30S-1

\+ Substitute tubes so indicated, should be used only when filament of the original tube is wired in a parallel circuit, or in a series circuit not requiring controlled warm-up time.

Find List For Premium, Reliable Types

Premium-Reliable Type	Collins Primary Type	Ordinary Substitutions
2014	6CL6	
5721	12AX7	ECC83, 12DF7, 12DT7, 12AD7, 12BZ7+, 12DM7+
5726	6AL5	6EB5
5749	6BA6	6AU6

Find List For Premium, Reliable Types

Premium-Reliable Type	Collins Primary Type	Ordinary Substitutions
5750	6BE6	6BY6, 6CS6
5751*	12AX7* Higher Htr Current	ECC83, 12DF7, 12DT7, 12AD7+, 12BZ7+, 12DM7+
5915	6BE6	6BY6, 6CS6
5931	5U4	5AR4, 5AS4
6057	12AX7	ECC83, 12DF7, 12DT7, 12AD7+, 12BZ7+, 12DM7+
6058	6AL5	6EB5
6060	12AT7	12AZ7+, ECC81
6066	6AT6	6AV6, 6BK6, 6BT6, 6AQ6+
6073	OA2	
6097	6AL5	6EB5
6136	6AU6	6BA6
6197	6CL6	
6201	12AT7	12AZ7+, ECC81
6297	6CL6	
6485	6AH6	6AH6V
6626	0A2	
6660	6BA6	6AU6
6663	6AL5	6EB5
6671	12AT7	12AZ7+, ECC81
6676	6CB6	6DC6, 6BZ6, 6CF6, 6DE6, 6DK6, 6HQ6
6677	6CL6	
6678	6U8A	6EA8, 6KD8, 5KD8, 6GH8, 6BL8, 6AX8+, 6GJ8+
6679	12AT7	12AZ7+, ECC81
6681	12AX7	ECC83, 12DF7, 12DT7, 12AD7+, 12BZ7+, 12DM7+

Find List For Premium, Reliable Types

Premium-Reliable Type	Collins Primary Type	Ordinary Substitutions
7025	12AX7	ECC83, 12DF7, 12DT7, 12AD7+, 12BZ7+, 12DM7+
7036	6BE6	6BY6, 6CS6
7212	6146	
7492	12AT7	12AZ7+, ECC81
7494	12AX7	ECC83, 12DF7, 12DT7, 12AD7+, 12BZ7+, 12DM7+
7496	6BA6	6AU6
7502+	6BE6	6BY6, 6CS6
7543	6AU6	6BA6
7631	6AL5	6EB5
7728	12AT7	12AZ7+, ECC81
7729	12AX7	ECC83, 12DF7, 12DT7, 12AD7+, 12BZ7+, 12DM7+
7731	6U8A	6EA8, 6KD8, 5KD8, 6GH8, 6BL8, 6AX8+, 6GJ8+
7732	6CB6	6DC6, 6BZ6, 6CF6, 6DE6, 6DK6, 6HQ6
8186	4CX1000A	
8298A	6146	
ECC81	12AT7	12AZ7+
ECC83	12AX7	12DF7, 12DT7, 12AD7+, 12BZ7+, 12DM7+
EF93	6BA6	6AU6
EF94	6AU6	6BA6
OTHER COLLINS PRIMARY TUBES WITHOUT RELIABLE TYPE NUMBERS ASSIGNED		
	6BN8	none known
	6BF5	none known
	6DC6	6CB6, 6CF6, 6BZ6, 6DE6, 6DK6, 6AW6

Find List For Premium, Reliable Types

Premium-Reliable Type	Collins Primary Type	Ordinary Substitutions
	6EA8	6U8A, 6AX8+, 6KD8, 5KD8, 6GH8, 6GJ8+, 6U8+
	6AZ8	none known

Notes:

a. All tube types suffixed A, G, GA, GB, GY, GYA, GYB, W, WA

- G — Signifies a glass bulb on an octal base
- GT — Signifies a T-9, straight sided glass bulb on an octal base
- A,B — Signifies a later and modified version which can be substituted for any previous version but not vise-versa
- Y — Signifies a base composed of special intermediate loss material
- W,WA — Signifies ruggedized or stabilized versions

b. The symbol + indicates substitutes should be used only when the filament of the original tube is wired in a parallel circuit, or in a series circuit not requiring controlled warm-up time.

c. Tube types underlined as a substitute are used in the Collins equipment elsewhere

R-390A Survey/Order Number List from page 18

tice that the 1963 Stewart-Warner Corp., 1966 Communications Systems and 1967 Clavier Corp. have been deleted from this list. No serial numbers were recorded for the survey, it is now believed these were spare parts contracts.

The differences between the high serial numbers in the survey and the number built is quite large. The reasons for this are many were surplused out in Europe and Japan. Large numbers were left behind in Vietnam. There are many more out there, get your serial numbers and tell your friends. Either contact Tom Marcotte, N5OFF via computer at: n5off%w5ddl.aara.org@usl.edu or the author via mail.

An excellent source for cabinets for the R-390/A series is Premier Metal Products Co. 1-800-227-9591. Part No. DCR-100, $104.12 plus shipping. They are available in a variety of colors, and wrinkle finish! Call for a catalog.

This list is far from being final, information is forthcoming on another possible manufacturer in Canada! Courtier Products, a veedor root counter assembly with their name on it has surfaced! It seems there is always another R-390A story lurking in the shadows. Very recently a large number of surplus R-390As surfaced in a military warehouse in the southwestern part of the United States. Who was it that said they are all gone?

I would like to express my gratitude to everyone who wrote or called, but especially to Tom Marcotte, N5OFF; Wally Chambers, K5OP; Neil Clyne, G8LIU; and Rick Mish of Miltronix. Without their invaluable assistance this article would not have been possible. **ER**

R-390A/URR ORDER NUMBER, SURVEY LIST NO. 4

YEAR	MANUFACTURER	ORDER NO.	HIGH S/N (In Survey)	TOTAL NO. (If Known)
1954	COLLINS	14214-PH-51	949	1000?
1954	MOTOROLA	363-PH-54	3427	5000
1954	COLLINS	375-PH-54	310	500?
1955	COLLINS	08719-PH-55	4914	5000
1956	MOTOROLA	14-PH-56	4909	5000
1958	MOTOROLA	14385-PH-58	5866	5000+
1959	STEWART-WARNER	42428-PC-59	2076	5000
	HELENA RUBENSTEIN			
1959+/-?	(Mfd. by Collins)	*unknown*	0	80
1960	STEWART-WARNER	20139-PC-60-A1-51	4511	5000
1960	EAC	23137-PC-60	3627	5000
1961	CAPEHART CORP.	21582-PC-61	4237	5000
1962	AMELCO, INC	35064-PC-62		
(Teledyne purchased Amelco)		3642	5000	
1962	TELEDYNE SYSTEMS	35064-PC-62		
	CAPEHART CORP.			
1963	(Mfd. for Adler Electronics)	20878-PC-63	5	?
1963	TELEDYNE/IMPERIAL	37856-PC-63	3976	5000
1967	EAC	DAAB05-67-C-0155		
	(see text)		10717	10000+
1967	EAC	FR-36-039-N-6-00189(E)		
1968	DITTMORE-FREIMUTH	DAAB05-68-C-0040	215	?
1984	FOWLER INDUSTRIES	N 00024-84-C-2027	2	5
		Totals	**53383**	**63388**

Farewell to Sam Fidone, WRL's Chief Engineer

by Jim Musgrove, K5BZH
4217 Buckeye
Fort Worth, TX 76137

Most vintage radio enthusiasts recognize Sam Fidone's name and immediately associate it with World Radio Laboratories. He joined WRL's staff after World War II and served as their Chief Engineer until the late 50's. After leaving WRL, he seemed to fade away. No one , not even Leo Meyerson had any idea what had become of him.

For the last couple of years I have been writing a biography of Leo Meyerson that will be released around the beginning of 1997. While researching the story of WRL, I became very curious about Sam Fidone, because I felt that his contribution to WRL was very significant - he designed the Globe Champs, the Globe Kings and the Globe Scouts. He should be a part of the book.

I did everything I could to find him; I checked callbooks with no luck and even phone directories in areas where I thought he might be. Ed Reitan who has worked on the Leo Meyerson book with me, even contacted some of Fidone's relatives with no luck.

Recently I made the comment in a letter that was published in Electric Radio, that perhaps one of the readers could enlighten me as to Sam's whereabouts. Shortly afterwards Andy Becker, WØNVM, contacted me with the information that Sam Fidone was living in Cheyenne, Wyoming.

A phone call was made and it was learned from Sam's wife Doris that he was in a poor state of health. They agreed to respond to a questionnaire that would provide information for this story.

Sam J. Fidone was born on August 20, 1920 in Omaha, Nebraska to parents who had immigrated from Carlentina, Sicily, in 1910. Sam's folks didn't have a lot of worldly possessions. His father was a carpenter for Streetcar Company in Omaha.

As a youngster Sam made model airplanes, shined shoes, and carried papers. At the age of fifteen he secured a job at Omaha Cold Storage and worked in freezers. Young Fidone took an electricity and automotive course at Tech High. He soon discovered that fixing anything really intrigued him.

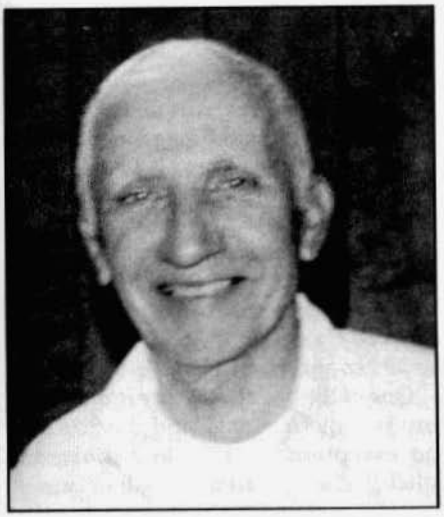
In 1940, Sam enrolled in a National Radio Institute correspondence course. He selected this as a means to better himself as he had recently taken on more responsibility through marriage. The course was completed in 1941.

Sam was in Civil Service in 1942. During 1943 he was inducted into the Army Signal Corps. He was attached to the 8th and 9th Air Force at Ipswitch, England. The young man, now 25 years of age, was discharged in December 1945.

Having developed skills in electronics to the point that he was virtually a self-made engineer, Sam sought employment to continue his chosen path and quickly obtained a position at Wholesale Radio Laboratories as Leo Meyerson's electronics manager and ran the radio shop.

At this point in time Sam held a first class radio telephone license; however, he did not hold an amateur license. Sam later took the amateur examination and he received the call WØQAB. His enthusiasm for operating a station didn't match that of his boss or other amateur teammates at WRL; however, his fascination with the repair and design of equipment was a different story. He was a very talented man, and his transmitter designs were very noteworthy.

Sam read QST and CQ regularly. He



Sam Fidone, WØQAB/WB7DRQ, now a Silent Key.

also subscribed to Radio Electronics for over 25 years. He remembered using books from NRI and the military as references. Sam recalled teaching himself the process of silk screening at home and using the technique at WRL, saving them some expense.

Fidone designed the Globe Kings, Globe Champions, and Globe Scouts. He likely designed the little WRL CW-7 seven-watt beginner's transmitter. He also designed police transmitters. The 755 VFO was also a Sam creation. It was later integrated into the Kings and Champions. Just prior to leaving WRL he participated in the development of the Globe Citizens Broadcasters.

Sam viewed the work environment as being great. He worked closely with the production folks. The production department was a one-shift operation and usually ran smoothly. The product mix depended upon the demand from customers. The team consisted of a few women and several men. All worked hard and got along well.

Leo Meyerson and Sam Fidone worked together to define the product line. Sam stated, "Leo was very good to me, we were honest to each other and we both knew where we stood with each other."

Fidone has been described as a very quiet man, who didn't mingle a lot with others. He didn't represent WRL at hamfests and conventions, although his wife recalls he once made a presentation entitled "The Sex Life of a 6L6" at a ham club in Omaha.

Sam Fidone, still a young man in his late thirties, left WRL in 1959 and filed an application for employment with the Federal Aviation Agency. His career at WRL only lasted 13 years, but it left an everlasting mark on WRL and amateur radio as a whole.

Fidone went to work for the FAA in December 1959 and retired December 31, 1982, a service of 23 years. Sam worked on instrument landing systems, radar, and communications. He served as a Sector Chief in Tonapah, Nevada and Cheyenne, Wyoming. Around this time he changed his callsign to WB7DRQ.

During his move to Cheyenne, someone stole his ham gear, a modest station, which included his Globe Scout 680 transmitter and Hallicrafters SX-71 receiver. That ended his activity.

Sam stated that he enjoyed every minute of his electronics career. Never once did he hate to go to work or get upset at receiving night calls. The FAA folks knew him as one of their best troubleshooters.

I learned that Sam Fidone passed away on Saturday, August 17th, just 3 days before his 76th birthday. He had been fighting cancer for over four years.

He left behind his wife of 56 years, Doris; three daughters, Patricia Barcus, Debi Fidone, and Kathy Brooks. He is also survived by 3 granddaughters and 3 great grandsons.

It's a little late, but Sam, if you can hear from where you are, let me take a moment to thank you on behalf of the old timers for your contribution to amateur radio. ER

The H-P 200CD from page 23
creases as the load impedance decreases, thus tending to maintain the output constant regardless of load. Self oscillation in the amplifier circuit is prevented by proper choice of resistance in the feedback circuits and by controlling plate and cathode impedances over the entire frequency range of the oscillator. The output stage is protected against a cathode-to-cathode short circuit by the resistors in series with the transformer secondaries. These resistors also make the oscillator present a 600 ohm impedance to the attenuator.

Output Circuit

Transformer coupling provides isolation between the oscillator and output circuits, and allows the output to be either balanced or unbalanced. Since a single transformer will operate suitably over only a part of the frequency range covered by the 200CD, two transformers are used. Connections between cathode-followers V2 and V4 and the proper transformer for the band in use are set up by the RANGE switch. The secondary windings of the coupling transformers supply a conventional bridged-T attenuator, the setting of which is adjusted by operation of the AMPLITUDE control on the front panel. As the control is turned counterclockwise, the loss inserted by the attenuator is increased. The source impedance at the output terminals is 600 ohms.

With attenuator set for minimum loss, the output circuit is arranged for balanced operation, and is so designed that for frequencies up to 10 kHz, stray capacity and leakage resistance will cause less than 0.1% unbalance. Unbalance at 600 kHz is approximately 1%.

When it is desired to operate unbalanced, ground should be connected to the center output terminal, the termination for the connection brought out from terminal 6 of output transformers T1 and T2. Proper operation cannot be obtained if the ground is connected to the side of the circuit which includes the attenuator.

Specifications

According to H-P's operating and service manual for the 200CD, the round six-inch diameter frequency dial, if straightened, would measure approximately 78 inches long. It is calibrated through 300° of arc. The instrument's accuracy is 2 % and frequency response is 1 dB over the entire range. Output is 160 mW (10 V) into 600 ohms or 20 V into an open circuit. Distortion is 0.2% from 20 Hz to 200 kHz; 0.5% from 5 Hz to 20 Hz and from 200 kHz to 600 kHz.

One of the beauties I have found about my H-P instruments, and the 200CD is no exception, is their incredible simplicity of use. Turn it on with its honest, purely functional toggle switch, select the range, dial up the desired frequency, set the output level and you're ready to roll. Like most basic H-P instruments, the 200CD is one of those that no serious experimenter should be without. They are available at swap meets and I assure you that if I see another one at the right price, I'll be the first guy to rescue it. Just think of the neat, but basically useless, Lissajous figures you could make with two 200CDs. ER

Acknowledgment

The author would like to thank Ms. Carol Parcels of Hewlett-Packard Corporate Communications for providing the historical photographs.

References

Wide Range Oscillator 200CD, operating and service manual published by Hewlett-Packard Corp., Loveland, CO, 1955.

"Max Wien, Mr. Hewlett and a Rainy Sunday Afternoon", Analog Circuit Design, ed. by Jim Williams. EDN Series for Design Engineers, Butterworth-Heinemann, Boston, MA, 1991, page 43.

R-389 from page 8

tried one out. I guess my performance conclusion is that the receiver definitely shows off the attention to detail that went into its design.

At my location, the R-389 seems to be completely free of any sort of detectable intermod product. For example, in broad daylight when the groundwave is the strongest and receiving from a broadside, full-wave wire antenna cut for the center of the broadcast band, there is no detectable product at 1140 kc, the 3rd order mix between KOA at 850 and KLZ at 560 kc (mixing product = (2 X 850) -560). These stations are powerful, longtime Colorado clear channel broadcasters. This test was made with my headphones on, the receiver AGC in the manual gain position, and the RF gain control at full tilt. There is no second-order mixing going on at 1410 kc between these two, either. There is no detectable mix between powerful AM broadcast stations and the receiver's local oscillators. I've never been able to detect any kind of image response (images tune "backwards" from real carriers). Tuning around with the antenna disconnected and the BFO on does not reveal any birdies, even when tuning through the IF! The receiver does not block up or overload when receiving the 50 Kw station in Louisville, Kentucky at 840 kc, the next channel down from the KOA powerhouse at 850. Yet, the receiver is so sensitive that at night in midwinter I can hear foreign carriers between the U.S. AM broadcast allocations, occasionally with a little bit of modulation on them.

At the time I checked it, my R-389 met or exceeded all of the specifications published in the Army technical manual. Due to differences in test equipment configurations and individual experience, interpretation of receiver test results can vary wildly. I'm not going to write up any more numbers relating to equipment performance.

This concludes the R-389 series. Readers wishing to obtain their own copies of the Collins engineering reports should write to Mr. Frank Gentges, (AK4R), 9251 Wood Glade Dr., Great Falls, VA 22066 for further details. **ER**

The Radio VT Fuze from page 15

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FOR SALE: R-390A/URR orig 1961 maintenance manual, TM11-5820-358-35, 189 pgs - $28 incl. priority mail. Aben, POB 4118, Jersey City, NJ 07304.

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FOR SALE: 1964 GE metal portable radio model 250, 5-tube - $60. Pat Stewart, W7GVC, 1404 Ruth Ave., Walla Walla, WA 99362-3558. (509) 525-1699.

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FOR SALE: Vintage RCA Mics: 44BX - $1875; 77DX - $1250; SK-70 (Varacoustic) - $385; Altec 639B - $600. Jerry Silvia, 1950 Graham Hill Rd., Santa Cruz, CA 95060. (408) 438-0378.

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

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WANTED: HELP, need schematic for Navy RV-16 RX; also coils D, F & K for same. Bob, W7SC, 3932 S. Mesa View Ln., Boise, ID 83706.

WANTED: HQ-1 hybrid mini quad; HT-18 panel glass. Did anyone ever convert the S-53A to ham band only coverage? Bill Bower, N7MOB, WA, (206) 839-8591.

WANTED: Info on early 1950's Meissner regenerative rcvr kits. Neil Borg, WØMXX, 2219 Ridgewood Dr. NW, Alexandria, MN 56308.

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

FOR SALE: Hallicrafters SX101A, has calibrator, no book, a beauty - $150 + shpg. Henry Mohr, 1005 W. Wyoming St., Allentown, PA 18103.

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

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

FOR SALE: AK 55 table model - $50, PU only; RAL-7 & pwr sply - $75, PU only; RBL-5 WW II Navy 15-600 kc rcvr - $100; G-43/G hand-crank generator w/tripod rest - $110; BC AO 229 w/5 coils & dynamotor unmodified - $75; Framton xmtr pre-WW II, nice - $120; B & W Match Master model 651 - $25. **WANTED:** National AGS &/or AGS coils, any condx., cash or interesting trades; Squares-Sanders spkr & rcvr schematic. John Orahood, N5SPQ, 5819 Miller Valley Dr., Houston, TX 77066. (713) 440-5598

FOR SALE: Heath SB-300 - $125; DX60B - $85; Sixer - $55; Two'er - $55; HG-10 - $65; AM filter - $85; CW filter - $50; Knight T-50 - $55; Conar 400 - $50; Globe VHF 62 - $115; Clegg 99er - $30. Other equip & manuals, free list. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (201) 728-2454

FOR SALE: Henry 4 K-Ultra amplifier, as new - BO over $3500; Signal One CX-11A, w/rare blower option, as new II- $2700; 90 ft Triex Sky Needle, accessories, Telrex, KLM Yagi's - package only - BO. Gary L. Goldsmith, KE6MS, POB 5786, Beverly Hills, CA 90209. (310) 696-0177

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

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

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

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

WANTED: HF-380, 451S1, AC-3814. Koji Mitoshi, Japan. TEL/FAX 011-81475-24-9115, e-mail:byj01726@niftyserve.or.jp

WANTED: Mics by Altec, Neumann, AKG, WE, Sony, any vintage; tube compressors/limiters; will trade my rare NOS tubes for mics. Mike States, Box 81485, Fairbanks, AK 99708. (907) 456-3419 ph/fx

WANTED: CQ 1945, 1946 whole issues, 1976 Aug, 1977 Sept, 1978 May & July or whole isues, 1987-1988. Dong-Hyun Cho, Biology Dept. Kang Won National Univ., Chun Chon 200-701, Korea. dhcho@cc.kangwon.ac.kr

WANTED: Hammarlund Super-Pro BC1004 rcvr, exc wrkg condx. Will PU. Joel Ekstrom, W1UCX, Box 391, Cabin John, MD 20818. (301) 469-6562

WANTED: Coil sets for Globe King 400 series & WRL Globe Champion 150 & 175 series. For use at museum. Leo, WØGFQ, NE, (402) 392-1708.

WANTED: 5SB xtal bandpass filter 915 kc (BC348). Mike. AC5P, POB 33, Bartlesville, OK 74005. (918) 333-2795

WANTED: ARC51, ARC164, ARC83, ARN118, ARN-127, SST181X, KY28, Wilcox 807, cables, radios, mounts, manuals. James Treherne, 11909 Chapel Rd., Clifton, VA 20124. (703) 830-6272

WANTED: EV Mics: 638, 641, 605-Hi-Z only; Shure 520, 707, 705, 545, 54PE, 545D; Astatic T-3, JT-40. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225/Fax 328-4217

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

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

WANTED: GPR 90, 91, 92; Hallicrafters SX-88; Eddystone rcvr's. James B. Geer, 1013 Overhill, Bedford, TX 76022-7206. (817) 540-4331

WANTED: Plug-in coil parts to restore damaged 1946 National HRO-5A1. Any 1946 or earlier HRO coil including "junk" coils will be appreciated. Especially need coil sets D, E and F. Many thanks! S.E. Watkins, K4OWN, 13003 Fennimore Terrace, Midlothian, VA 23113-4482. (804) 379-0521.

WANTED: Dead or dying Johnson Viking I or II for restoration project. Collin Collier, N4TUA, GA, (912) 988-1276.

WANTED: Bandswitch SW4C-D for Heath HX-1681, PN 63-1344; mounts on PCBA, RF cage. Bob, WBØAUQ, 986 E. 1587 Rd., Lawrence, KS 66046. (913) 842-9799

WANTED: Eldico TR-75 xmtr. Need not even be in working condition. Don Temple, AFØC, 5405 S. Florence CT, Englewood, CO 80111. (303) 779-0923.

WANTED: Looking for TM 11-275 for SCR-284/BC-654A; need schematic for PE-103. Norm Hall, 6506 Jetta, Bakersfield, CA 93308, (805) 399-4101

WANTED: Heath SB-301/401 & SB-200 or SB-220. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603

WANTED: Manuals for Hallicrafters HT-7 & Electric Eye Corp. Mon-Key. **FOR SALE:** HT-44 PS. JeRB, MI, (616) 226-8873. view2earth@aol.com

WANTED: Schematic/book for Realistic DX 150A. Mac, W6SDM, 24 Glenbrook, Camarillo, CA 93010.

WANTED: Heath AT-1 xmtr & CO-1 code practice oscillator. Pete Cullum, KØWRX, 1332 Harlem Blvd., Rockford, IL 61103. (815) 965-6677

WANTED: Collins 51S-1 commercial, mint condx., for personel use. Robert Struk, 1726 Kinglet Ct., Sunnyvale, CA 94087. (408) 991-3747

WANTED: DM-24 Dynamotor, R25/ARC-5 1.5-3.0 Mc rcvr. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407.

WANTED: Small knob for HR-10; pilot lites for HP-425A; manual for Hickock 188X. Jack Bertholf, WA4CSM, 8109 NW 58 Ct., Tamarac, FL 33321. (954) 721-2337.

WANTED: Navy xmtrs TBK, TBL, TBM, TBW, TCA, TCE, TCX & accessories, any condx. Steve Finelli, N3NNG, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211

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FOR SALE: Heath RF oscillator IG-5280 - $20; large stock air capacitors; send SASE for list. Bill Riley, W7EXB, 863 W. 38th Ave., Eugene, OR 97405. (541) 345-2169

FOR SALE: BC 357B; BC 375J; BC 341B; CV89 freq shift converter; CREI radio engineer course 1947; conversion manuals vol 1 & 3; Wilcox F3 rcvr; Galaxy mobile sply. Howard Hood, 5670 SW 44th St., Port Orchard, WA 98367. (360) 674-2179

FOR SALE: USM-117 solid state oscilloscope w/ plug-in, (only 2 left) - $110 + UPS. Bob Bakinowski, 1524 Saint Tropaz, Tucson, AZ 85713. (520) 624-8029

FOR SALE: Heath AT1 - $95; RCA AR88, CR88A rcvrs - $250 ea; HQ180, nice - $325; Centronics 20A - $90. Larry, VE3RF, Box 509, Ayr, Ont N0B 1E0, Canada. (519) 632-7921

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

FOR SALE: Hammarlund HQ110, HQ145, HQ145, HQ180. All working w/manuals. Hoover, SC, (803) 726-5762

FOR SALE: Heath printed circuit board kit, unused - $20; 2 Midland 6 channel CB HT's w/4 sets of xtals in each one, back missing on one, not working - $15, 1 ship. Don Dillard, 5106 Red Oak Dr., Amarillo, TX 79110-4628

TRADE: HT32 for Heath Warrior amp. W7RBF, AZ, (602) 864-9987.

FOR SALE: RCA WR-59-C sweep gen. w/manual, like new - $40 + UPS. Ken Tountas, 2309 N. 51 St., Waco, TX 76710. (817) 772-7307

FOR SALE/TRADE: As new Bird 43 wattmeter w/mini UHF convertors & 2 slugs - $350. Fred Watson, KB8NRF, 581 W. Summit St., McClure, OH 43534. (419) 748-8798

FOR SALE: Hallicrafters FPM300 xcvr - $350; National NC 173 rcvr - $125; RME 6900 rcvr - $125; Federal Radio 101 rcvr - $125. All w/manuals. Mel Stoller, K2AOQ, 100 Stockton Ln., Rochester, NY 14625. (716) 671-0776

FOR SALE: Exc Drake T4XC, R4B, AC4, MS4 - $350 + shpg. Gary, W5UXL, LA, (318) 878-8032

WANTED

Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. (805) 259-2011. FAX (805) 259-3830

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

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

WANTED: TMC GPR-92 HF Rcvr. Hank, W6KC. (602) 281-1681 FAX: 281-1684

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

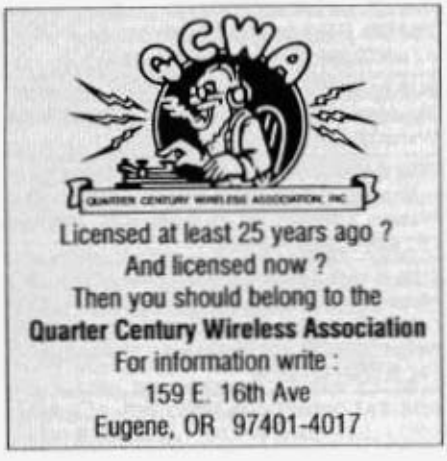
WANTED: Manual & RF trans 10-30 Mc part #38815-1 for Hammarlund HQ-145. Burt, MI, (517) 736-8020

WANTED: Xtal socket & knob for Rec-trans on Clegg 99er. Les Mathews, WB2DQV, 421 Carvin St., Clayton, NJ 08312.

WANTED: Assembly manual for a Heath EK-2A regenerative RX & Brown Brothers straight key. Gary Wagner, K3OMI, 11124 Oak Hollow Rd., Knoxville, TN 37932. (423) 690-4217 M-F days

WANTED: Nice SP-600, 9+ condx. Tom, N5OFF, LA, (318) 989-3430, n5off%w5ddfl.aara.org@usl.edu

WANTED: J. Miller Co. broadcast band AM tuner 565, 585, 595; ant coil 241A, 242A; coupling coil EL55, EL56. Al Kaiser, W3LEQ, 713 Marlowe Rd., Cherry Hill, NJ 08003-1551. (609) 424-5387



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

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

WANTED: TMC GPR 92; Hallicrafters SX28, SX42 rcvrs, collector quality, complete. John, NE6C, 7495 Gunter Rd., Pensacola, FL 32526. (904) 944-6563

WANTED: Panel for SX-88 or parts radio with good panel. **FOR SALE:** SX-88 band selector drive belts, $25 each, 2 for $40. Jim Jorgensen K9RI, 1709 Oxnard, Downers Grove, IL 60516. (630) 852-4704.

WANTED: Readable copy of only the schematic diagram for Clegg Interceptor rcvr. All costs for reproduction will be reimbursed. Thanks. Tom Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (312) 262-5360

WANTED: Schematic & information on filter amplifier F10A used w/ARC-5 rcvrs. K1MBI, 21 Freestone Ave. Portland, CT 04680.

WANTED: 7094 tubes. Joe, W7ISJ, 10332 Camino De La Placita, Tucson, AZ 85748. (520) 886-3087

WANTED: Turner plus 3 base mic, gray or black model, any condx, working gray preferred. Michael Murray, KE2LH, NY, (516) 489-4094

WANTED: 500 or 800 cycle CW filter for 75A-4. Steve, N4LQ, KY, (502) 935-7848 h, 581-3890 w. n4lq@iglou.com

WANTED: Manual-schematic Allied-Knight sweep-gen KG-687; Squires-Sanders SS1BS. Weber, 4845 W. 107th, Oak Lawn, IL 60453-5252.

WANTED: Henry 2K-Ultra, mint. Takashi Nakamura, JR7TEQ, 20-2 Midorigaoka Shiroishi, Miyagi 989-02 Japan. Fax: +81-224-26-1424

WANTED: Meter for Heath Warrior HA-10 amplifier. Don, K8POU, MI, (616) 649-4646.

WANTED: Final plate tuning capacitor for the Johnson 6N2 xmtr (or 6N2 parts rig); small black/silver knobs from Knight Star Roamer, T60, R55 etc; Hallicrafters HA-6 6-meter transverter; older/working broadcast or studio mic. Emil Zelasko, KA8GEF, 9401 Grand Division, Cleveland, OH 44125. (216) 883-5134.

WANTED: Manuals for Navy AN/FRR 23 & Heath HR-10B. Gary Lang, WN9U, 5129 N. Elkhart Ave., Whitefish Bay, WI 53217. (414) 332-5872

WANTED: Hallicrafters S-29, S-39 radio. Bill Gustavson, N5YGM, 1819 Green Tree Ln., Duncanville, TX 75137. (214) 981-3310 w.

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

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

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

WANTED: Johnson Challenger, Adventurer, Navigator, good cosmetic condx. Doug Knoll, KA9IQA, 1400 4th Circle NE, Waseca, MN 56093. (507) 835-8821

WANTED: National NC80X or NC81X. Have NC303 for trade. Niel Wiegand, WA5VLZ, 12105 Mustang Chase, Austin, TX 78727. (512) 219-8548. nielw@ix.netcom.com.

WANTED: Unassembled Heathkits, Heath gear, Heath catalogs. Bill Robbins, 5339 Chickadee Dr., Kalamazoo, MI, (616) 375-7978, billrobb@serv01.net-link.net

WANTED: Nice SP-600, a 9+ in excellent working condition. Tom, LA, (318) 989-3430 n5off%w5ddl.aara.org@usl.edu

WANTED: Hallicrafters R-46B spkr. Harold I. Stark, K9UBL, IN, (317) 788-1210.

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

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

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

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

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

WANTED: Hammarlund Comet Pro, AVC model; Comet Pro coils, parts & parts sets; Hallicrafters SX-11 dial plate; Millen 90801 exciter. Dean Showalter, WA6PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: BC-456 modulator; BC-442 antenna relay; ARC-5 cables w/connectors. David Boardman, 101 Lemaistre, Sainte-Foy, Quebec G2G 1B4, Canada (418) 877-1316

WANTED: Manuals/schematics for RME (Globe) VHF-602 xmtr's; Sonar SR-9 2M rcvr. Al Bernard, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: Clean SP-600-JX-21A & HQ-170ACX VHF w/orig. manuals, C6ANI, POB N410G, Nassau NP, Bahamas.

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

WANTED: Johnson Challenger, Adventurer, Navigator, good cosmetic condx. Doug Knoll, KA9IQA, 1400 4th Circle NE, Waseca, MN 56093. (507) 835-8821

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FOR SALE: Heath DX-60B w/HG10 VFO; 2 Viking II w/122 VFOs. Michael H. Wilke, WB4AQL, 215 Dale St., Rossville, GA 30741. (706) 861-3070

FOR SALE: Mobile Antenna (DK-3 Screwdriver type) 80-10, 12 V, new unit - $145 + shpg. K6RRC, CA, (916) 991-8580. k6rrc@aol.com

FOR SALE: Heath HW16 CW xcvr, manual - $65; HP13A ,DC sply - $40. **WANTED:** Command Sets, good/prts units. Dave, W1DWZ, (508) 378-3619

FOR SALE: WACO-5NWX telephone interference filters - 1/$12.95, 2/$24, 3/$33. If these don't work then none will. Just plug in. Cecil Palmer, 4500 Timbercrest Ln., Waco, TX 76705. w5nwx@juno.com

FOR SALE: Just released: Send 2-stamp LSASE for latest Olde Tyme Radio Co. Flyer 196A. Olde Tyme Radio Company, 2445 Lyttonsville Rd., Ste 317, Silver Spring, MD 20910.

FOR SALE: Mechanical filter F455FA-21 - $55; NOS tubes 8233 - $25, 841 - $18. **WANTED:** TBY antenna. Joseph Pinner, KC5IJD, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766

FOR SALE: Large list includes Collins 30S-1, Ranger I & II, Hammarlund, Hallicrafters, National, Military, etc. SASE. Joe Pfeifer, KB7ZZG, 9483 S. Mumford Dr., Sandy, UT 84094-3101. (801) 571-5453

FOR SALE: Tube list, new & used, wide variety audio, ham. Recently expanded. SASE 52¢. Bill McCombs, WB0WNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212.

FOR TRADE: Have SSR-1G rcvr, need xmtr & pwr sply. Steve Bartkowski, 4923 W. 28 St., Cicero, IL 60650. (708) 863-3090

FOR SALE: KWM2/PM2 w/CC-2 suitcase - $600; NC 183, exc condx. - $175; Sig. One CX7B - $1200. Joe, K2QPR, FL, (561) 220-7362, any time.

FOR SALE: Low freq rcvr - $60; Heath VF1 - $40; R-388 Collins rcvr, fixer - $100; PRC-47, access's & spare - $200; Knight T-60 xmtr - $40. Ed Hammond, POB 390, Buckfield, ME 04220. (207) 336-2858

FOR SALE: R390A & manuals - $200; HRO50T1, all coils, no spkr, works good - $200; Globe 300A w/813 final, fair condx. - $100; Johnson Adventurer, CW only, clean - $150; CE 20A w/458 VFO - $75; RME45, broken glass, no spkr, works, good - $75. All + shpg. Clyde Denton, K4UXK, 2538 Country Club Ln., Columbia, TN 38401-5811. (615) 380-8480

FOR SALE/TRADE: Paragon RA-10; Grebe CR-9. **WANTED:** Paragon DA-2; Grebe CR-13 or pre 1940 Collins xmtrs. K2OA, NY, (914) 691-7957

FOR SALE/TRADE: Hallicrafters SR-150 xcvr, nice, book, AC pwr, DC transistor sply. Fred Clinger, OH, (419) 468-6117 after 6 PM ET

FOR SALE: Very nice Johnson Viking Adventurer xmtr in working condx, no manual. Dusty Rhodes, W8MOW, 1324 N. Dorset Rd., Troy, OH 45373. (513) 339-1546

FOR SALE: Drake R-4A - $150; TR-4C - $185; MS-4 - $40; Hygain collectable rotor repeater - $70; Collins X455KO, Q-200 - $130; NC-109 - $95. WA1APX/8, MI, (810) 781-9717.

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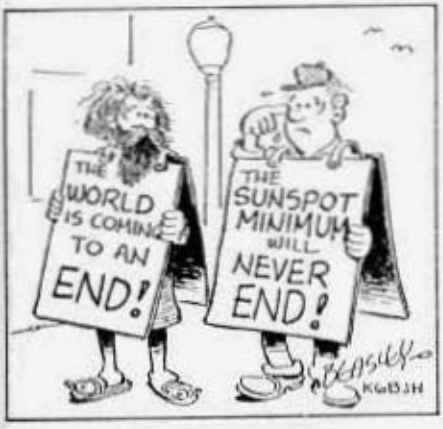

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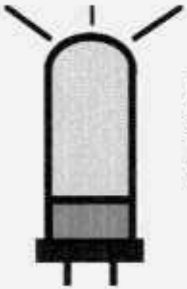

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