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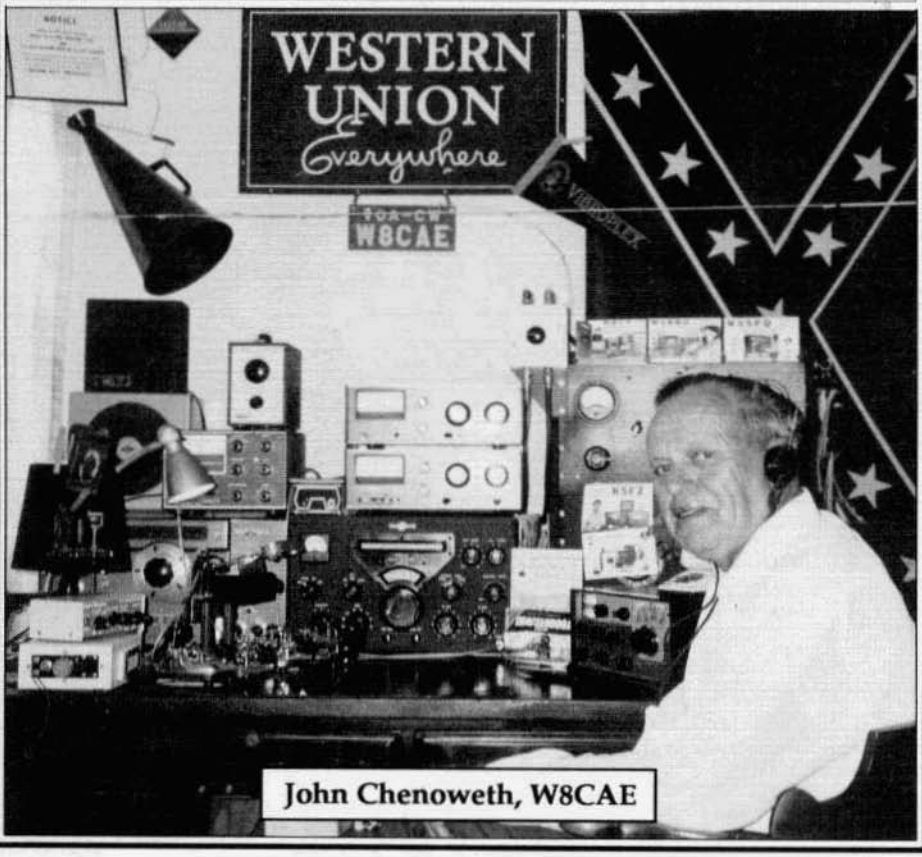
ELECTRIC RADIO

celebrating a bygone era

Number 33 January 1992



John Chenoweth, W8CAE

ELECTRIC RADIO

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WALT HUTCHENS,KJ4KV.....ELECTRIC RADIO IN UNIFORM
FRED HUNTLEY,W6RNC.....REFLECTIONS DOWN THE FEED-LINE
BILL KLERONOMOS, KDØHG.....VINTAGE PRODUCT REVIEWS
DALE GAGNON, KW1I..... AM REGULATION UPDATES

Electric Radio is published for amateur radio operators and others who appreciate the older tube type equipment. It is hoped that the magazine will stimulate the collecting of, and interest in, this type of equipment.The magazine will provide information regarding the modification,repair and building of equipment. We will also work to-wards a greater understanding of amplitude modulation and the problems this mode faces.

Electric Radio Solicits Material

We are constantly searching for good material for the magazine. We want articles on almost anything that pertains to the older amateur equipment or AM operation. From time to time we will also have articles and stories relevant to the CW operator and the SWL. Good photo's of ham shacks, home-brew equipment and AM operators (preferably in front of their equipment) are always needed. We also welcome suggestions for stories or information on unusual equipment. For additional information please write us or give us a call.

EDITOR'S COMMENTS Barry Wiseman, N6CSW/Ø

Back in August of last year, Ralph Gross, W2WME, was electrocuted while working on an amplifier in his ham shack. I knew Ralph quite well - I'd worked him many times on ten AM - but I learned of his death only recently from Dick, KB2EGG, who along with three other AM'ers purchased most of Ralph's 'boatanchor' gear.

I called Ralph's widow, Jean. She told me that Ralph was working on an amplifier in his hamshack which adjoined the room she was in. She heard a loud bang. She called to Ralph asking what had happened. He replied that he had been electrocuted. When she went to the next room, Ralph was by then unconscious and died in a couple of minutes.

Ralph was 80 years old. I never thought he was that old. I think most people would agree that he sounded much younger. Jean said that Ralph had retired in the early '70s and had spend the last 20 years doing "exactly what he wanted to do". He enjoyed excellent health and was always very active.

He was first licensed in the early '40s. He spent the war years in the Air Force as a flight instructor. After the war he started a wholesale electronics business - Associated Electronics - in Utica, NY. He operated that business for 25 years, until his retirement.

Mrs. Gross was very disappointed that she did not have a single photo of Ralph with his equipment. In fact, she did not have a photo of him of any kind. "I'm just so mad", she said, "Ralph was always taking pictures, but we do not have a single picture of him".

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Reflections Down the Feedline

by Fred Huntley, W6RNC
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"The Microphone That Talked Back"

A few years ago, while listening around the 2 meter FM repeaters, I came across two ex-broadcast engineers reminiscing about the San Francisco AM broadcast scene of the 1950's. One fellow got into describing some of the fun they used to have in those days. (The large studio ribbon microphones of that era were also capable of acting like a loudspeaker, if an audio signal was fed into it.)

His story went like this: At one of the main San Francisco broadcast stations, Mr. Big Name Radio Announcer was getting ready to go on the air. With a minute to go, he was at the studio mike, clearing his throat and studying his script. Meanwhile, behind the glass window, a mischief-bent control room engineer plugged a speech amplifier with microphone into the studio microphone line.

While concentrating on his script, with second hand of the station clock counting down, the announcer was suddenly startled to hear his microphone blare out; "Hello, you big ugly baboon" (and a few other choice comments.)

Before the announcer had time to react, the engineer restored the original microphone connection. In a few seconds, it was on-the-air time while the announcer struggling to maintain his composure, had to proceed with the broadcast program and suppress any reaction that he would have liked to have made. Meanwhile, behind the glass window, the control room engineer was having a big belly laugh at the trick he had just pulled off on his co-worker.

"Fun on the Hood Victory"

For a couple of years after WW II, some cargo ships maintained a 24 hour radio watch with a staff of three operators. Charley Short, in a book of poems about radiomen and the sea, tells about his adventures as 2nd Operator of the SS Hood Victory.

It seems that the Chief Operator was a sensitive guy, but otherwise a pretty good fellow. The 2nd Op., having a lot of time on his hands, liked to play tricks on the Chief. One day, the 2nd Op. got a brilliant idea! He hooked an electric buzzer and dry cell to an aerial wire and called the Hood Victory while the Chief was on watch.

When the Chief heard his ship's call coming through the receiver, he would slap on the transmitting power and acknowledge. But no answer ever came. These phantom calls kept occurring for a few days, and the Chief Op. was beginning to think that he was hearing from a ghost ship.

The 2nd Op. was having real fun over all this. As he started to make a repeat performance, and was hooking up the buzzer to the aerial wire, he received a jolt of electricity and was knocked across the deck. It seems that the Chief Op. had wised up to what was going on and had hooked the aerial wire to 110 volts DC!

Can You Top This

There long have been stories about CW operators with fantastic abilities - like the ship operator who could copy the press (news bulletin), play a hand in a game of poker, smoke a cigarette and carry on a conversation - all at the same time.

Then, there is the President of the Spokane, Washington, Morse Telegraph Club chapter who said that he knew a landline operator in Montreal, who could send, with a separate key in each hand, messages in French and English – simultaneously! ER

LETTERS

Dear ER

Not many seem to have noticed a proposal which may affect those of us with vintage amateur equipment. The ARRL is proposing for the next WARC to move the 40 meter band down to 6.9 - 7.2 Mcs. As an ARRL Life Member, I wrote to Headquarters concerning my displeasure with this proposal. The unsympathetic response indicated that I should modify my equipment. I am not very inclined to mess with modifying my perfectly useful Ranger I. If this proposal is enacted I and many other amateurs will lose some usefulness of equipment and access to frequency privileges.

Steve Putman, N8ZR

Dear ER

I really enjoyed issue #32. K6BJH's cover was really great.

I'm just mildly AM-active here with a Ranger II/R390A/HQ-170 on the air with a DX-100 and Commanche waiting in the wings for restoration. I mostly work 10 meters but every now and then join the gang on 20 and 160. I'm still looking for some activity on 15.

I noticed your comment on getting a 20A on SSB and asking if others were interested in vintage SSB. Yes. My 20A is on the bench now and hopefully I can get the gremlins out and have it on 20 meters soon.

Bob Rainbolt, WBØAUQ

Dear ER

Some comments on the 160 meter contest. Please give us more notice next time. I received the December issue on 12/24, only 4 days before the contest. The timing is not good, being the week between Christmas and New Years. Many people have parties on that Saturday night, as we did, so I missed it. Please consider these comments when you plan next years 160 M contest.

Dan Radcliffe, KP9BP

Dear ER

A bunch of us here in this region [Southwest] are getting on 160 AM early mornings on Mondays, Wednesdays and Fridays. The frequency is approximately 1950, plus or minus 10 khz. The time is between 5 and 5:30 AM Arizona time. It usually goes until 7 AM or so. The regulars are W8SXX, N7SEP, K7VZP (Phoenix), WC7O, K7CMS, WV5G (Albuquerque) and myself [WA7WOQ].

The morning works out well because we can get in a little AM before work and many of us have trouble with the neighbors telephones and VCRs.

Gary Kabrick, WA7WOQ

Dear ER

It was again, a marvelous experience. Headphones on, tuning the dial of the SP-600 up and down the band, after midnight one could only hear AM; not a single SSB signal on the band. Thanks to this annual 160 M contest (?) we were all treated to a re-creation of those days of yore!

Band conditions did not appear to be great by any means, but were certainly better than during last year's event. At least those of us in the west could work east of the Mississippi this year.

The big dissappointment this year was the lack of participation by many AM stalwarts. Most conspicuous by their absence were WA8LXJ, W7FG, W6PSS, W6HDU, K7BDY and others!

Taking up some of the slack were some the big signals (heard here in Colorado) of W8VYZ, VE4BX, N8FSB, W5PYT, WB5G, WØZUS, KØAS and WA7WOQ. WB5G was on my standout list. He was using a balloon supported vertical with a 30K. He was VERY LOUD. Also VERY LOUD was VE4BX. Why couldn't your hear me Doug?

Mostly I was running my 304TL rig but at one point AI8Z, KEØMT and yours truly were all running ART-13s in a QSO; probably some sort of record for this decade.

I'm looking forward to next year.

Bill Kleronomos, KDØHG

"A Not Noticeably Drifty VFO"

by Walt Hutchens, KJ4KV
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Arlington, VA 22207

"Part II -- Construction"

Actually building a stable 80-meter VFO turned out to be a lot more difficult than I had imagined; most of the surprises were in the behavior of the parts rather than in the circuit or how the unit was built. In part one (last month) we discussed some theory and the basic design choices for the Not Noticeably Drifty VFO. This month we'll look at construction and parts issues.

The Tuned Circuit

With a well chosen oscillator circuit, the tuned circuit will effectively control the frequency with the tubes and other parts having little effect. If the tuned circuit drifts, however, so will the VFO.

The ideal is to build the tank circuit from parts which don't change in value with temperature changes; coming as close as possible to this ideal is the first line of defense against drift. The next step is to minimize temperature changes. Then finally we compensate the remaining drift as accurately as possible. Compensation is last on the list because it can at best remove 'most' -- say 90% -- of the drift; if you have a lot when you start, you will have more than you want at the end.

An added advantage of using stable parts for the tuned circuit is that changes in ambient temperature will have less effect.

Oscillator Circuit Capacitors

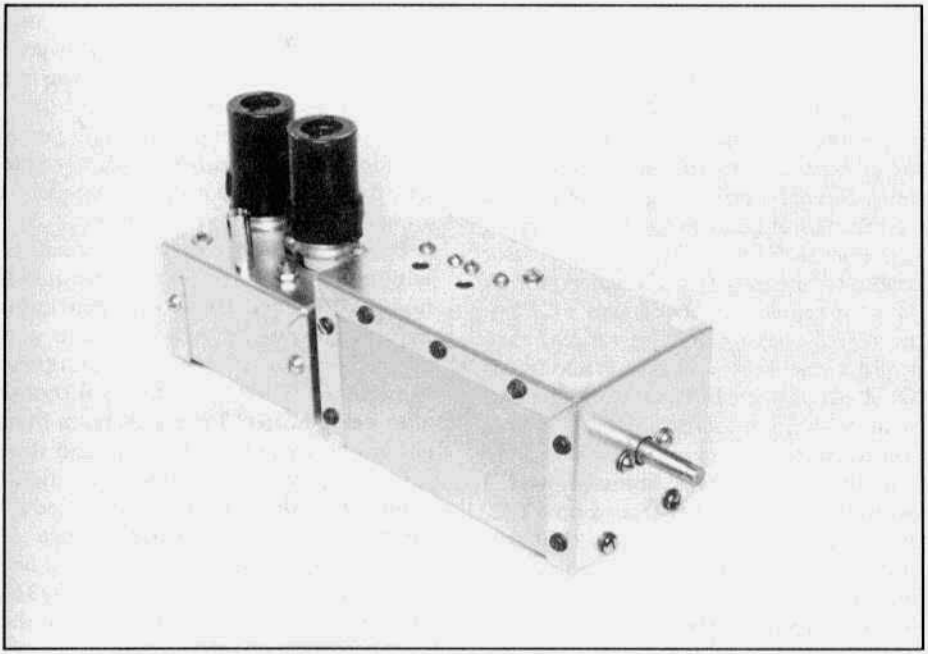
Much of what I had believed about small fixed capacitors turned out to be wrong. Silver mica caps have a substantial positive coefficient; they can't be used if you want really good stability. (When talking about temperature coefficients we will use 'positive' to mean the value of the part increases, causing the frequency to go down; 'negative' will mean the value gets smaller.)

Polystyrene capacitors seem to have a moderately negative temperature coefficient so they may be used in non-critical spots or for temperature compensation. A bigger disadvantage is that they have both an extremely high 'Q' and substantial self-inductance; many of the test circuits in which I tried them, required treatment (a small series resistor) for VHF parasitic oscillations.

The modern subminiature ceramic caps change temperature by enough to matter even with the small RF current flowing in a tank circuit at this power level. Far worse, I found that some would change value about 5 PPM per hour for days.

It turned out that the best capacitors for tank circuit use are NP0 (zero temperature coefficient) ceramic units. Even these have a small temperature coefficient -- perhaps 10 parts per million per degree Fahrenheit. At 4 Mcs, that will cause 1/2 x 10 x 4 = 20 cycles drift for every degree of warm-up! (The 1/2 is because the frequency depends on the square root of the capacitance). NP0 disk ceramics of 1/2" or larger diameter gave the best results. Two or more should be used in parallel for the most important jobs to reduce the current that each has to carry; they should be mounted with the disks vertical to allow the best cooling.

Various makes and even different supposedly identical parts are somewhat different. It might be worthwhile trying to select especially good ones by the method described below for testing of the coil but I did not do this.



The Not Noticeably Drifty VFO. The unit covers about 3500-4000 kcs. After one minute, it drifts about 20 cps in the next four minutes. Drift thereafter is usually less than 10 cps per hour and 100 cps per 24 hours.

Some sort of trimmer will be needed for band set and compensation purposes. Ceramic trimmers with NP0 or specified negative temperature coefficients are available but most of them cause a downward drift of up to several hundred cps over a period of several hours each time you change the setting. Some of the ones I tried also caused sudden jumps of ten cps or so from time to time during warm-up for the first several warm-up cycles after adjustment. These effects would not be a problem in many applications but if you are shooting for drift in the under 50 cps/hour range, they are a real headache. In any future redesign of this VFO I will use subminiature air dielectric or piston-type trimmers.

Even though they are not part of the tank circuit, screen and plate bypass capacitors affect the oscillator frequency so stable parts must be used. My junkbox (and local fleamarkets) could not supply NP0 caps this large so I used mylar units for C8 and C9. Common 'Z5U' disk ceramics are too unstable for use anywhere in the oscillator circuit.

The choice of a tuning capacitor depends on what you are trying to do. Caps with aluminum plates or only one bearing should be avoided unless the tuning range is very small or drift in the 1 kc range is acceptable. With brass plates and sleeve bearings at both ends of the rotor you can build a very low drift VFO to cover a ham band or less, provided that you don't require high reset accuracy. I used a double bearing APC unit which I found at a fleamarket.

To get reset accuracy better than 1 kc or low drift operation over a wide frequency range you need ball bearings.

The tuning capacitor should be mounted so its plates are vertical to assure that it will follow the air temperature within the tuned circuit box. Since the tank coil generates some heat, the tuning capacitor should not be mounted above it.

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The Tank Coil

The coil is the biggest challenge. Forget ceramic coil forms and tuning slugs; the configurations I tried had a large positive temperature coefficient. By 'large', I don't mean 'kilocycles of drift', but amounts like a few hundred cycles – good by normal standards, but a real problem when trying to get below 50 cps per hour. Miniductor stock was much better, but since I didn't have a good assortment of sizes, I did not finish this exploration. One article I read reported excellent results with a National XR-50 plastic form but this would depend on the wire size, spacing and other factors – you would have to experiment.

In the end, L1 was home-brewed. I wound a layer of heavy thread on a 1/2" dowel, wrapped it with a layer of stiff paper, covered that with thin polyethylene film, and then wound on the coil, allowing several extra turns for adjustment. The ends were passed through holes drilled in the dowel.

All this is about as tricky as it sounds and it took several tries before I got the first one wound without something slipping. Then I heated it with a hair dryer and applied a few drops of '5 minute' epoxy resin glue which flowed into the winding. After this had set for a few minutes, I pulled the coil ends free, pulled the thread out, and removed the dowel, paper, and poly film, leaving a single layer coil held together by epoxy. I applied a thin layer of epoxy to the inside of the coil to further strengthen it.

It took several tries to arrive at a really good L1. The first coil was close wound; it had a better temperature coefficient than anything else I had tried. In fact, with fairly large compensating capacitors it met the design goal. However, I suspected that it could be improved. To explore this, I extended the coil connections by several inches so I could heat it with a hair dryer without affecting the rest of the unit and found that it had a substantial positive coefficient – the frequency went down as it got warm. Hummm... plastics have a greater coefficient of expansion than metals; maybe a space wound epoxy covered coil would increase its turns spacing fast enough to correct for the increase in diameter caused by the expansion of the wire. I made one up and sure enough when the hair dryer hit it, the oscillator frequency went up.

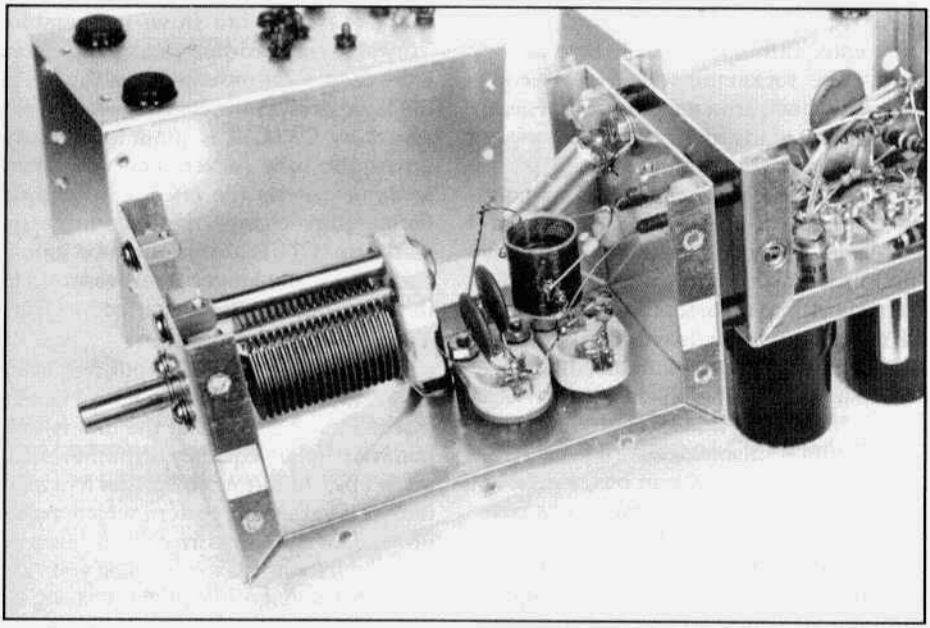
Bingo! I wound a coil having 4/5 of the winding close wound and the rest spaced (and with extra turns on each end), mounted it on the extended leads and applied the hair dryer. Watching the change of frequency as the coil cooled after being heated, I removed turns from either end as necessary to get and then keep roughly a zero temperature coefficient while decreasing the total inductance to hit the right frequency range.

The final L1 consists of 30 turns of No. 28 wire with an inside diameter of 17/32". The first 24 turns are close wound; the remainder is spaced by the diameter of ordinary sewing thread. Taps at 10.5, 18 and 19.5 turns from the close wound end are connected to the plate, R2, and grid, respectively. I suggest starting with at least 4 extra turns on each end.

I could not make an accurate measurement with the tools available, but the resulting coil has a very small coefficient – between 2% and 10% of the close wound version.

I tried supporting the coil in various ways but none gave stability as good as mounting it by short leads attached to No. 20 support wires from the ceramic trimmers. This mounting is somewhat microphonic and not strong enough for mobile operation; if rough service is required it should be reinforced.

The coil generates some heat; not enough to feel, but enough that a thermometer placed against the winding will show a temperature rise of two or three degrees. To minimize the temperature change, mount the coil so it is vertical when the VFO is in operation. When I tried a horizontal coil, the rate of drift was several times greater.



Inside the VFO. The tuning cap is at the left, next comes C4 and C5 supported on C6, and then L1. C2, the temperature compensating cap is at the right, connected to the compensation trimmer, C3. Plastic bushings through which run the leads to the tube compartment are on the wall to the right.

Construction

Now we come to the second line of defense -- keeping heat away from the tank circuit. In order to do this, the Not Noticeably Drifty VFO is built in two separate miniboxes. One contains all the parts to the left of R1 and R2 in the diagram -- that is, all the tank circuit parts. The other has the tubes and everything else. The two units are joined end-to-end with nylon screws and nuts and plastic spacers so there's a gap of 1/4 inch between them. The three wires which connect the units pass through plastic bushings in the end of the tuned circuit unit and then through a 1/2" hole in the tube unit. A fourth wire, joining the boxes themselves, runs from a ground lug inside the tube unit to one on the end of the tank circuit box.

These connections are made with No. 30 wire wrap wire. Contrary to everything you've heard, heavy connections are not always good for VFO stability; because these connections are made at low impedance points (to coil taps or across large capacitors), slight movement has little effect. On the other hand, they join the heat producing unit to one which must be kept cool. I was amazed at the rate at which heat was transferred by even a No. 24 wire; No. 16 (often recommended for VFO wiring) would effectively eliminate the thermal separation of the two units.

Using the No. 30 wire, the units are well isolated. The chassis of the tube unit operates about 20 degrees Fahrenheit above room temperature while the temperature of the other rises about 3 degrees.

Other steps are taken to keep the tube assembly as cool as possible. The tube sockets are 7-pin ceramic shield base types; they are mounted in 9/16" holes instead of the 1/2" hole normally used. 1/8" plastic spacers are used to raise the sockets above the surface so there's room for air to flow up around the socket from inside the unit. Metal screws must be used here to ground the shields.

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Air leaving around the tube sockets can only enter through the 1/2" hole at the end. Tube socket pins (and parts connected to them) are a major source of heat; this airflow tends to carry the heat away from the tank circuit unit.

The usual bright metal shield without an insert, significantly raises tube temperatures; not only does this reduce their life but it causes more heat to be transferred back into the assembly. In this VFO, EBY black tube shields with heat absorbing (corrugated) inserts are used; inserts are also used in the shield bases. With these shields the tubes run cooler than they would if unshielded.

Within the tuned circuit box, I tried to keep the parts as far from the box as possible so they would be heated by the air rather than the box itself. This assures that they will heat gradually and at roughly the same rate. The tuning capacitor rotor contact spring is grounded by a 2" wire to a lug in the center of the top of the box rather than by being soldered to one of the mounting studs. The two ceramic trimmers are mounted on 5/16" plastic spacers to reduce heat transfer from the box however metal screws must be used because plastic ones aren't strong enough.

In order to keep the tank circuit unit at a uniform temperature and make it as rigid as possible ,its cover is held on by 18 screws. The four on the bottom go into studs mounted on the ends; the others go into tapped holes in the box cover. The tube unit cover is mounted with the four screws supplied by the maker.

In spite of the lightweight construction and No. 30 wire connections, the VFO is mechanically quite stable: finger pressure on top, squeezing the sides, tapping the unit lightly on the table, or twisting the ends (all with a few pounds of force) typically causes under five cps change of frequency.

Temperature Compensation

Since even the best parts will cause some drift, temperature compensation must be used to get the best possible stability. In this VFO there are three temperature 'zones' so three compensating capacitors were used. C2 is mounted near the coil in the tank circuit unit; its effect can be adjusted by C3. C10 is mounted directly across the tube socket with very short leads; it cancels the effect of the rapid temperature change there during early warm-up. C11 is also in the tube unit; it corrects for the longer term warm-up in this area and its effect is varied by C12.

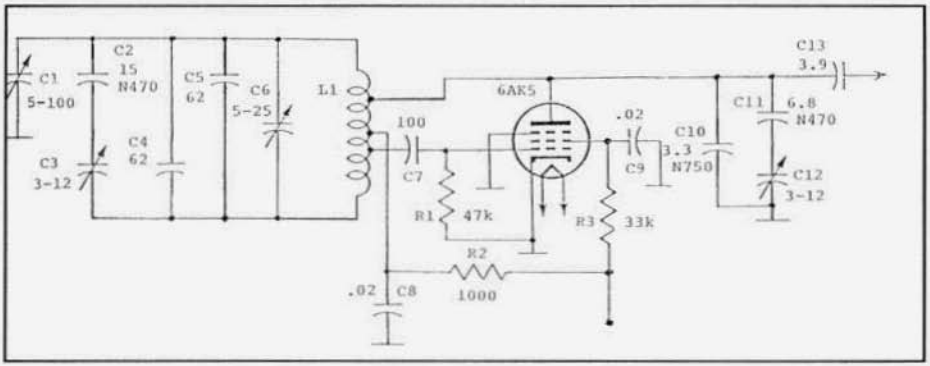
Testing And Adjustment

After initial testing for output, frequency range, and so on, stability checks can be made. First, be sure that the unit is well behaved: if the frequency drifts more than a few cps/minute after the first five minutes, if it varies in a pattern which makes no sense or if it jumps irregularly (even by a few cps) for no reason or when you vary the plate voltage, touch the chassis, or otherwise slightly disturb the unit, find out why -- you have parasitics, something loose, power supply hum, or a bad part.

(Bad parts are usually capacitors; those military surplus fleamarket units sometimes are 'surplus' for a good reason!)

Since a 1 volt change in high voltage causes a change of about 2 cps in frequency, final testing and compensation should be done with a regulated voltage source. You also need a frequency counter; a cheap one will do but it must be thoroughly warmed up. For all tests, the VFO must be fully cooled to room temperature; allow several hours between tests or turn a small fan on it for an hour, and then let it sit without the fan for 15 minutes. It must be sitting upright with the covers in place and screwed down and should not be touched during the last few minutes before starting.

Make a test run of at least four hours to establish the warm up pattern. Record the frequency at intervals of one minute, beginning one minute after power on and continuing for 30 minutes. Then drop to 5 minute intervals for the next 30 minutes; after one hour the frequency can be recorded hourly.



Circuit of the Not Noticeably Drifty VFO, Mk II. Except for C1, all caps with values over 1 are in mmf and are 'NP0 ceramic types unless otherwise noted, others are in mf and are mylar. L1 is described in the text. C1 is the tuning capacitor; C6 is used for band set. The cathode follower buffer stage is not shown.

If the results meet your requirements, you are done, otherwise adjust the compensation or take other corrective action until you are satisfied. Serious temperature compensation is a tedious job (especially with ceramic trimmers), however with the 'NP0' L1, very little is actually needed. Probably you could build the unit with the values given on the diagram; adjust L1 using a hair dryer as described above, set C3 and C12 to midrange (or pick equivalent values for C2 and C11 and omit the trimmers), and be within 50 cps warm-up and 25 cps/hour without further work.

Improvements

This design can be improved. One weak point is the ground connection between the two sections, which in this model consists of about an inch of No. 30 wire. If this unit is installed in a strong RF field, the voltage developed along this lead will cause problems. I expect it to be okay in a low power transmitter, but doing it again, I would use a much heavier ground connection running to a heat sink on the outside of the tank circuit unit.

Stability would be even better if transistors were used instead of tubes. The transistors could be mounted in the same box with the tank circuit which would make a more compact assembly. If (like me) you rule out transistor designs, then I would tackle the temperature coefficients of the other parts in the tank circuit unit. Apply to each capacitor the technique that was used on L1 and select or adjust each in turn to get the smallest possible coefficient.

3500-4000 kcs is 'pushing it' with this circuit and oscillation is somewhat weak at the low end of the range because of the change of the tank circuit voltages as the tuning cap is increased. A split-stator capacitor would probably solve the problem; so might a slight change in the location of the grid tap to increase the feedback voltage.

A high quality tuning capacitor would be a definite improvement. The 'command transmitter' tuning capacitors have an excellent reputation as VFO capacitors and one often sees usable ones in hacked-up sets for a couple of dollars at fleamarkets. Best of all would be a capacitor of 'invar' - the zero expansion alloy used in critical instrument tuning capacitors. While most of these capacitors (the ones in the LM and BC-221 frequency meters are examples) are fairly large, you might find a VHF or UHF unit small enough for use in a compact radio.

Because the suppressor grid is connected to the cathode internally, a 6AK5 isn't a

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THE FIRST FIFTY YEARS OF SIDEBAND

by Jim Musgrove, K5BZH
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Part Three

Tony Vitale, W2EWL, created the 'Cheap and Easy Sideband'. It was a phasing rig constructed around a military surplus BC458 transmitter. I asked Tony how it came about. He said the Central Electronics exciters required an external VFO and they recommended using a modified BC458 to accomplish this task. B&W had recently introduced an inexpensive phase shift network. Why not take a 9 megahertz crystal and build the whole rig inside a BC458? Tony ran one of these as a mobile in the early to mid-fifties driving a linear with four 837s that he had mounted in his trunk. A *QST* article was published in 1956 and more than just a few of these were built.

George Bigler, W6TEU, was the designer of the 'Sideband Package'. His design criteria was to build a self contained rig that had sufficient power to drive a large linear amplifier. The 'Sideband Package' used the surplus FT241 crystals for the sideband filter. It used a single 6146 in the final amplifier. This particular design is one of the favorites of the early sidebanders.

Stirling Olberg, W1SNN, revised the 'Sideband Package' into the 'Sideband Package Plus'. Olberg had been using a phasing rig that he had built in 1948. Bigler's 'Sideband Package' captured his attention. Olberg elected to use a Collins mechanical filter and he also revised the master oscillator. This was another design that received a lot of attention. Many of these rigs were duplicated. Olberg received over a thousand requests for copies of the layout and responded to many questions. The original transmitter is still in use along with a homemade receiver.

Joe Galeski, W4IMP, designed the 'Imp' which was a 3 tube filter exciter. Joe was an optometrist by profession. His object in designing the 'Imp' was to prove that sideband didn't have to be complicated and alignment could be done without a laboratory full of instrumentation. Joe told me that OE1FF wanted to know how much it would cost to get one made. He sent the original to him. Joe later transistorized the 'Imp'. Another one of his projects was a transceiver which was appropriately named the 'Shrimp'.

Ed Sommerfield, W3SGF, did a modification to one of the earlier commercial exciters that received a lot of attention. He told me that the ARRL was not interested at the time in publishing an article about it. They thought that not too many people would be interested in drilling holes in a commercial exciter. "Shoes for the 10B" was published in the June 1957 issue of *CQ*.

What about VHF and UHF? There was some activity in the middle fifties. Articles were beginning to appear in the ham magazines by the late fifties. Tony Vitale, W2EWL, told me that he put a 2 meter sideband transmitter on the air in January of 1951. He mixed a 14 megahertz SSB signal with 130 megahertz. Most of his friends were using crystal controlled converters in front of HF communications receivers, so they had no problems in copying him. Vitale also told me that in the late fifties he started working on a six meter sideband transceiver. Ed Clegg became interested and it led to the 'Clegg Venus' which was released in January 1963.

By Goodman's August 1951 "On the Air with Single Sideband" revealed that W1PNB was on 6 meter sideband in 1951 using a pair of 2E26's in his final. The May 52 column stated that as far as they knew, W1PNB, W1CGY and W1SCO were the only ones on 6 meter sideband.

Leroy May, W5HN, was one of the VHF pioneers in the Dallas area. Leroy bought one of the early Central Electronics 20A's and ran it barefoot for a short time on HF. He then started thinking about VHF. He wondered if this sideband jazz would come to VHF. Leroy modified a piece of surplus equipment by changing a driver to a transmitting mixer. That gave him 15 watts on 6 meters. There wasn't much sideband activity in the middle fifties on six, but he had the capability if anyone wanted a sideband contact. A little later, Whit Whittenberg, W5GG, and Leroy started talking about putting a SCR522 on 2 meter sideband. Whit modified one and used a 14 megahertz sideband transmitter to drive it. He called Leroy and asked Leroy to listen for him. Sure enough, Whit was on 2 meter sideband. Leroy then modified another one, only he used a 21 megahertz source. Whit experienced some problems with unwanted products. Leroy decided to modify an ARC5 and used a little more caution. He drove a 4X150A. It put out a pretty fair signal on two meter sideband.

Leroy had a telemetry transmitter that had pencil tubes and used 2C39's in the output. He modified one of the pencil tube stages and injected 21 megahertz sideband from his 20A. This placed him on 220 sideband. 432 was just a little more difficult for Leroy. He modified some components of an ARC27. He used 21 megahertz injection from the 20A again. Leroy used a 4X150A final. He wrote an article on this setup and submitted it to Wayne Green for publication. Green wrote back and explained that he didn't think it would have enough interest from his readers as it was hard enough to get on 432 AM. He suggested that Leroy submit the article to *Six Up*. Leroy did and they published it.

Leroy May arrived on 1296 AM by 1961. It was much later, sometime around 1967, that Leroy found his way to 1296 sideband. He had a rig on AM using 2C39 coaxial tanks from a piece of DME equipment. One of the fellows in California provided Leroy with the answers of how to modify it for sideband. Leroy performed the modifications and it worked out great.

DX was another topic. By the middle fifties sidebanders had several folks actively chasing SSB DX. Not every country had a sideband station. Some hams worked to put new sideband countries on the map. Reg Tibbetts, W6ITH, is credited with putting four new countries on the air. Arthur Godfrey, K4LIB, of television fame, carried sideband gear with him to Africa. The chase was on.

Commercial manufacturers were moving into sideband offerings heavily by the late fifties. By the middle sixties the sideband market was well established. The 1963 Barker & Williamson 6100 was the first synthesized sideband transmitter to be offered on the ham market. The first ad for it appeared in June of 1962 with delivery to start in September. It was one of Jack Brown's pieces of work. He still has one and claims that he wouldn't sell it for anything as he has too much of his own blood in it.

The Central Electronics 10B and 20A exciters were available throughout the fifties. CE also developed some sophisticated equipment for the sideband marketplace. They offered the broadbanded 600L linear amplifier in March of 1955. This amplifier required no tuning. Just set the band switch and talk. It used a single 813 in the final. The 100V broadbanded SSB transmitter was advertised in December of 1957 after being mentioned for a couple of months in the regular CE ads. A February 1959 advertisement announced that Zenith had acquired Central Electronics. Their May 59 *QST* ad stated that a companion receiver for the 100V and a 2500L linear amplifier would be released in the future. The last mention of the receiver and amplifier appeared in January of 1961. I understand that the distortion specifications for the 2500L amplifier far exceeded anything that was on the market. The 200V was introduced in February on 1961.

continued next page

The last Central Electronics advertisement that I could find was in December of 1961. Wes Schum said that Zenith closed Central Electronics early in 1962. It's a shame that we never got to see the new receiver and high power amplifier.

The Collins S-Line gained extreme popularity. The 32S-1 was advertised in the February 58 *QST* . The 75S-1 was announced in the March issue. The 30S-1 kilowatt linear was advertised in the May 59 issue of *QST*. The 30L-1 linear was announced in the April 61 *QST* with a note that delivery would start in July. The 75S-3 receiver was announced in August of 1961 and the 32S-3 transmitter was announced in July of 1962. The 75S-3B came along in March of 1964.

Drake introduced a marvelous little receiver, the 1A, in the December 57 issue of *QST*. The 1A was a radical change from the typical receiver. It was narrow and deep. There were few knobs. The large round dial had a tuning mechanism with an excellent feel. This new receiver had no provision for standard AM detection. The 2A was introduced in December of 1959. The tuning drive on it used a dial cord and consequently it wasn't as smooth. In addition to the product detector, the 2A contained a diode detector for AM. It was upgraded to the 2B in July of 1961. Drake introduced a TR-3 transceiver in February of 1963. The R-4 receiver came along in February of 1965. The TR-4 transceiver followed in May of the same year. The T-4X transmitter appeared in a June 65 *QST* advertisement.

Hallicrafters introduced the SX-100 in September of 1955. The hambands only SX-101 appeared in the October 56 *QST*. The Mark III version was advertised in the March 58 issue of *QST*. The SX-101A appeared in August of 1959. The deluxe SX-115 was introduced in October of 1961. The SX-117 came along in October of 1962.

The first Hallicrafters SSB transmitter, the 1955 HT-30, used a 50 kilohertz LC filter in the generator. They then developed a 5 megahertz crystal filter. It was used in the famed HT-32 which was introduced in February of 1957. The HT-32 was upgraded to a HT-32A in January 1959. The HT-32B was advertised in February of 1961.

Hallicrafters introduced a phasing sideband transmitter, the HT-37, in October of 1959 that became extremely popular. It used the same VFO and final amplifier as the HT-32. They did not include one kilohertz markers on the VFO though. They also left the cooling fan off the final amplifier assembly. Nevertheless, it retained a lot of similarities of its filter brother and it was offered at the substantially reduced price of $450 which made it extremely attractive. As far as I know, this was the last popular phasing rig to be marketed other than the CE 200V. Another interesting transmitter that Hallicrafters developed, at least to prototype stages, was the HT-36. This was a 2 to 30 megahertz continuous coverage sideband transmitter. It was aimed at the military market.

Hallicrafters introduced the HT-44, which matched the SX-117 receiver, in late 1963. It should be noted that Hallicrafters offered a SR-500 in late 1955. It was a console that included the SX-100 receiver, the HT-30 exciter, and a HT-31 linear amplifier. Another SR-500 appeared in June of 1965. This SR-500 was a 500 watt transceiver. Some of the other transceivers of the sixties were the SR-150, SR-160, and SR-2000.

Heath moved further into the sideband market with a HX-10 Maurauder in early 1962. They offered the SB-300 receiver in October of 1963. The SB-400 transmitter was advertised in June 1964. The SB-200 linear amplifier was ready in August of 1964. Their SB-100 SSB transceiver had been mentioned as a coming event several times. It was advertised at $360 in the December 1965 *QST*.

E.F. Johnson offered a small linear, the Courier, in November 1957. The Thunderbolt amplifier was introduced the same month. The Invader SSB transmitter was introduced in late 1960. They also offered

the Invader 2000 which was the high power version. Unlike most of the competitors, Johnson continued to pursue the conventional AM market.

National introduced the NC-300 receiver in September of 1955. The NC-303 was released in late 1958. Their NCX-3 sideband transceiver was announced in October 1962 with deliveries to start in the latter part of December. National's NCL-2000 linear amplifier was advertised in the May 64 *QST*. A five band transceiver, the NCX-5, was announced in September 1964.

The Swan monobanders appeared in July of '62. Swan announced a 3 band transceiver, the SW-240, in February of 1963. The Swan 400 made its way in May of '64. The Swan 350 was advertised in November of 1964.

World Radio Laboratories introduced the Galaxie 300 SSB transceiver in March of 1963. The 3 band Galaxie III was offered in April of 1964. In June of '64 the 5 band Galaxie V was announced.

It would be interesting to know how some of the sideband terminology started. The term 'Hot Water' was initiated by Leonard Meyer, W5EBM, one night when he referred to one of the Heath Monobanders as a 'Hot Water' rig. Needless to say, it spread rather quickly. I'm still trying to find out how the term 'barefoot' originated. I'd venture to say that the word "sidewinder" was from the early feuds.

I would suggest that anyone who is really interested in the history of early amateur sideband to read through some of the older publications. The 1954 ARRL "Single Sideband for the Radio Amateur" and the 1954 "Single Sideband Techniques" which was published by *CQ* are absolute musts to read. The *CQ*s and *QST*s from 1948 to about 1960 contain some excellent material. Last, but certainly not least, get acquainted with some of the old timers that were on sideband in the late forties and early fifties. They can tell you about a lot of things of interest that for various reasons just did not get published.

Special thanks to:
Joe Batchelor, W4EGK
Leonard Meyer, W5EBM
Rod Beaudette, W7FXI
Bob Moren, K4CX
Jack Brown, W3SHY
Stirling Olberg, W1SNN
Jim Burks, KA5QYV
Greg Raven, KF5N
Ray Dawley, W6DHG
Sid Rexford, W2TBZ
George Devoll, W5EFJ
Bill Rust, W2UNJ
Grady Fox, W2VVC
Wes Schum, W9DYV
Joe Galeski, W4IMP
E.O. Seiler, W2EB
By Goodman, W1DX
Harry Snyder, WØRN
Harry Hackerty, W3BOL
Ed Sommerfield, W2FJT
Pete Hoover, W6ZH
Trish Taglairino
Dick Long, W3ASW
Reggie Tibbetts, W6ITH
Leroy May, W5HN
Mike Villard, W6QYT
Web Mays, AA5NZ
Tony Vitale, W2EWL

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continued next page

The First Fifty Years of SSB from previous page

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"The IMP - A 3-Tube Filter Rig", by Joseph S. Galeski, W4IMP, QST magazine, May 1960

Editor's Note:

Jim Musgrove, K5BZH, and I invite comments on this series of articles on the history of SSB. Send them to either Jim or ER and we'll endevour to incorporate them into a follow-up article. N6CSW/Ø

Comments On 20 Meter SSB

by Ken Morgan, KC5DW
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Albuquerque, NM 87123

While working on my HQ-180 about noon on Jan. 1, I switched to the 20 meter phone band to see how well it was receiving SSB. On the frequency that I tuned to a verbal squabble was going on. As I listened I came to understand that what had happened was that some OM had started reading a New Year's poem and he had interrupted an on going QSO. This had started an argument about squatter's rights on the frequency, which included a lot of shouting and name calling; "Dawm hypocrite!" was commonly used. I counted at least eight hams yakking all at once, more or less, on the same frequency. It sounded like a chicken house just after sunrise. Then someone started making sounds like he was throwing up, and in between belches he would utter a few expletives. Actually, he was making about as much sense as anyone on the frequency. The OM with the poem had apologized for interfering and was long gone. The remaining crowd was about evenly divided between "Let's hear the poem!" and "Dawm hypocrite!". Meanwhile the belcher, to his obvious amusement, was drawing the wrath of just about everyone. After about 20 minutes of this inspiring conversation I tuned away.

Here it was, the first day of a glorious new year, and a bunch of hams with multi-kilobuck so-called sophisticated radio stations had nothing better to do than get into a shouting match. The ARRL and FCC seem to feel that we need more amateurs and are introducing 'No Code' and 'Not Very Much Theory' licenses at an alarming rate. Maybe the FCC should open up the 20 meter band to anyone who wants to use it and name it 'The Lower Citizen's Band', or perhaps 'The Good Buddy Band'.

The HQ-180 does FB on SSB, but I'm not sure If I'll be needing it. ER

John Chenoweth, W8CAE and the R.L. Drake Co.

by Mike Palmer, K5FZ
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Houston, TX 77068

John was plant manager of the R.L. Drake Co. of Miamisburg, Ohio. Most readers of ER are familiar with Drake amateur products and a survey would likely reveal an agreement that these radios gave superb performance for their price tag.

John first became interested in radio in the 1930's. His first projects were crystal sets and regenerative receivers. Family duties were priority so it was 1948 before he first became licensed as W8CAE. John met Bob Drake briefly in 1939 but it was 1950 before they became close friends.

Before WW II Bob Drake was chief electronic engineer for inventor Bob Lear, building low frequency aircraft communications equipment. Bill and Bob went their separate ways in 1942. During and after the war,Bob designed and constructed equipment and parts for the Army and Navy. Unique transformers, special test gear, various solenoids and RF coils were only some of the varied products Bob produced in his early business.

In 1956, Bob received an order for 56 power transformers for the Air Force and promised 6 weeks delivery. He decided he would need help in producing the order and asked his friend John, W8CAE, to help. John was working with Delco Products at the time but was happy to help. John and his wife, Lavonne wound the transformers by hand and finished the project in 2 weeks! Bob made an offer that John could not refuse and he began work full-time at the R.L. Drake Co.

TVI was a big problem with amateurs in 1956 as most sets had 21 Mhz IF's. Drake marketed a high pass and low pass filter with great success. These first products were followed by a phone patch that was also very successful. " The TV high pass filter was constructed in a tin pharmacy pill box. It was economical, yet effective, and was a big seller", said John.

Bob and John saw great potential in the amateur market. Would amateurs be receptive to a new ham-band receiver? It would have to work well and sell at reasonable cost.

Electrical design on the 'new' 1A was shared by Bob Drake and Milton Sullivan, K8YDO. Mechanical design was also credited to Milton. "They were a great team. What one didn't think of the other did", said John.

The 1A receiver was finished and ready to sell but Bob got cold feet and thought that it might not fly. He felt that the 1A was a big gamble for the small Drake Co." His philosophy had always been, "Pay your bills, be an honest man, stay small and know when to pull your horns in."He decided to search for a buyer of the 1A's engineering and parts inventory.

John remembers,"Milton Sullivan visited the National Company and it seemed they were interested. However, they finally decided not to buy the 1A, so we went ahead with it.

"Bob and I took the 1A prototype to the Cincinnati hamfest and showed it off from the back of Bob's pick up truck. It created great interest with all who saw it. Our timing was right as SSB was just starting to gain popularity and hams were looking for smaller, lighter receivers with better sensitivity, selectivity and stability."

Drake's first ad for the 1A appeared in December 1957 *QST*. "We were amazed at the number of immediate orders", said John.

Some of the production methods and materials were very innovative. For instance, John came up with the idea for the

John Chenoweth, W8CAE, with Drake 1A and 2B receivers.

dial pointer. He purchased steel needles at the local drugstore. The girls on the assembly line soldered them to the adjustable brass plate and painted them red. They were perfect.

VFO coils were wound with a modified pencil sharpener. Number 24 silver plated wire was wound on the form and then low voltage, high current was ran through the wire. When the wire cooled it stayed on the form 'tight as a drum'. They then dipped the assembly in Q-Max and hung them up on a 'clothesline' to dry.

The VFO was costly to produce as well as the other mechanics of the 1A. You will find less complexity in the 2A and 2B. "Because we sought simpler mechanics the cost was lower on these later receivers", said John.

Collins Radio Co. ordered a 1A; for evaluation no doubt. Bob Drake wrote a brief note for Art Collins and placed it inside the VFO can. "Hi Art! Stable but simple. Bob"

Bob spent a lot of time listening to the hambands. He wanted to know what the fellows were saying about his products. John said that the Drake company was always strong about looking for ways to improve any circuits. To make a production line change was simple with no "big factory red tape".

Bob Drake admired anyone who was efficient and creative. Suggestions for simplification or efficiency would get a man a raise. At the peak years of production Drake employed 50-60 persons.

In 1963, the classic TR3 appeared and was followed by the TR4. The TR4 was made in several versions over 15 years of production. The complete list of all Drake products is longer than one would expect and it's really amazing that everything was built to the same level of quality.

John Chenoweth left Drake around the beginning of the TR-3. He went back to Delco Products. John and Bob Drake remained close friends and saw each other frequently. Bob, W8CYE, passed away in 1975.

John enjoys radio today as much as ever. He likes the older gear like the rest of us. Two dozen different radios can be found in his radio shack. For AM he uses a 32V-3/HRO-60; for SSB a TR3 and for CW a 2NT with a homebrew 4-400 amplifier. He prefers his Viboplex bug over a keyer.

He says he bought a new TR7 but it failed and the repair estimate was too high for the pleasure he got out of it. He says he likes the oldies, "They look and feel like real radio gear." John can be found on 80, 40 and 20 meters. ER

Drake Equipment List

Model	Description	Date	Cost
1A	Ham band rcvr	Dec.'57	$260
2A	Ham band rcvr	Dec.'59	$270
2AQ	Q-Mult/spkr	Dec.'59	$35
2B	Ham band rcvr	July'61	$280
2BQ	Q-Mult/spkr	July'61	$40
TR-3	SSB-CW xcvr	May'63	$495
AC-3	AC power supply	May'63	$80
DC-3	DC power supply	May'63	$130
RV-3	Remote VFO/spkr	May'63	$100
MS-3	Station spkr	May'63	$20
2LF	VLF/BC cvtr for 2B	Nov.'64	$25
R4	Ham band rcvr	Jan.'65	$380
MS-4	Station spkr	Jan.'65	$20
TR-4	SSB-CW xcvr	May'65	$585
T4	Exciter slaved to R4	June'65	$270
T4-X	SSB-CW xmtr	June'65	$370
L4	KW linear amp.	June'66	$695
2C	Ham band rcvr	Sept.'66	$230
2CQ	Q-Mult/spkr	Sept.'66	$40
2NT	Novice CW xmtr	Sept.'66	$130
SC2	144 Mhz rcvr cnvtr	Dec.'66	$69
SC6	50 Mhz rcvr cnvtr	Dec.'66	$65
R4B	SSB-CW-AM rcvr	Dec.'67	$430
W4	2KW wattmeter	Dec.'67	$50
MN4	300 wmtching ntwk	Dec.'67	$90
MN2000	2KW mtchig ntwk	Dec.'67	$160
T4XB	SSB-CW-AM xmtr	Jan.'68	$430
TR44B	pkged T4B and R4B	Apr.'68	$795
TR6	50 Mhz xcvr	Nov.'68	$600
RV6	Remote vfo/spkr	Nov.'68	$100
FF1	Fixed freq. adapter	Nov.'68	$25
TC2	144Mhz xmtg cnvtr	June'69	$300
TC6	50 Mhz xmtg cnvtr	June'69	$250
WV4	VHF wattmeter	June'69	$75
L4B	2KW HF amp.	Sept.'69	$750
SPR4	Solid state GC rcvr	Nov.'69	$380
ML-1	2 mtr xcvr	Dec.'70	$330
C4	Wattmter/fonepatch/Rotor/antenna switch/spkr/clock	Feb.'71	$300
TR-22	2 meter xcvr	Mar.'71	$200
DSR-1	Solid state GC rcvr	Oct.'71	$2200
AA-10	Amp for TR-22	Oct.'71	$50
TR4C	SSB-CW-AM xcvr	Nov.'72	$600
RV4C	Remote vfo/spkr	Nov.'72	$110
TR72	2 meter xcvr	Mar.'73	$300
R4C	SSB-CW-AM rcvr	Mar.'73	$500
T4XC	SSB-CW-AM xmtr	Mar.'73	$530
TR22C	2 meter xcvr	Dec.'73	$230
DSR2	Solid state GC rcvr	June'74	$2300
SSR1	Solid state GC rcvr	Nov.'75	$350
RCS4	Remote coax-switch	Jan.'76	$125
TR33C	2 meter xcvr	Aug'76	
PS4	Freq. sythesizer for 'B' and 'C' lines	Mar.'77	$350
1525EM	Encoding mike	June'77	$50
TR4CW	SSB-CW-AM xcvr	July'77	$650
UV3	VHF/UHF xcvr	Nov.'77	$1000
MN4C	Matching network for 'C' Line	Feb.'78	$165
TR7-DR7	Solid state SSB-CW xcvr, digital read-out	June'78	$1400
MS7	Station speaker	June'78	$33
MN7	Matching network for '7' Line	June'78	$165
WH7	2 KW HF wattmeter	June'78	$90
RV7	Remote vfo	June'78	$156
DL1000	KW dummy load	June'78	$40
DL300	300 w dummy load	June'78	$20
7077	Desk microphone	June'78	$45
L7	HF amplifier	June'78	$950
R7	Solid state GC rcvr	June'78	$1300

WHY DO YOU INSIST ON INVENTING THIS THING YOU CALL "RADIO" --- YOU'LL NEVER GET A SIGNAL OUT OF THIS CAVE!

TCS Carbon Microphone Replacement

by Mike Murphy, WB2UID
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Hooksett, NH 03104

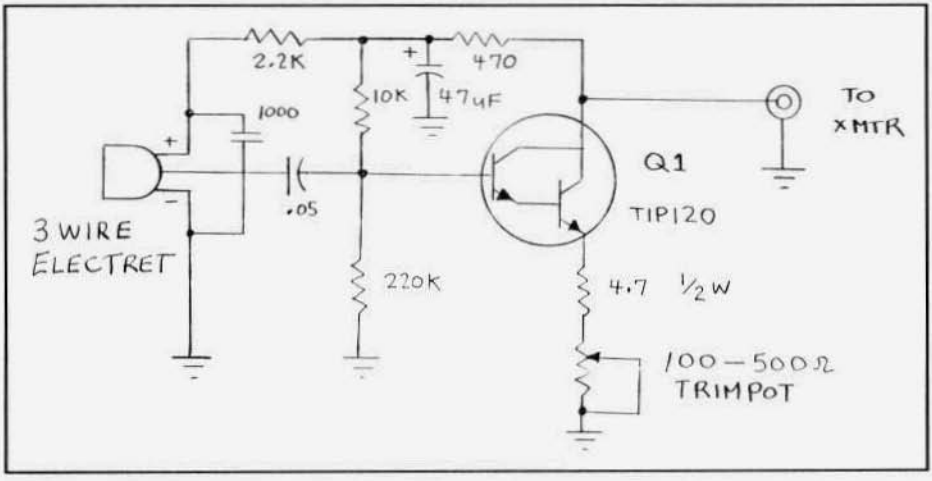
Ever try using a military transmitter with the carbon microphone designed for it? The typical order of events is yelling, baking and smashing before finally relenting and substituting a telephone element in the mic housing.

My stock TCS-12 is hungry for audio drive. The microphone is expected to swing the grids of the push-pull 1625 modulators and produce watts of power without the benefit of a voltage amplifier stage. True, many carbon mic driven radios do not require this kind of drive, but most could benefit from some extra gain. Here is a circuit that fits right into my stock mic housing and requires no batteries because the circuit remains parasitic to the transmitter bias. An electret element and power Darlington provide the basis for the fake.

This circuit is gain adjustable and provides plenty of audio punch for the TCS. The circuit can be adapted to other radios as well. The key is measuring the electrical parameters of the original carbon mic (both V and I) "in circuit" with the transmitter and biasing Q1 to the same point. All that's left to do is to set the gain level.

ONE NOTE OF CAUTION: make sure the TX supplies positive bias to the collector (tip of plug) of Q1 or this mic may do something that carbon mics seldom do: FAIL. Turn the circuit upside down for negative bias!

A devise that handles up to 200 MA with plenty of power gain and capable of handling some embarrassingly high open circuit voltages was chosen for Q1.



AM FREQUENCIES

2 Meters - 144.4, calling freq., activity in most cities; **6 meters** - 50.4 calling freq. **10 meters** - 29.0-29.2 operating window; **12 meters** - 24.985 calling freq.; **15 meters** - 21.400 - 21.450; **17 meters** - 18.150 calling freq.; **20 meters** - 14.286 for the nightly SPAM net starting at 5:00 CA time; **40 meters** - 7160, 7195, 7290 are the main freqs. Westcoast SPAM net every Sunday afternoon ,4:00 PM on 7160; **80 meters** - 3870, 3880 and 3885 are the main freqs. Westcoast SPAM net Wednesdays nights, 9:00 PM on 3870. AM Swap net Thursday nights, 7:30 PM on 3885; **160 meters** - Gray Hair net every Tuesday at 8:00 PM EST on 1945. Mostly sporadic summer-time activity but during the winter signals can be heard anywhere on this band.

From the Editor:

160 Meter Contest PreliminaryReport

Conditions were better for the contest this year than last but according to reports I've received so far, the level of participation was down. There may be a couple of reasons for this. One letter suggested that I should give more advance notice; next year I will. Another said that I should change the date of the contest, that there are too many people who cannot participate because of parties etc; I'll consider that. See the "Letters" page for more comments.

Vintage CW Net Report

Tracey Reese, WB6TMY, reports that the Vintage CW net is turning into a big success; so much so that another net will be starting up - same frequency, same time - on Sunday evenings. This net will be controlled by Henry Rogers, WA7YBS. Tracey suggests that those that check in on the Saturday net should not do so on the Sunday net and vice versa. The Vintage CW net is on 7.137 at 6 PM Pacific, 9 PM Eastern. The Sunday net will start on January 19.

According to Tracey, they had 16 check-ins last session (Jan.4) and it just took too long to get around to everyone. He thinks that the additional Sunday session should make vintage CW net activity better for everyone.

Vintage SSB Net To Start Saturday, January 18

Since I suggested the possibility of a Vintage SSB net a couple of months back, I've received quite a number of calls and letters encouraging the idea. A lot of AM'ers and vintage collectors have old 'boatanchor' SSB rigs they'd like to get on the air.

From my recent experiences with a newly activitated CE 20A, I know that it's more enjoyable to get on the air with someone interested in vintage radio than it is to call CQ and work someone who has no knowledge and/or appreciation for a 40 year old transmitter. The net should provide for an exchange of technical and other useful information.

I suggest that we get started on 20 meters, 14.290 (plus or minus) at 6 PM Pacific, 9 PM Eastern on Saturday, January 18. I think that once we get started we can work out further details, like who will be net control and so on. Perhaps we'll even change the time and frequency.

I've been asked what constitutes a vintage SSB rig. Personally, I think the older the rig the more interesting it is, but that anything that's all tubes should qualify as vintage.

I'm looking forward to our first Vintage SSB net. I hope everyone will consider turning out.

Avenger: The Viking That Almost Was

by Jerry Buckner, WAØYSG
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Springfield, MO 65803
and
Mike O'Brien, NØNLQ
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Springfield, MO 65807

Any ranking of tube-type ham gear must include near the top of the list the Viking transmitters and linear amplifiers produced by E.F. Johnson Co. Between 1949 and 1966, the factory in Waseca, Minnesota, churned out, in kit or wired form, more than 53,000 rigs – first the Viking I and II, then the Viking Ranger, Valiant, Adventurer, Navigator, Courier, Thunderbolt and almost a dozen other memorable models.

However, by the mid-1960s the solid-state era was dawning in the ham market. Also, transceivers produced by Collins, Drake, Hallicrafters, National, Swan and a few other American manufacturers were gaining in popularity, with imports rumored on the way. The folks at E.F. Johnson Co. read the handwriting on the wall – and it was in Japanese. So they abruptly threw in the towel, abandoned the hams and concentrated on the Citizens Band and commercial land mobile communications markets.

At least, that's how many old-timers believe it happened.

Truth of the matter is that E.F. Johnson Co. made a bold attempt to join in the solid-state transceiver revolution. A special engineering team was assembled in 1964 and assigned the ambitious task of designing an all-in-one rig that would renew the Viking reputation for first-class ham gear and give the company a product to lead it into the next decade and beyond.

The result was the Viking Avenger, a model virtually unknown except to veteran Johnson hands around Waseca and a few Johnson buffs around the country. Only a handful of Avengers were ever built – maybe 16, maybe almost 50, depending upon whose memory is being relied upon. Whatever the total, for years most Avengers were kept within the Johnson ham community in Minnesota.

The Avenger twice appeared poised on the brink of mass-production. In late 1968, prospective buyers were offered, for $2.75, an extraordinarily detailed 80-page Avenger owner's manual that even included color transparencies to enhance the schematic diagrams. Dealers were told Avengers were on the way. The 1969 WRL catalog, for one, pictured both the Avenger and its proposed companion two-kilowatt linear amplifier, the Thunderbolt II. No prices were listed but the new gear was promised to be available by the time the catalogs reached readers.

However, no deliveries of Avengers were made to the public and by 1970 the plug had been pulled on the project. The Thunderbolt II also was shelved, but a deal eventually was struck with Henry Radio that resulted in the amplifier, which featured a pair of 3-400Zs, being built and sold as the Tempo 2000.

The Avenger employs three vacuum tubes (a 6HB6 driver and two 6HF5 sweep tubes for finals), but the circuitry is mostly solid state, incorporating 52 transistors and 57 diodes.

Design highlights include:

– Two built-in identical and independent VFOs, individually calibrated with varactors and double-regulated for stability.

– Full ham-band coverage 80 through 10 meters, with 250 watts CW input or PEP on SSB (200 watts on 10 meters) No provision was made for AM operation.

Front panel of the Avenger. It's 5 inches high and 11 inches wide.

– An 11-stage AGC circuit, described at the time as "commercially unique," utilizing electronic attenuators to control receiver audio gain and minimize distortion.

– A VOX circuit, dubbed VLX for Voice Latched Transmit, said to trigger the transmit mode faster than "rectified audio" schemes of other transceivers of the day.

The main Avenger package (power supply is separate) weighs 22.5 pounds and measures 5 inches high, 11 inches wide and 14 inches deep -- slightly smaller in size than the Collins KWM-2, and much more compact when the Collins rig is similarly configured, because a second VFO for the KWM-2 reguires a separate cabinet.

Only one previous Viking production model had included a receiver – the 10-meter Viking Messenger, a no-frills offshoot of the company's burgeoning CB line with 585 sold between 1960 and 1966. In keeping with that history, initial specifications for what was to become the Avenger were modest.

"When we began, we were told to aim for a simple design, a basic transceiver," recalls project engineer Hamilton Fay. "But ultimately it was decided to go with a more comprehensive design."

The decision to upgrade the program to produce a state-of-the-art rig is not surprising. Pride and zeal still were hallmarks of E.F. Johnson Co. despite plummeting ham sales at the time. And ambitious goals were nothing new to Fay and his immediate boss, Walt Zarris.

Zarris worked for Collins in the late 1950s when the KWM-2 was being developed, then moved to Johnson to oversee the 1960 introduction of the last big traditional Viking transmitters, the Invader and its legal-limit big brother, the Invader 2000. Soon thereafter Zarris went to work for General Dynamics in Rochester, N.Y., where he met Fay, who was transmitter project engineer on the GRC-106 military HF SSB transceiver. When Zarris was lured back to Minnesota in 1964 with the challenge of revitalizing the flagging Viking line, he asked Fay to join him.

continued next page

Avenger from previous page

A main design goal when the Avenger project began was to create a one-board radio. But as the list of features grew, so did the complexity of circuits and number of components. "Eventually it became clear that what was wanted was something that would get the company back into the amateur field in a really big way," recounts Fay. "Something which, for that time, would have all the bells and whistles any ham could want." Thus the Avenger came to include seven printed-circuit boards.

The Avenger's most dramatic departure from other popular rigs of the day was the dual built-in VFOs. It wasn't exactly a new idea. As early as 1957 the ill-fated Cosmophone, while a vastly different design, offered operating configurations similar to the Avenger's. And Hallicrafters struggled bravely through the late 1950s and early '60s to develop the brilliant FPM-200, which foreshadowed many Avenger features but was saddled with a pricetag that ballooned to a whopping $2,700.

By the time the Avenger team got busy, most transceiver manufacturers had joined Collins in offering remote VFOs as optional accessories to allow split receive-transmit operation. However, having two VFOs standard in the same box promised to be a big selling point for the Avenger.

A great deal of work went into stabilizing the Avenger's twin VFOs, Fay says. In addition to double-regulating the power supplies, three temperature compensation capacitors are linked in series to help minimize drift to less than 150 Hz from a cold start. Tests indicated no appreciable drift at nominal room temperature (between 60 and 80 degrees Fahrenheit). "And with what little drift there was above or below those temperatures, we took pains to keep it in the same direction regardless of whether the ambient temperature went hotter or colder," notes Fay.

A single drum dial with dual slide-rule pointers indicates the band in use and freguency in 25-kHz increments. Twin knobs tune the VFOs separately, with the knob skirts calibrated in 1-kHz increments. Each knob offers both coarse and fine tuning; a complete revolution of the fine-tuning ring moves the VFO 15 kHz. A 100-kHz crystal calibrator, said to be accurate to within a single Hz, is included, and thumb-wheel controls adjust voltages across varactor diodes to zero the VFOs.

Each VFO covers 4.9 to 5.5 mHz. VFO output is used directly on the 80- and 20-meter bands, with a five-crystal oscillator switched in for 40, 15 and 10. The output is fed to a heterodyne mixer and, depending upon the mode of operation at the moment, the signal continues on to the receiver mixer or transmit mixer driver.

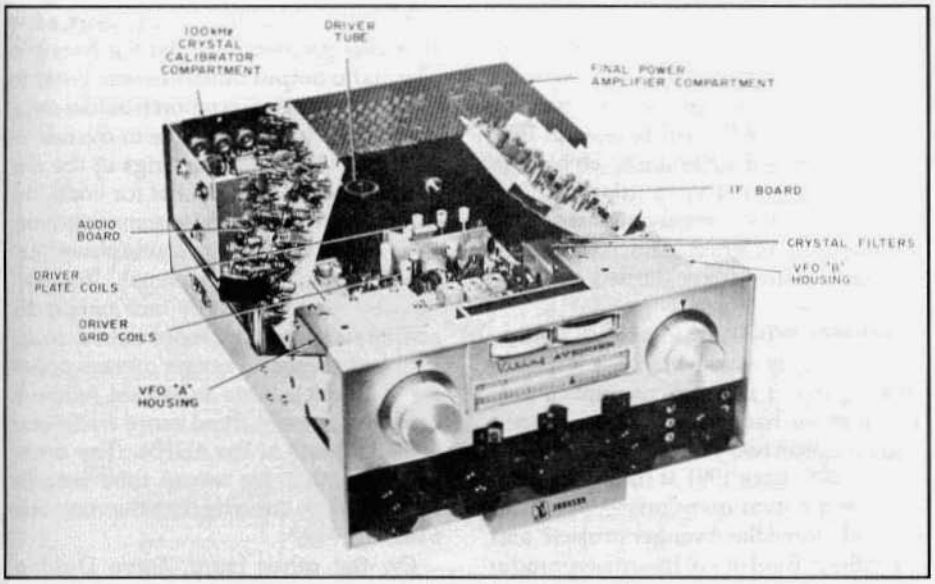
A centrally located front-panel switch offers three VFO configurations: transceive with VFO A; transceive with VFO B; or use VFO A to transmit and VFO B to receive.

Most other controls are familiar. A 13-wafer bandswitch selects among 80, 40, 20, 15 and three 10-meter segments. Various knobs and switches adjust RF and audio gain, noise-blanker, grid and plate drive, etc. Two edgewise meters are provided, one to monitor plate current, the other switch-selectable as an S-meter or power-output meter.

Similar to the Collins 32V-series of transmitters, a six-position Coarse Load switch adds fixed amounts of capacitance to the final loading variable. The six indicator lights associated with this switch, plus red and green pilot lamps on the VFOs, red and green thumb-wheels to adjust the VFOs' calibration, and drumdial lighting that changes from white to red when transmitting, provide colorful contrasts to the subdued silver and black cabinetry.

The man who lent the company his name, the late Edgar F. Johnson, took personal interest in the Avenger's appearance. "Edgar had final approval on the front panel and exterior looks," says Fay. "We were pretty much on our own on other aspects of design."

The non-traditional decor and small size



This photo from a Johnson brochure shows the interior layout.

prompted an unusual deal for one early Avenger owner, John Rooks, WAØYCZ, of Northfield, Minn. Rooks reluctantly sold his Avenger to a persuasive U.S. military officer who was about to be posted to Turkey. "He needed an unknown radio because they weren't supposed to have personal communications gear in Turkey," Rooks explains. "He wanted the Avenger because he thought he could pass it off as hi-fi gear."

Jacks for key, microphone and headphones, plus terminals for an external speaker, are located on a panel on the left side of the Avenger cabinet. At the rear are linear amplifier hookups; controls to adjust the VLX sensitivity, anti-trip level and drop-out delay; antenna coax connector; and a receptacle to connect either the fixed AC power supply or DC mobile supply offered by Johnson.

For receiving, the Avenger's two six-crystal lattice filters provide IF selectivity of 2.6 kHz at -6 db, with no provision for alternate widths. In transmit mode, carrier suppression is rated at 55 dB minimum and unwanted sideband suppression at a minimum of 60 dB.

Two engineering models of the Avenger were built. "They were rather kludgy, but they worked pretty well," Fay recalls. "I took one home and worked an ARRL DX contest with two friends, and we won our section."

Four engineering prototypes were constructed as the design was finalized. Then, according to Fay, a pilot run of 10 Avengers was completed. Fay installed one of the pilot models in his car and successfully operated it mobile for almost a year.

The most dramatic test came in April of 1968 when Fay flew to California with an Avenger for a visit to the legendary "Rhombic Ranch" of Don Wallace, W6AM, former classmate of Edgar Johnson at the University of Minnesota and a longtime sales representative for the components division of E.F. Johnson Co. "I spent three days in W6AM's shack, testing the Avenger against the Collins receivers he had hooked to those magnificent rhombic antennas," says Fay. "The Avenger didn't do too badly. The biggest difference was when there was strong interference on nearby frequencies. The Collins receivers could switch in narrower selectivity."

continued next page

Avenger from previous page

Back in Waseca, however, enthusiasm was mixed among E.F. Johnson Co. executives. "They hemmed and hawed for a long time over whether to go into production," says Fay. When it appeared in 1969 that Avenger wasn't going to be built in quantity, Fay quit. "I was a little bit miffed, naturally," he says. "We'd put a lot of hard work into the program. And, if I do say so myself, it was a pretty darned good radio."

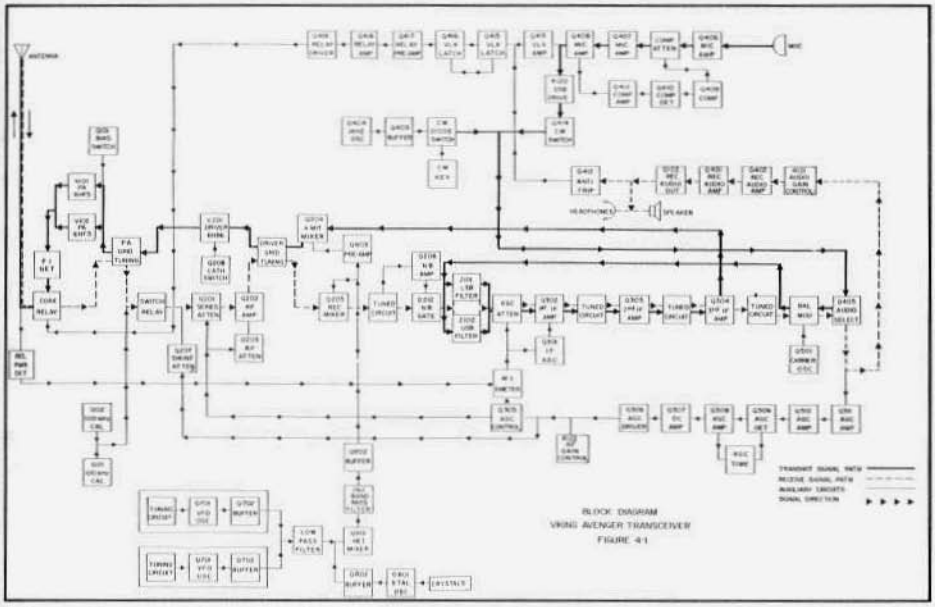
Bill knish, WBØKEK, a former E.F. Johnson Co. employee who has been Waseca's barber the past 11 years, recounts a conversation he had with his good friend Edgar Johnson two years before Johnson's death in February 1991 at the age of 91: "I asked Edgar two questions – 'Why did you back out of the Avenger project?' and 'Why did you get out of the amateur radio line altogether?' – and his answer was the same to both. The company had made its name in AM rigs, and by the '60s AM wasn't really in vogue anymore. The two sideband rigs they had made, the Pacemaker and the Invader, had some problems, so Edgar was a little bit skittish about another sideband rig. But the big reason was the cost to reproduce the Avenger. It would've been enormous for that time. Edgar said retailing that radio would've had to have been at just a shade under $2,000 in order for everyone to come out on the deal."

Fay recalls early price estimates for the Avenger were as low as $900. "But as time went on, the projections kept being revised upward because prices of parts and everything else kept going up," he says. Meanwhile, the marketing department was warily eyeing the prices of existing transceivers. For instance, a Collins KWM-2, 516F-2 power supply and 312B-5 console with a second VFO sold new for about $1,650 in 1969. A Drake TR4 with power supply and remote VFO went for $800. And the last brainchild of Faust Conset, the Sideband Engineers SB-34, also offered mostly transistorized circuitry (but no second VFO) for only $500.

Too, true to Edgar Johnson's fears, a few technical problems nagged the Avenger. The audio output transistor was prone to blowout. Some users report troubles ranging from insufficient drive to overabundant heat. As with other rigs of the day employing TV sweep tubes for finals, the Avenger's 6HF5s worried some operators who were used to more stable power amplifier tubes. "Temperamental," "finicky," "touchy" and "squirrelly" are among descriptions offered by more than a dozen past and present Avenger owners polled for this article. One frustrated fellow is reported to have fitted more traditional 6146s in place of the 6HF5s. (Fay notes, however, that the sweep tube actually exhibits more linearity than the venerable 6146).

On the other hand, Dave Dunlap, WØHUU, has operated an Avenger steadily for two decades and is well-satisfied with its performance. And though he lives in Waseca, Dunlap isn't merely spouting the "company line"; he is an independent service technician and has never worked for E.F. Johnson Co. ("For a long time, I was the only ham in town who didn't work there," he notes with a chuckle, "so, of course, anytime there were any problems with TVI, all the Johnson guys told people it was my fault.") Dunlap says his Avenger's original 6HF5s continue to perk. These days, Dunlap does use an ICOM 730 as his main rig. "But when I need more signal," he says, "I reach over and turn on the Avenger to double my power." As for receiving, he says the Avenger "will hear anything the Icom can." On the minus side, Dunlap says the Avenger's AGC circuit, innovative as it may have been in the 1960s, is no match for today's receivers. Dunlap's overall verdict on the Avenger: "A really nice little rig. Too bad they didn't go ahead with it."

Apparently the Avenger almost did get a belated go-ahead. Not long after he left Waseca in bitter disappointment, designer Fay received a call at his new place of work – the R.L. Drake Co. from an E.F.



Johnson Co. executive. "He said they were rethinking the Avenger decision, and he queried me for input," Fay says. "I told him I still thought it was a viable product. I suggested a couple of changes they might consider making, including trying out some of the newer sweep tubes that had become available. But, once again, they decided not to go ahead with production."

There may have been more Avengers assembled -- officially or otherwise -- in addition to the 16 built while Fay was in Waseca. Dunlap says reliable factory sources have told him 45 Avenger cabinets were made, along with 55 complete sets of circuit boards. Dunlap, among others, has some extra factory-made circuit boards for his rig. "I think if you look around out there, you'd find 45 radios, maybe 46 or 47," suggests Knish. However, he quickly adds that he's actually laid eyes on only about 8 over the years. So the exact degree of the Avenger's rarity remains a mystery.

The E.F. Johnson Co. no longer is a family-owned operation but is a cog in a large corporate wheel. The Waseca plant's output today includes land mobile gear, a line of gold-plated connector hardware and remote meter-reading sensors that relay data via radio.

Hamilton Fay, meanwhile, now resides in New England where he eventually moved to take an SSB engineering job with Raytheon Marine. Semi-retired professionally at age 64, he remains active in ham radio as WE1Q. And, yes, among gear in his shack is an Avenger, which he uses regularly on 75 meters.

"I'm proud of the Avenger," says Fay. "It wasn't perfect, but it had potential. I enjoyed working for Johnson. I was sorry to see the company drop out of the ham business. I like to think the Avenger could've saved the day." ER

Electric Radio Photo Index

Numbers 1 - 32

by John Seginski, N7NV
625 Akard Circle
Reno, NV 89503

I guess the thing I like most about AM is that it's just like the good old days of ham radio I remember so well in the early '50s. Nowadays I meet a lot of great friends on the air (especially on 10 meter AM) and oftentimes I wonder what the person on the other end of the QSO looks like. What does his shack look like?

Since ER prints several photos of hams along with their shacks each month, I figured many of these people I talk with should be pictured in back issues of the magazine.

Here's an index I made up of our fellow fans of AM, in most cases in their hamshacks. The issue (or issues) where the ham's picture appears follows his call sign. If you're not listed, consider sending a photo of yourself in to ER. We'd all like to see what you and your hamshack look like.

District #1

K1BH 26, W1DGH 21, N1FYX 25, AJ1G 32, K1GWT 27, WA1HLR 26, KW1I 10/23, W1JEL 16, KU1R 26, KA1RZF 10, W1YG 26, KA1YKG 27.

District #2

W2AN 19, N2BAU 31, N2DXO 15, K2EJX 2, WB2FOU 6, N2GBY 28, KD2HB 25, W2HBE 3 16, W2ICE 19, N2INR 31, W2IQ 16/31, WB2IUD 32, K2LXW 30, W2LYH 12, W2MJH 31, WA2NFF 26, WA2RIH 28, W2XC 31.

District #3

W3BJZ 31, W3BPZ 4, NO3E 31, WB3ETN 31, K3EWZ 32, WB3FAU 32, WB3FRY 31, N3GWE 31, N3HFB 31, W3HHC 12, W3HM 17, WB3HUZ 25, N3IYP 31, WA3JJT 31, KO3L 31, K3NFS 31, W3NFY 31, K3USC 31, WA3VJB 26/31, W3ZIF 29.

District #4

KD4AJ 16, W4CJL 2/17, K4DR 18, W4EGK 32, W4HAH 18, WA4KCY 5/29, KJ4KV 4, KY4KV 17, W4KYL 4, K4KYV 21, W4PNM 16/17, N4QAS 31, AA4RM 16, KQ4S 16, WA4UGR 21, K4UJZ 21, N4VHK 22, WB4VVI 17, KB4YST 14.

District #5

K5BAI 3, WB5BMD 7, K5BZH 17/31, K5CF 31, WA5EHS 3, N5EIF 24, KA5FGS 3, K5FZ 1/3/10/23/31, KB5IWX 3, N5JBT 13, K5LLK 3, WA5MOE 3, W5OLY 27, W5PYT 3/8, K5SWK 5/27, W5TOP 20, K5UPX 6, WA5VGO 3/10/23, WA5VLZ 7, KA5WOT 21, WB5YLQ 10, WB5ZPQ 11.

District #6

W6AD 26, W6ATC 26, N6AW 32, W6BM 11/15, W6CC 25, WC6D 14, KF6EA 25, K6EOB 28, WD6EWE 25, W6HDU 11, WA6HDY 9, K6HLO 11, K6HQI 7, K6HV 4/6/26, WA6IPD 2, N6OMW 28, K6PKO 20, W6PKW 16, W6PSS 25/26, W6RNC 3, WA6THD 7, N6TPU 28, N6UXW 25, WA6ZJC 9/25.

District #7

WR7A 28, WA7AMI 2/16, K7BDY 30, N7BEG 22, K7CMS 28, K7DU 32, W7EH 17/23, W7FF 17, W7FG 6, KB7GAI 28, N7GEG 28, K7GCO 16, W7GZ 28, N7IOK 27/28, W7ISJ 28, W7JKY 2/14/16, KB7JZQ 28, W7KCK 24, N7MHI 2, K7MJ 16, N7NV 25, AJ7O 20, WC7O 28, K7OBB 28, W7OUI 2, K7POF 3/25, KV7S 18, KA7TSH 28, WK7U 13, K7VZP 15/28, WA7WOQ 10, AI7Y 16, WA7YBS 27, K7YIR 2/16, K7YOO 4.

District #8

W8AHB 28, W8DFV 16, WD8DWR 28, KB8FJ 24, W8GNV 15, W3HHC 12, N8IAH 28, KF8IK 28, K8IOV 28, WB8JBT 28, N8JRJ 28, W8KGI 4, WA8LXJ 13, W8PRQ 12, KB8QF 28, W8RHZ 9, W8RXP 31, KA8UKO 28, W8VYZ 9/31, WA8ZNX 28.

District #9

WA9ASZ 7, K9BBA 3, KF9BP 28, W9CN 31, W9CNI 4, W9CVU 26, W9DYV 32, K9FCM 15, WB9GKZ 19, N9INW 22, N9IPQ 22, N9IQM 22, N9IRD 22, N9ISH 22, WA9IXP 18, N9IYC 22, N9JBF 22, W9WZE 11, WA9ZOR 19.

District # Ø

WDØALN 7, KØAQO 7, KØBS 31, WØBUN 19, WØCXX 7, KØDEW 6/23, WØDOZ 7, KØEOO 30, WAØFBQ 7, WØGFQ 1/8/18, KDØHG 2/8, KFØIE 32, WØIWV 24, WØJOL 29, KØLZW 19, KØOCC 16, WØOGH 28, KØOJ 6, WØRN 22, WRØS 13, WBØSUJ 7, WØVT 3/23/10, WØYDX 7.

Other Districts

JA1DNQ 25, KH6CC 13, KL7GKY 22, VE3CBK 22, VE3GRO 20, VE4BX 5, VE6GYJ 16, VE7FY 14/16.

Editor's Note:

I think John's index will be very useful for us all. If we hang a copy of these two pages near our operating position and have our back issues handy it will be very easy to locate a photo of someone we're talking to; provided of course they've had their photo in ER.

John says that he will continue to index the photos as each issue of ER appears. Perhaps we'll print a revised index annually.

I would like to encourage anyone who has not had their photo in ER to send one in. Here are some guideline to follow when submitting photos:

First of all, please do not submit polaroids. They just don't seem to print well and they're never as sharp as a convention print. Either black and white or color prints will do however we prefer color prints because of the terrible way black and white prints are processed these days. Usually they are run through a color processor and turn out rather muddy. About 90% of the photos in ER are copied from color prints. Size is not important; snapshot size (3"x5") is just fine. Horizontal shots are better that vertical because of the layout of the magazine.

Please do not send in photos of just your hamshack; we want to see you in it. And please do not have relatives or friends in the photo unless they also happen to be hams.

The ideal photo will be a color shot, horizontally oriented with the ham sitting at his operating position with his gear in the background. N6CSW/Ø

Niel Wiegand, WA5VLZ, in his hamshack. Some of gear shown includes an HRO-500, HRO Sr, FBXA, HRO-50 and a late '30s Stancor 20P.

Suzanne Gaeta, KB2IRH, with some of her vintage gear. She says she uses the HT-40 xmtr with Eico 722 vfo and SX-28 receiver as her AM station.

Barton Berg, K8IRC, says he started collecting vintage gear at Dayton last year where he found a Ranger and a Drake 2B. He operates 160-10 meters.

Tom Jurgens, KY8I, at his operating position. He says his main station consists of a DX-100 transmitter and NC-98 receiver.

A Not Noticeably Drifty VFO from page 9

good cathode follower. A 6C4 would be better, at the expense of somewhat higher filament power (and the use of a less common tube) a pentode-triode like the 6KE8 could serve as both oscillator and buffer.

Probably because of the gradual loss of volatile solvents from the epoxy resin on the coil, this oscillator has a long term upward 'creep' which started at about 10 cps/day and after a month of operation had fallen to about half that amount. This might be fixed by baking the coil at 150-200 degrees Fahrenheit for a few days or by using another type of binder.

Using The VFO

The most practical way to use the VFO subassembly is to build it into something which contains a power supply. The oscillator requires 105 volts at 7 ma plus filament power. For best results the plate voltage should be regulated with something like an 0B2 or OB3 (VR-105) regulator tube.

This unit might serve as a 'heart transplant' for a 'drifty' commercial VFO like the Heath VF-1; if necessary to fit the space available the tube unit could be mounted (with the connection hole down and tubes pointing to the front or rear) on top of the tuned circuit unit. Otherwise you will need a dial of some sort. I plan to use a National MCN. As with any VFO, the coupling between the dial and tuning capacitor should be perfectly aligned to prevent side forces. Unless your tuning capacitor has an insulated shaft, make sure there's an insulated coupling between it and the front panel to avoid introducing an unstable ground path.

The VFO output is about two volts peak-to-peak; because output is taken from a cathode follower it will drive almost any kind of load. Somewhat greater output can be obtained by increasing C13 but the isolation will be reduced. As it stands, however, you will probably need another amplifier stage if this unit is to replace a crystal.Because heat is the big problem, a stand-alone VFO is more easily made stable than one built inside a transmitter or receiver. However, you can still get results far beyond the usual ham set if you take pains to control the heating of the VFO subassembly by the radio in which it is installed. Keep it away from large tubes (because of the strong RF fields it should especially be kept away from the final amplifier) or groups of small ones. Use a shield if necessary to reflect heat; arrange the air flow to bring in cool air below the front of the tank circuit unit and let heated air escape above the tubes. Mount the tuned circuit unit with plastic hardware to minimize heat pick up from the chassis. If your VFO was stable on bench test, your radio will be 'on frequency' when the others have drifted into the next round table... **ER**

Editor's Comments from page 1

I think that we can all learn something from Ralph's death and that is that even the most experienced of us can wind up dead if we are not forever vigilante when around high voltage, or any voltage for that matter. Apparently, under the right circumstances, almost any sort of shock can cause the heart to stop. We'll get into that more in a future issue after I've had a chance to gather more information.

The November issue of *"Popular Communications"* contained an excellent article on AM titled, "AM Revival: Hams Do "Classic Radio" by Paul Courson, WA3VJB. I think Paul did a great job of describing what AM/Vintage operation is all about. He also listed all of the popular AM frequencies so we should expect that now there's a lot more SWLs out there listening to our roundtables. AM needs all the good PR it can get. Thanks Paul.

Pat Person, K7YIR, reports that he recently rented some gear (Ranger,SX-32,etc) to the folks who produce the television show "Northern Lights". The gear should be seen in a episode coming up between mid-February and mid-March. Pat says that the television show is filmed at Roslyn (exterior shots) and Redmond (interiors), in Washington state.

On to #34....

CLASSIFIEDS

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FOR SALE: Repair and restoration on all vintage equipment; 35 years experience. Barney Wooters,W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. (303)

FOR SALE: Weather balloons, large military ML-537A/UM by Kaysam Mfg. - $15 each or 2 for $25; giant discone antennas, military, AS-3886, 9' radials, 6' disc, excellent, UPS shippable - $100 each; Navy rcvr RDZ-1, 200-400 Mhz, unused, mint, truck ship only - $150; military AN/PSM-13, 7 piece battery test set for most backpack batteries - $15 each; AN/URM-25F sig. gen. - $75. Plus UPS. **WANTED:** 3TF7; 3TF11; 26ZSW; 7077; 7486. New or unused. Joe Bunyard, 1601 Lexington St., Waco, TX 76711-1701. (817) 753-1605

FOR SALE: Drake 2B w/manual - $140. Best audio quality, engineer/musician aligned, gladly deliver to Dayton Hamvention. Steven Putman, N8ZR, 720 W. Algonquin Rd., Apt. 10, Des Plaines, IL 60016-5739 (708) 439-5168

FOR SALE: NC-303, clean - $250; Valiant II, nice - $395; Ranger II, almost new - $295; R390A w/cab - $350; S38E - $45; R-46 spkr - $25; NC spkr - $20; Philco 20 - $45; NC -300 converters - $90. W7IYG, (208) 466-2803 after 8 PM MST.

FOR SALE: Miscellaneous odds and ends, antique radios and parts. LSASE for list. Hidyne Research, POB 3342, Williamsport, PA 17701. (717) 326-2148

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

WANTED: Old receivers, SX-73, SP600JX, AR-88, BC-342, BC-348, ST Tube Type HRO and etc. Masahiro Nada 6-9-3 Fujiwaradai-Kitamachi Kita Kobe 651-13 Japan. FAX 011-81-78-981-3261

WANTED: Technical Material Corp. rcvrs - GPR-90, GPR-91, GPR-92; SBC-2, GSB SSB adapters; VOX-5 diversity combiner. Also original manuals, cabinets and spkrs for same. Ron, KC6WTC, POB 783, Santa Rosa, CA 95402. (707) 539-8319

FOR SALE: Meisner Signal Shifter - $85; Swan SW175 w/supply - $85; Hammarlund HQ-129 spkr - $40. Steve Harmon, N9HGF, 4340 N. Congress Ave., Evansville, IN 47711. (812) 474-0842

CLASSIFIEDS

FOR SALE: Used technical books - radio, electronics, military manuals, equipment manuals, catalogs, magazines, Handbooks, etc. List-$1 (stamps ok). Softwave, Dept. ER, 1515 Sashabaw, Ortonville, MI 48462

FOR SALE: Drake R-4C, AM filter, spkr and manual - $250 firm. Levy, 8 Waterloo Dr., Morris Plains, NJ 07950. (201) 285-0233

FOR SALE: 300 rigs, SASE for list; vintage manuals. Mike Horvat, POB 73, Stayton, OR 97383.

WANTED: Audio tubes KT66, KT88, 7308, 8223, 6550, 6CA7, 7027, 8417, 6336. Michael Charest, P.O. Box 1540, Champlain, NY 12919-1540. (514) 389-8537

FOR SALE: Hewlett Packard instruments: 330B distortion meter and 206A audio generator, both in excellent condition, w/instruction books. Bill Riley, 863 W. 38th Ave., Eugene, OR 97405.

WANTED: RCA 1628, 8025A and/or 8012A VHF triodes. Need 4 or so. Harry, AA6PP, 8538 Serapis, Pico-Rivera, CA 90660.

FOR SALE: PRC 25 w/handset and short antenna - $300; PRC 10 w/many accessories - $150. Bob McGraw, N3KTT, 732 Orley Pl., Bel Air, MD 21014. (301) 836-8191

WANTED: S or SX 16 or 17, good or junker chassis. R. Haworth, W2PUA, 112 Tilford Rd., Somerdale, NJ 08083. (609) 783-4175

FOR SALE: Synchronous detector for 455 khz IF rcvrs. Dramatically improves AM: reduces fading distortion, selectable sideband cuts interference. Kit - $139. Built/tested - $199. Info - $3. Steve Johnston, POB 3420, York, PA 17402-0420

WANTED: Schematic/manual for Temco RA-600 xmtr & RA-400 vfo or for RA-150. Dale Krolczyk, KB5IKH, 424 Spring Valley Rd., Waco, TX 76643. (817) 666-3787

WANTED: 75A-4/KWS-1, Collins emblem; 75A-4 spkr or any 75A series spkr; T-195 vfo. Dean Gagnon, KK1K, (802) 878-8293

WANTED: Millen Vari-Arm vfo, type 90700, 90701 or 90711. Also looking for a Millen ceramic jack-bar type, 5 pin coil socket #41205 and air coils #43022 and #43042 for a 90800 exciter. Interested in Millen equipment and any information on James Millen's life and company for a future article. Thanks to all who have helped so far. Henry Rogers, WA7YBS, POB 501, Minden, NV 89423. (702) 267-2725

WANTED: HRO-60 coils type G,H, J, AA, AB. Cash/trade. Barry Nadel, Box 29303, San Francisco, CA 94129. (415) 346-3825

FOR SALE: Automatic tube tester model USM 118B, made by Hickock - $35 each; 6AK5 miniature tubes for R390 and 51J series rcvrs - $.99. Levy, W5QJT, 539 McCarty, Apt 407, San Antonio, TX 78216. (512) 366-3290

WANTED: Ranger I operate switch (SW-4); original manuals for 75A-4, 75S3-B, 312B-4 and 516F-2; also need Millen 90801 exciter and IERC tube shields. Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429-2062

FOR SALE or TRADE: Globe Chief; Heath VF-1; HP260 Q-meter; Collins filters, 455 kc, 3.1 kc; Collins spkr 312-B3; Drake MN-4, T-4 Ultra Tuner; Sencor PS43; D6MMVD 1000; DGM 2000; HP608D; Drake TR4 w/spkr and AC supply; HP606A; Heath HA14 linear; NC-173; Eico 753, 751, 752; Gonset G-76; GR 1611A; GR 724A; Gonset III, 6 mtr; TMC TAC-1 tuner; Ameco TX-62; Macintosh MC-30 and last of the known HyGain 3750 parts. Bruce Walther, W9QA11, (715) 344-9099

WANTED: Breting radio equipment. Also looking for information on Breting: photos, newspaper articles, letters, anecdotes and facts. Bill Mayes, N6LKA, 255 So. Montgomery St., San Jose, CA 95110. (408) 280-7172

WANTED: RCA 8D21 water/air cooled TV transmitting tube. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

WANTED: Model 3201 modulator/ps for Gonset G-77A xmtr. John Lewis, WB9NWO, 3526 N. Elmcroft Ter., Peoria, IL 61604. (309) 685-5865

CLASSIFIEDS

WANTED: Wireless Set No. 19 equipment circa WW II. Also looking for information and anecdotes. Chris Basaillion, VE3CBK, 1324 Old Carp Rd., RR #1, Kanata, Ontario, Canada, K2K 1X7

WANTED: Mac-Key with brass nameplate. "Radio" magazine January 1935 with McElroy article. Tom French, W1IMQ, 120 Great Rd., Maynard, MA 01754. (508) 897-2226

FOR SALE: ARC 3 - $10; ART-13 - $50; CE 10B - $35. U-ship. Jim, W8IHPL, 13549 Morse, Pataskala, OH 43062. (614) 927-2592

WANTED: Original or very good copy of manual for Johnson Navigator. Jerry Buckner, 2119 N. Grant, Springfield, MO 65803. (417) 866-8669

WANTED: TCS power cables, remote control, vertical rcvr-xmtr mounting hardware, AC power supply. Charles Graham, K6KDZ, 20335 Casa Loma Rd., Grass Valley, CA 95945. (916) 273-6847

FOR SALE: Hallicrafters S-129 - $65; S-81 - $25; E.F. Johnson 2 mtr vfo - $15; New Nobility 12-transistor radio - $25. Ward Becht, 625 Tufts Ave., Burbank, CA 91504. (818) 842-3444

WANTED: Manual for HP600B; 3TF7 tubes; meters for R390A; TEK 465 or 475 scope, must be in very good cond. Clark Hatch, WØBT, 2546 SE Peck Rd., Topeka, KS 66605. (913) 235-2721

FOR SALE: R-392 rcvr/T-195C xmtr station w/mount, all connectors, manuals, ready to go - $1000. Mike, WA5MOE, (409) 693-1461

WANTED: HRO-60T; NC-400; spkr/coils/calib. for HRO-50T1; preselector for 51S1 (55G1); Drake RV-4C remote vfo; MS-4 spkr; SPR-4 manual/xtals; spkr for 75A-4 (270G3). Carter Elliott, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383 (h), 980-7698 (w)

WANTED: HQ-100 schematic and alignment info or manual. Xerox ok. Mike, AC5P, POB 33, Bartlesville, OK 74005. (918) 337-1288 8-9 CST, M-F

ELECTRON TUBES FREE 1991 Catalog, over 2,000 types in stock. **Electron Tube Enterprises,** Box 311, Essex, VT 05451. (802) 879-0611, FAX (802) 879-7764

WANTED: Radar equipment; need parts for SCR-584; 5J26 magnetrons. Also collect early TV cameras. Allan Weiner, 14 Prospect Dr., Yonkers, NY 10705. (914) 423-6638

WANTED: WW II military sets, racks, etc. Finders fee paid on non-owned sets purchased. Sam Hevener, "The Signal Corps", W8KBF, 3583 Everett Rd., Richfield, OH 44286. (216) 659-3244

WANTED: KW-1, SC101, SC301, 75A-4, NC-101X, HRO-500, NCL-2000, NCX-1000, NC-400, 150A, 150B, 40B, 30W, 32A, 32B, 30DX, 30DXB, 20B, 42B, 300B, 202A, 202B. Collector. Rick, (617) 233-1414, collect.

FOR SALE or TRADE: HRO-500 for Sony CRF-330K, CRF-320A, Drake R-4245, Collins 451S-1, 651S-1, Racal RA-6772 or HRO-600 Jim Weil, 15915 Armada Center, Romeo, MI 48065. (313) 784-9860

WANTED: Regenerative radio nut needs antique and vernier dials, chokes, audio xfmrs, coils forms, tuning condensers etc. Bruce, NR5Q, 504 Maple Dr., Springdale, AR 72764. (501) 751-6536

FOR SALE: Scott SLR-12B (1945), working - $100; RBB or RBC chassis halves and cabinets - Free; power supplies, few parts and cables. Alan Douglas, Box 255, Pocasset, MA 02559.

FOR SALE: Xmtr tuning unit TU-26-B made by GE - $25 + $5 shpg; Eico model 723, 60 W CW xmtr, less 2 tubes and cover - $25 + $7 shpg; Seco Transmitter Tester, model 510B, no papers, like new - $25 + shpg; 6 page list of literature copies available - SASE; Telrad Frequency Standard, WW II, paper included - $25 + $5 shpg; Interphone amplifier, AN/ATC-2 with dynamotor, less tubes - $20, w/ tubes $30 + $5 shpg. James Fred, R1, Cutler, IN 46920. (317) 268-2214

CLASSIFIEDS

FOR SALE: BC-610F, DX-100, both excellent and working; NC-303 w/cal. - $175. Chuck Graves, KØRFQ, 641 N. Oak Grove, Springfield, MO 65802. (417) 863-7415

WANTED: Viking Navigator; Collins 75A-4; SX-32 parts source; 160 M xtals; Speed-X bug. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

FOR SALE or TRADE: 75A-3; HRO-50; SX-100; SX-71; S-20; HT-37; HT-44; NC-303; HQ-140X; RME-4350. **WANTED:** Drake L4B; RNC; NCL-2000; 32V-3; KWS-1; SX-115. James Olson, N6IFO, (415) 221-1976

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

WANTED: McIntosh and Electro-Voice amplifiers and accessories for my collection! Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53220-0803. (414) 545-5237

FOR SALE: McMurdo Silver 5C rcvr - BO; Knight T-150A xmtr - $50; Heath DX-60 w/HG-10 vfo - $60; Heath HR-20 and HX-20, no supply - $75; Lafayette HE-50 w/matching vfo - $40; Regency ATC-1 all band, solid state, converter - $40; 809 tubes, new - $3 each; other tubes - SASE. Plus shpg. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, L.I. , NY 11758. (516) 798-1230

FOR SALE: Collins 51J-1 - $200; Conset G-77, C668, 115 ps w/modulator - $125; Hammarlund HQ-160 - $100; Heath Cheyenne and Comanche w/115 ps and mic - $100; Johnson Desk KW , 160-10 meters - $1600. Gary, W7FG, (918) 336-2953

CLASSIFIEDS

FOR SALE: Over 150 military manuals of the 1940's and early 1950's. Large SASE w/$.52 postage for list. August J. Link, 2215 Faraday Ave., Suite A, Carlsbad, CA 92008. (619) 438-4420 days.

FOR SALE: Ham Radio (many ARRL Handbooks) and Radar/Microwave. Book lists now available. Send $.29 stamp for each. Rainy Day Books, POB 775, Fitzwilliam, NH 03447. (603) 585-3448

FOR SALE: WW II Navy (ship, submarine?) xmtr systems, 2 types, made by Westinghouse, contract date 1941. LSASE for xerox copy of equipment nameplates. Craig Woods, 548 Simoron, Ogden, UT 84404. (801) 393-2192

FOR SALE: BC-645; Command 7-9.1 xmtr; BC-454; Hallicrafters Sky Buddy; SX-24; SX-101. Also vintage radio replacement caps, 450 V and xmtr bypass caps 600, 3 KV. Frank, (617) 641-2055 eves.

WANTED: Novice xmtrs/rcvrs - Walter Ashe, Philmore, Meisner, WRL, Ameco; pwr xfmr for DX-40; manual for RME HG-303. Larry Howe, KBØHIB, 1333 S. Airwood, Springfield, MO 65804. (417) 882-1682

WANTED: WW II military or civilian radio sets, radar, aircraft, infantry, racks, manuals, anything. Sam Hevener, W8KBF, "The Signal Corps", 3583 Everett Rd., Richfield, OH 44286. (216) 659-3244.

WANTED: Multi-Elmac ATR-4 or other mint Multi-Elmac equipment. Lea, KN4JW, 310 So. Park Dr., Spartanburg, SC 29302. (803) 582-8237

FOR SALE: Hammarlund SP-600JX - $225; TV-2 tube tester - $115; BC-344D VLF receiver - $95; USM-207 525 Mhz freq. counter, oven time base - $110. Mike, WA5MOE, (409) 693-1461

FOR SALE: 20 tubes GE 814/VT-154, unused, boxed in 1944 - $10 each plus UPS. Fred, W6RNC, POB 478, Nevada City, CA 95959.

WANTED: Amateur Call Book (Flying Horse Cover) for 1926, 1935, 1936. Bob Arrowsmith, POB 166, Annandale, VA 22003. or collect (703) 560-7161

FOR SALE: DM-64 dynamotor 12v/275v - $20; WRL Galaxy 300 VOX plug-in - $10; Heathkit GD-1 grid dipper, no coils - $5; 1957 Heathkit catalog - $7; 1951 ARRL Handbook - $8; "Men And Volts At War", story of GE in WW II - $20; 1964 Callbook - $6; Radiotron Designers Handbook, 1941 - $10; Radio Magazine Handbooks 1940 and 1946 - $10. Mark Hovda, NØSWI, POB 10091, Cedar Rapids, IA 52410. (319) 364-4048 7-9 PM PST

FOR SALE: R4C w/ AM filter, SW xtals, spkr and SPR-4. Both good condition w/manuals. **WANTED:** PS-4. Levy,8 Waterloo, Morris Plains, NJ 07950. (201) 285-0233

CLASSIFIEDS

FOR SALE: High Voltage Capacitors: If you didn't buy from me you probably paid too much! Free Catalog, large SASE appreciated. My winter catalog contains many new items, including Electrolytics. Place a $10 parts order and get $2.50 off a Tri-Mark Crystal Calibrator (must be ordered together). Visa/MC accepted. We cater to the vintage operator/builder. Those who placed an order in 1991 will automatically receive our new flyers. Thanks, Steve, NW2F, Two Fox Electrix, POB 721, Pawling, NY 12564. (914) 855-1829

FOR SALE: SX-122, near mint - $145; SB-10 SSB adaptor, good - $50; original manuals. WANTED: 813 amplifier like CE 600L or LPA1. Bill Kipping, KE7KK, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

WANTED: National R175 chokes, RME DB-20 preamp; xmtr variables and National type "O" dials or similar with metal skirts. Roland Matson, K1OKO, RFD #1, Box 2943, Kennebunk, ME 04043.

FOR SALE: 1 KW homebrew xmtr w/B&W turrett and plug in coils; RME 45 rcvr; SX-28 rcvr; 300 W modulator. Gene, KB4YST, 224 Idlewylde Dr., Louisville, KY 40206. (502) 895-1705

FOR SALE: National NC-2-40D rcvr w/spkr, working - $200. Stuart T. Carter II, W4NHC, POB 033177, Indialantic, FL 32903-0177. (407) 727-3015

WANTED: BC-AA-191; TU-AA-3 thru TU-AA-10; BC-AA-192; TM-AA-160; BC-196. James Treherne, 11909 Chapel Rd., Clifton, VA 22024. (703) 830-6272

WANTED: QST copies for May-June, 1962. Mail direct with billing. What do you need? Cdr. Glenn W. Ritchey, USN Ret., W7SAB, 219 Naval Ave., Bremerton, WA 98310. (206) 373-9631

FOR SALE: Accepting bids on Hallicrafters SX-88. Unit is functional and ready for restoration. Appears to have been a prototype as the dial bezel is wavy, not squared and the two knobs adjoining the bezel are black, not chrome. However, serial no. is 296. For more information write or call. Steve Sauer, WA9ASZ, R3 Box 413, Bloomfield, IN 47424. (812) 863-2088 eves. 6-9 EST.

FOR SALE: CE 100V audio limiter module - $50. WANTED: 55G1; late 75A-4; mint HQ-180/170; Viking Valiant; HRO-60. K5YY, Box 3600, Texarkana, AR 75504. (903) 832-3344

CLASSIFIEDS

WANTED: Hallicrafters SX-88 rcvr; Viking II front panel in nice condition or entire xmtr. Dan Radcliffe, KF9BP, 8201 Plainview Pkwy, Sussex, WI 53089. (414) 255-9165

WANTED: Hallicrafters HA-5 vfo; RME 6900 rcvr; Bliley T-9's; Cross, Premier, Hipower, round crystals for use in Novice and gen. band. Larry Howe, KBØHIB, 1333 S. Airwood, Springfield, MO 65804. (417) 882-1682

WANTED: Riders manuals Volume 22 and 23; J.W. Miller 612-W4 1600 kc IF xfmr; Electronics Illustrated June, 1961. Al Bernard, NI4Q, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

FOR SALE: TMC DDR7T diversity rcvr - $2000 PU only; GPR-91RXDS rcvr w/SBC1 adaptor - $600 plus UPS. J.M. Etter, W2ER, 16 Fairline, East Quoque, NY 11942. (516) 653-5350.

WANTED: Collins KW-1, KWS-1, KWM-1, R389, R390a, 75A-4 with 3 filters; Hallicrafters SX-115. F.H. Werry, DJ3OE, Saturnweg 18, D-4056 Schwalmtal, Germany. phone: 01149-2163-20528, FAX: 20552. 24 hrs., will call back.

FOR SALE: Nice Drake TR4C w/AC4 - $250; RV4C - $75; MS-4 - $20. **WANTED:** Hammarlund S-200 spkr; Globe 75S-A vfo. George Carroll, N2GBY, 301 New Jersey Ave., National Park, NJ 08063. (609) 848-6699

WANTED: National SW3 rcvr; SW3 coils; frequency tuning knob for BC-453 rcvr. J.J. DeSousa, Jr., 29 Whiting St., Plymouth, MA 02360. (508) 746-6533

WANTED: DX-100B, must be excellent. Pickup within 200 miles of Joplin. Don Hilliard, WØPW, Rt 5, Box 219, Neosho, MO 64850. (417) 451-5892

FOR SALE: RU-16 dynamotor & filter box - $15; Carter dynamotor, 5.5 VDC in/600 VDC out - $14; I-95-B PS meter - $15; TCS Rx - $24; PMR-8 DCps - $15; Signal Shifter #9-1090, exc. - $60; Collins 353C-31 3.1 Khz adapter - $75; Johnson Fone Patch - $20; clean Signal Sentry case - $4. Parting 75A-1. **WANTED:** HK-24 tube. Joe Sloss, K7MKS, 4732 119th SE, Bellevue, WA 98006. (206) 747-5349

WANTED: Hallicrafters S-76 or S-meter for same; RCA 44BX or 77D microphone. Terry Knapp, KA7TVP, 1937 Valley Dr., Las Vegas, NV 89108.

ELECTRIC RADIO PARTS UNIT DIRECTORY

At this point the directory has 200 units in it. If you need a part for a vintage restoration send $2 and an SASE (.52 postage) for the list. If you have a parts unit, consider putting it on the list. Your dead unit can help bring others to life!

CLASSIFIEDS

WANTED: Machine shop work. Knobs shafts bushings, etc. made to your sample or drawing. Reasonable. Jim Dill, Box 5044, Greeley, CO 80631. (303) 353-8561 evenings.

FOR SALE: Very clean Johnson equipment - Desk KW w/late SN and extras, Viking T-Bolt, KW Matchbox; 2 Shure SM-60 prof. broadcast mikes, NIB; 19" equipment racks. If I can't sell this stuff I am open to any AM ham wanting a good centralized location, willing to share expences on a 2 bedroom house with full use of Johnson KW & station, interested in living in Colorado. Rick, K8MLV/Ø, (719) 543-2459

FOR SALE: Hammarlund HQ-120X, vg cond. - $150; B&W LPA-1 w/extra power supply - $500. Plus UPS. Bob Ivone, 622 Ave "U", Brooklyn, NY 11223. (718) 339-3394

WANTED: Pre-war FCC amateur license application form, a copy, blank or otherwise. James T. Schliestett, W4IMQ, POB 93, Cedartown, GA 30125. (404) 748-5968

FOR SALE: R648/ARR-41 - $200.WANTED: Navy RAX CG-46115 rcvr; BC-375 shock mount; TCX xmtr. Steve Davis, KD2NX, 705 Belmar, NJ 07719.

WANTED: HA 410 and 2M SSB. Chris Schiotz, K2PGB, 15 Runyon Mill Rd., Ringoes, NJ 08551.

WANTED: Ranger II; Collins 75A-1; 4D32 tubes; pwr xfmrs for Collins 32V. Ron, KC6WTG, POB 783, Santa Rosa, CA 95402. (707) 539-8319

WANTED: Ameco AC-1T xmtr; J-38 key; amateur band FT-243 xtals, any freq. Howard Weinstein, K3HW, 15 Lakeside Dr., Marlton, NJ 08053. (609) 596-3304 after 9 PM EST

WANTED: Collins spkr for 75A-2, 3, or 4; good tube tester; CW filter for 75A-4. Pat Bunn, N4LTA, (803) 583-1304

FOR SALE: Parts by mail since 1954. Vintage parts available. Send stamp and request "Vintage Flyer". USA only. Bigelow Electronics, Box 125, Bluffton, OH 45817

FOR SALE: Transmitting/Receiving tubes, new and used. LSASE for list. I also collect old and unique tubes of any type. Looking for Taylor and Heintz-Kaufman types. Maybe you have something to trade? **WANTED:** Large tubes and sockets from the old Eimac line; 450T through 2000T for display. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

WANTED: 51J4 or R-388A, good working order, clean, all filters. Art Delibert, 17 Montgomery Ave., Takoma Park, MD 20912. (301) 270-6775 eves and wknds

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FOR SALE: BC-1031 panadaptor - $50; URR-35 rcvr - $60; PDR-27 radiation counter - $40; more, lists - $.75. WANTED: Collins 62S-1 VHF converter. J. Orgnero, VE6RST, Box 32, Site 7, SS 1, Calgary AB T2M 4N3, Canada (403) 239-0489

WANTED: HRO-60 coils, G, H, J; scales, A - (14.0-30 Mcs), B (7.0-14.4 Mcs); 50J-3 Select-O-Ject; XCU-50-2 xtal calibrator; both meters for R-390A. Joe, WA9LAE, 2239 S. Harvey, Berwyn, IL 60402. (708) 795-6761

FOR SALE: LS-3 WW II spkr; antique headphones; RV-13 aircraft rcvr; NC-183D; SX-42; R-42 spkr; test equip. SASE for list. WI5D, 1040 Cleveland, Stephensville, TX 76401.

WANTED: General radio or similar antenna impedance bridge; Bird wattmeter; VLF rcvr; Drake SPR-4; SW-4; R4-C; loop antenna; old QSL cards; books (antennas, acoustics, tubes); HF preamp; Johnson Matchbox; vacuum variable; Rohn tower sections; old radio mags (Radio, Radiocraft, CR Experimenter, PE). Joe Holstein, N8EA, 1515 Sashabaw, Ortonville, MI 48462.

FOR SALE: Complete Drake station - TR4C, RV4 VFO, ps/Spkr, very nice - $395; Hammarlund rcvrs - HQ-100, gen. cov. - $110; HQ-215 - $150. Charlie, KD4AJ, (404) 396-0276

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

CLASSIFIEDS

FOR SALE: Technical manuals TM 11-800 BC-191A-E - $12; TM 11-620 SCR-608-A, B & -628-A (BC-683/684) - $15; TM 11-601 SCR-808-A & -828-A (BC-923/924) - $20; TM-11-284 AN/GRC-3 to 8 - $6; TM 11-5039 AM-65/GRC - $4; TM 11-5036 PP-109 & 112/GR - $4; TM 11-289 RT-66, 67, 68/GRC - $8; TM 11-5038 AN/GRA-6 - $5; GRC special, previous 5 manuals for - $22; TM 11-296 AN/PRC-6 - $6; TM 11-612 AN/PRC 8,9 & 10 - $10; TM 11-295 AN/GRR-5 - $10; TM 11-291 AN/VRC-13, 14, & 15 - $15. Excellent condition,quantity available. Shpg included on orders over $10. Sase for list of over 100 manuals. August J. Link, 2215 Faraday Ave., Suite A, Carlsbad, CA 92008. (619) 438-4420 days Mon.-Sat.

WANTED: Collins cabinets for 32V-3 and 51J-4; need service manuals for 32V-3, 51J-4, KWS-1, 75A-3 and 75A-4; need manuals for Radiophone Model 44 Bandscanner and U.S. Navy RB V-2/BC-1031 panadaptors. Roy, N5QQM, 1336 Sherwood Forest Blvd., Baton Rouge, LA 70815-5330.

BOOKS, MAGAZINES WANTED. Modern Electrics, Experimenter, Science Invention, Radio News, Radio Retailing, Radiocraft, M.I.T. Radiation Laboratory Books, **OTHER TECHNICAL BOOKS, MAGAZINES**, also **CRYSTAL SETS, MICROPHONES.** State lot price for resale. Delton Lee Johnson, WB6MNY, 14 McKevett Heights, Santa Paula, CA 93060. (805) 525-8955,evenings

WANTED: More of that great military radio gear - R-1051 'parts' set, freq. standard module for GRC-106 xcvr, MAY, MAW, URC-11, URC-68, other interesting stuff. Walt, KJ4KV, 3125 N. Military Rd., Arlington, VA 22207.

FOR SALE: Central Electronics Multiphase RF analyzer model MM-2; keys; tubes; parts; books. SASE for list. State your wants. Art Collatz, N 7818 Barker Lake Rd., Winter, WI 54896.

WANTED: Pay well or have nice trades for National SW-4; AC-SW-58; DC-SW-34; SW-45; doghouse power supply; Red Diamond Black wr. spkrs; SW-3 coils; RME-9; 9D; Hammarlund SP-110 (FOS p. 232-1937); Meisner Traffic Master; Echophone EC-2,3 and Harvey Radio Labs xmtr FT-30 (FOS p. 257). Robert Enemark, W1EC, Box 1607, Duxbury, MA 02331. (617) 934-5043

WANTED: Receivers: Squires Sanders SS-1R; 51S-1; ARR 15; R-388/388A; G1 33. Mitsugu Shigaki, JA6IBX, Jozan Kamidai Machi 2825-2, Kumamoto, Japan 860.

ELECTRON TUBES: All types - microwave, transmitting, receiving, obsolete, military--Large inventory. **Daily Electronics Corp.**, POB 5029, Compton, CA 90224. (213) 774-1255; (800) 346-6667

CLASSIFIEDS

WANTED: Very old or unusual Hallicrafters equipment, entire 1934 "H" and "Z" line of Silver Marshal, parts, memorabilia and manuals. Chuck Dachis, "The Hallicrafter Collector", WD5EOG, 4500 Russell Drive, Austin, TX 78745.

WANTED: Military Radios and Electronics. Systems, collections and accessories: dynamotors, DF loops, control boxes, etc. Any vintage or nationality. Charles DiCecca, KA1GON, 501 Mystic Valley Pkwy, Medford, MA 02155. (617) 396-9354

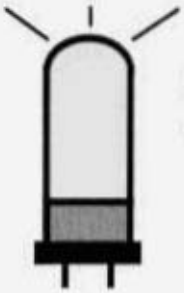
FOR SALE: National NC-88 - $80; Hallicrafters S-40 - $75; S-53 - $45; Heathkit MN HP-13A power supply - $50; Collins 312B-4 - $90; TEK Signal Generator type 190B - $120; Hammarlund SP-400-SX w/ps - $150. All are G/VG and include manual and shipping. Clyde Sakir, N7IOK, 4243 E. First St., Tucson, AZ 85711. (602) 323-1120

WANTED: Knight Ocean Hopper w/case and plug-in coils in good to mint condition; manual or schematic for Hallicrafters S-107; both dial scales for Hallicrafters SX-24, unscratched; info on SSB adaptor for 75A-2 that plugs into FM socket. David Ishmael, WA6VVL, 1118 Paularino Ave., Costa Mesa, CA 92626. (714) 979-5858

WANTED: Harvey Wells Bandmasters - T90, R9, AC ps; SX-88; HQ-180; 32S3; 75S3; 516F2 AC ps. Call Collect if you have clean units for sale. W7MXM, (208) 522-5854

FOR SALE: Johnson Valiant, excellent condition - $275. Will Ship. Duane Vasold, K8CCE, 5768 N. River, Freeland, MI 48623. (517) 695-5140. Mach. after 3 rings.

WANTED: BC-191 or BC-375; GO-9. Any condition. Ted Bracco, Quincy College, 1800 College Ave., Quincy, IL 62301. (217) 228-5213



SECOND
CLASS

ELECTRIC RADIO
145 CR 123
Hesperus, CO 81326

TO: