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ELECTRIC RADIO

celebrating a bygone era

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Steve Ickes, WB3HUZ/3

ELECTRIC RADIO

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REGULAR CONTRIBUTORS

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

Paul Courson, WA3VJB's story on page 10, about an AM special event station he helped organize and operate on an island in Chesapeake Bay has inspired me to start thinking of something similar I might organize out here in Colorado.

I have been fantasizing about an expedition my 'office manager' and I might take. I see her and me on a mountain peak somewhere in the Rockies with my trusty Johnson 500. It's getting towards winter out here now so maybe my 'fantasy' won't materialize until next summer. All the components of the event: the good fellowship, the fun of organizing everything, the camping and being the on-the-air are very enticing.

While I'm in the 'fantasizing' mode I see other locations that might be fun for AM expeditions/special event stations other than islands or mountaintops; how about a skyscraper in a large city or a wilderness site in a national park or from a boat at sea. There are a lot of interesting possibities. Not only would it be fun to participate at the site but it would also be fun to participate via the 'airwaves'.

I'm sorry I didn't work WA3HUZ/3 - maybe the first AM special event station in decades - but hopefully there will be others in the near future. Quite possibly there are others in the planning stages right at the moment. If there are I invite the organizers to let me know the details and we'll give everyone advance notice of the event. We'd also be interested in an article after the event; something similar to Paul's.

I think AM special events stations could become an important part of AM/vintage operation and provide us all with some interesting on-the-air activity. They also give AM some good PR.

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Cover: Steve Ickes, WB3HUZ/3 at the operating table during the Dobbins Island AM expedition. See the story on page 10.

A History of American Call Signs

Jan D. Perkins, N6AW
524 Bonita Canyon Way
Brea, CA 92621

The American call sign system has its roots in the era of wireless communication and was initially set up shortly after the turn of the century.

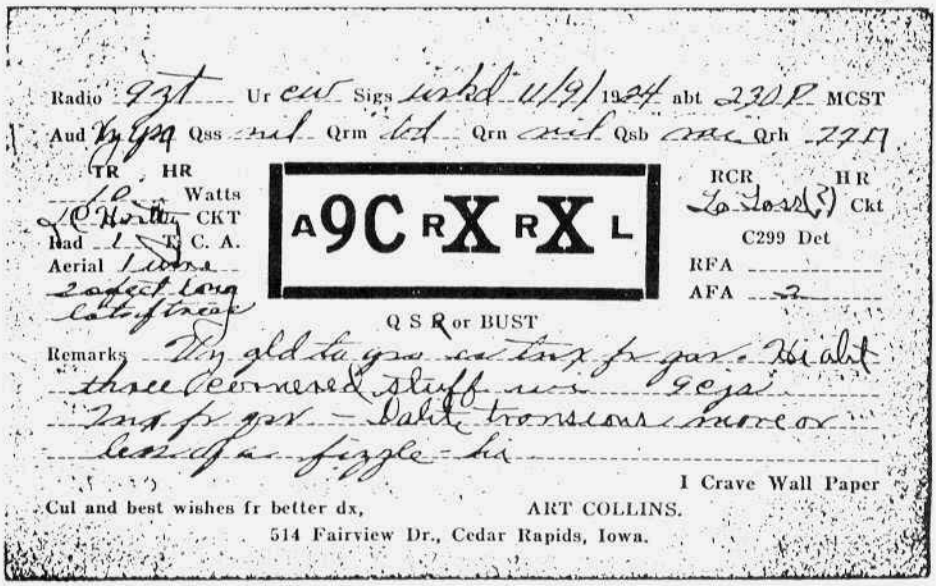
By 1909 there were significant numbers of wireless experimenters in the USA, principally in the New York and Chicago areas. The call signs of these pioneer radio amateurs were self assigned as there was no licensing authority yet in existence. In 1909 the first organization of amateur wireless operators in the USA, The Radio Club of America in New York, published a list of its members, the Wireless Blue Book.

The Department of Commerce, of the Bureau of Navigation, was formed by the US Congress in 1912. All matters concerning the regulation of wireless communications in America, both on land and at sea, came under its jurisdiction. Commercial, government, and amateur wireless stations all shared the same frequencies (they used wavelengths in those days).

One of the first actions of the Department of Commerce was to institute a call sign system, as well as wavelength allocations and power restrictions. The amateur call system followed very closely the existing system for US ships and naval stations.

The US Navy was the first practical application for wireless communication, around 1902. By 1907 numerous ships had wireless power plants installed, and the Bureau of Navigation published a book of maritime call signs. The boundary between call areas was determined by the Naval Districts around large ports (e.g. San Francisco). When a need arose for amateur call signs to be issued in 1912 they naturally followed the existing system. The Department of Commerce issued the first edition of Radio Stations of the United States on July 1, 1913.

continued on page 32



This QSL card was received by Don, 9ZT, in 1924, from Art Collins, 9CXX.

AM International Update

October, 1993
AMI Discovery Weekend

by Dale Gagnon, KW1I,
Interim President

Propagation was not ideal for our September 10-12 activity, but it was gratifying to hear quite a few stations on. I made contacts on 160, 75, 40 and one contact on 15 meters. The WB3HUZ/3 island expedition was a highlight of the operating weekend on the East Coast. Andy, WA4KCY, sent in 17 membership applications from AMI activities over the weekend at the Prater's Mill hamfest in Georgia.

Overheard several QSO's where one station was either describing AM operation to a SSB station or the AMI organization to another AM operator. Bob, W2HBE, reports several AM stations he talked to plan to join AMI.

AM Jamboree, November 25-28

Make sure your high and low HF frequency gear is in order for this year's AM Jamboree. Look for other AM operators on 10, 15, and 160 meters over this Thanksgiving weekend. Remember this is an operating event as opposed to a contest, but let's exchange contact numbers as part of our QSO to make things interesting. I encourage you to send in a report of your activity. Your local reports will make this AMI column more informative reading!

Occasional operating events are fun of course, but they have a serious impact. When all of us show up on a few frequency segments once in a while it has the important effect of signaling the rest of amateur radio that AM operations are alive and well and organized!

Membership Hits 350

Five months have passed since the announcement of AMI and the membership applications keep arriving daily. There is a spurt of activity after each issue of *ER* or the *AM/PX* is published or after an operating event like AMI Weekend. But the steady membership inflow primarily comes from AMI regional activity, nets and one-on-one passing of the word.

Treasurer's Report

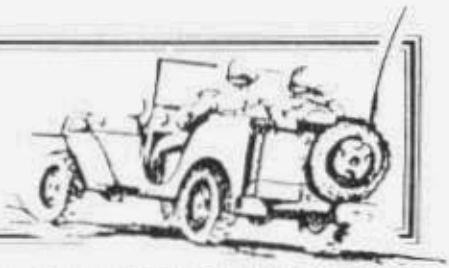
NY2H reports $720 income from memberships and contributions through mid-September. Expenses for the same period were $889.97, which included start-up printing and office materials, copying and postage. Though this puts our financial position $169.97 in the red, we should be in the black before we hit the 500 mark. AMI registered with the IRS as a non-profit organization and received its identification number in September.

Nominations and Elections

AMI will have elected officers by January, 1994. Members can help this process by encouraging AM operators in their regions to run for either Regional Director, Treasurer or President. It seems most of us have plenty of responsibility to keep us busy, even before we get to our radio rooms, but you can encourage the right person to stand for election by offering to help them once they are elected. To have a name entered in nomination for an office, the nominee must be an AMI member and must be willing to serve. If you would like information on the tasks of elected AMI officials, send a request to AMI headquarters. You may nominate yourself. Nominations must be received at AMI Headquarters by November 20. A slate and ballot information will be published in *ER* and The *AM/PX* in December. Voting will occur at the end of December. Electioneering for AMI offices is encouraged on the AM frequencies over the Christmas Holiday! Votes will be tallied independently and will be announced in January. **ER**

AM International
Box 1500
Merrimack, NH 03304-1500

ELECTRIC RADIO IN UNIFORM



by Jim Kearman, KR1S
83 Main St., #13C
Newington, CT 06111-1330

The GRC-109 HF Radio Set

Introduction

Compact HF equipment has always appealed to me. Lately, I've become interested in covert Amateur Radio operation, too.(1) When I saw the GRC-109 advertised in Fair Radio Sales' catalog, I couldn't resist. Earlier Fair Radio ads for the GRC-109 said it had been used by the US Army Special Forces, but I couldn't immediately confirm this claim. I even wrote to a GRC-109 collector whose ad appeared in *Electric Radio*, but received no response, despite my providing return postage. At the US Government Printing Office bookstore in Washington, DC, however, I found a book by Army historian John D. Bergen that answered my questions. (2)

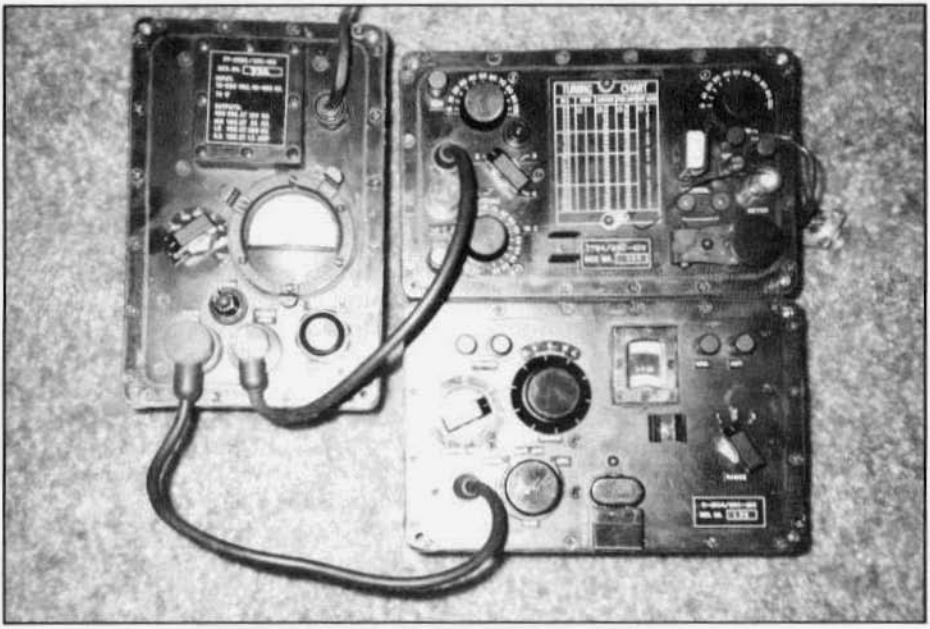
History of the GRC-109

In the early years of US involvement in Vietnam, the Special Forces ("Green Berets") were under the control of the Central Intelligence Agency (CIA), and so could obtain equipment not available from the Army Signal Corps. The CIA was using its RS-1 radio set (which came into service in the early 1950s) to communicate with Civilian Irregular Defense Corps (CIDG) units, consisting of Montagnard tribesmen advised by the Green Berets. The Army chief signal officer arranged to have the RS-1 adopted, with a military model designation. It was not used by regular US or South Vietnamese troops. Although the GRC-109 was already technically outdated by the time the Special Forces began using it in 1962, its rugged construction and reliability kept it in service for the duration of the Vietnam War. (The last US combat troops left Vietnam in 1973; the war between North and South Vietnam ended when the North occupied Saigon, the capital of South Vietnam, in April, 1975.)

GRC-109s were originally used by the Special Forces to communicate directly with the CIA station in Saigon, about 200-300 miles away from camps in the northern parts of South Vietnam. Later, a hierarchy of Corps Area nets reduced the distances the radios had to cover. I don't know what frequencies were used. The 21st Tactical Air Support Squadron HF SSB net used 8825 kHz, and we often had trouble communicating from Phu Cat to Nha Trang, about 150 miles, at night. Another tactical SSB net operated around 7350 kHz. The period 1962-1965 experienced low solar activity, so optimum night-time operation over short distances would have required frequencies around 3 MHz.

General Construction

A basic GRC-109 set consists of a transmitter, receiver and power supply, built into separate, cast-aluminum cases. Covers are held in place by four captured screws with integral handles. (The later GRC-109A cabinets are slightly larger and have hasp fasteners, according to the Fair Radio Sales catalog. I haven't seen a GRC-109A.) All controls and connectors are sealed with gaskets, as is the receiver dial escutcheon. Each case has a removable dessicant cylinder. These radios were obviously designed with dirty, damp operating environments in mind. I wouldn't want to carry a set on my back, but it's easy to see why the Special Forces had so much confidence in them. A soldier could toss these radios into a hole in



GRC-109 components. At left is the PP-2685 ac-only power supply. The T-784 transmitter is at upper right, with the R-1004 receiver below it. The crystal plugged into the receiver is visible at the bottom center of the panel.

the ground and trust they'd work on his return. Cabinets and panels are painted basic black, so they look good anywhere: hootch, bunker or ham shack.

You'll want a power Phillips screwdriver to remove a unit from its case, as there are many screws. Before removing the receiver or transmitter panel screws, though, unthread the dessicant cylinder, as otherwise it interferes with removing the chassis. Operating and service instructions are contained in US Army TM 11-5820-474-14.

T-784 Transmitter

The transmitter circuit would have been right at home in any 1962 hamshack: a 6AC7 Pierce crystal oscillator driving a 2E26 PA. Operation is possible from 3 to 22 MHz, in 4 bands. You peak the oscillator and PA outputs with the aid of neon bulbs mounted to the front panel. A type-47 lamp in series with the antenna helps you tweak the pi network for maximum power output. Even the pi-network coil will be familiar to old timers: it sure looks like a piece of B&W Miniductor stock! The transmitter is built as solidly as it looks: Just what you want when mortars and rockets are exploding a few feet away.

The T-784 features a tiny straight key right on the panel, but an external key can be connected via push terminals. An external high-speed keyer for burst transmission can be plugged into the front panel as well. Dale Gagnon, KW1I, told me he saw one of these keyers at Fair Radio, but I've never seen one. The panel-mounted straight key works well, but is too high above the operating surface to be comfortable. The transmitter PA is cathode keyed, placing a few hundred volts on the key. Watch out. A few years ago I made the transition to a keyer, and the one I use has solid-state outputs. Rather than try to remember the keying polarity of each vintage rig, I use a mercury-wetted relay between my keyer and the transmitters.

continued next page

A handy front-panel tuning chart allows quick tuneup into random lengths of wire. The specifications call for an antenna impedance of 72 to 1000 ohms. The loading capacitor was fully meshed with a 50-ohm load, but I still was able to measure the specified 15-W output on 80-15 meters. I didn't try, but the transmitter probably will load up on 12 meters, although that's outside the specified frequency range. In Vietnam, antennas were magnets for enemy fire, and were usually the most fragile element of a system. According to Bergen, some stations used antennas encased in bamboo pipe, buried underground! (3)

This equipment wasn't designed for long transmissions, and the transmitter case gets warm after a few minutes of transmitting. With normal air circulation around the case, though, I have had no problems. The T-784 requires 450 V dc at 100 mA and 6.3 V ac at 1.5 A.

There are two front-panel crystal sockets. One accepts the common FT-243 holder, while the other accepts holders with larger pins and greater pin spacings. I've had good luck with CW Crystals (see *QST* Ham Ads) FT-243 rocks on 80, 40, 30 (fundamental), 20 and 15 meters. Like any good CW set, the GRC-109 can work full break-in, with one or two antennas. If you connect the receiver antenna to the RCVR ANT connectors, you can dip the final by listening for a peak in received signal. The key shorts the receive antenna line on transmit, a quick and dirty way to protect the receiver (there are also back-to-back diodes across the RCVR ANT terminals inside the transmitter). There is no sidetone oscillator.

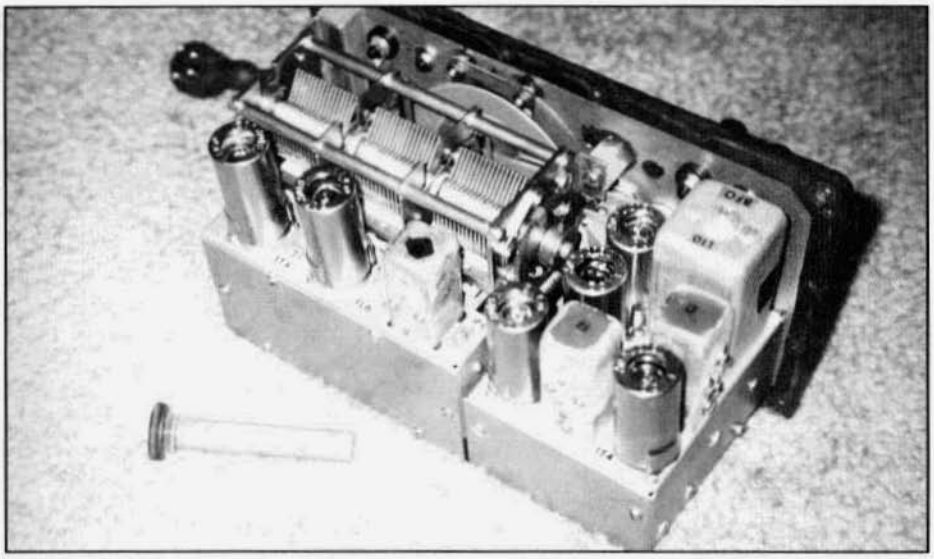
All connections to the transmitter except power and the high-speed keyer jack are made through push terminals. These terminals allow the front panel to remain sealed, and have no parts to fall off, as do screw terminals. I soldered a short piece of zip cord to an SO-239 for use with coax-fed antennas, but my indoor wire antenna connects easily to these terminals. The manual recommends an inverted-L antenna of 100-foot (30-m) overall length, but my 66-footer with short counterpoise loads fine, even at 3.5 MHz.

I always get good signal-quality reports with the T-784. When asked, other stations report no clicks, although it will chirp if the oscillator plate tuning is misadjusted slightly. Peaking on the neon bulb usually gives a stable note. The nominal output power of 15 W is a bit low for crowded conditions on 40 meters, but I've been able to work stations up to about 800 miles (1300 km) away on 40 with my 66-ft indoor wire. The manual claims a range of 75 miles, although operators knew better: the radios were used to cover much greater distances in Vietnam.

R-1004 Receiver

The receiver is a single-conversion superhet with 455-kHz IF. It tunes from 3 to 24 MHz in four bands. IF bandwidth is specified at 9 kHz. The tube lineup sounds more like a Zenith Transoceanic of the period than a piece of military gear: The RF Amp, 1st and 2nd IFs and BFO are type 1T4 tubes; the converter is a 1L6; and the Detector/AF Amp is a 1U5. If you open the receiver, though, you'll see it's no consumer-grade portable. Like the transmitter, the R-1004 is built to absorb the brutal treatment often accorded military gear. The receiver requires regulated 108 V dc at 20 mA and 1.5 V dc at 300 mA.

The receiver has no AGC, so its recovery in full break-in operation is instantaneous (more than may be said for the operator's! Turn down the gain while transmitting.) It also has no BFO on/off switch. To disable the BFO (to listen to Hanoi Hannah, for example), you twist the BFO frequency knob until the BFO pitch is out of your range of hearing! The BFO knob also serves as a fine-tuning adjustment, as the tuning rate is very fast: 150 kHz/turn on band 1 (3 to 6 MHz) and a whopping 750-kHz/turn on band 4 (12 to 24 MHz). More on this later. Aside from the BFO and main tuning controls, the only other adjustment is the combina-



Inside view of the receiver. The dessicant cartridge is shown in the foreground.

tion RF/IF gain control and power switch. Considering the tuning rate, dial calibration is good. Shortwave broadcast stations sound good, which you'd expect with the wide selectivity. I wonder how many Special Forces radio operators were able to mentally escape their inhospitable camps from time to time, through occasional forays onto the shortwave-broadcast bands? As most stations probably depended on battery or hand-cranked generator power, I'd guess not very many.

All connections to the receiver (except power) are through push terminals. I used zip cord to connect the receiver antenna to the RCVR ANT terminals on the transmitter. Another piece of zip cord terminating in a 1/4" phone jack provides a headphone connection. You'll need high-impedance headphones (the H-65/U headset and an adaptor cable came with the original set, but aren't available from Fair Radio Sales), unless you hook up an audio filter, a good idea on even a lightly occupied band! The receiver drifts very little after a few minutes warmup in a constant-temperature environment.

The fast tuning rate and wide IF bandwidth combine to provide very poor performance on the ham bands. The tuning dial includes a logging scale, but it's very hard even to zero beat the transmitter with this receiver. How did Special Forces operators cope? The explanation is given by the front-panel crystal socket. Plugging in an FT-243 crystal disables the internal, tunable local oscillator, and turns the R-1004 into a single-channel, crystal-controlled receiver. Crystal frequency is equal to the operating frequency, plus or minus 455 kHz. The tuning dial now serves as a preselector.

Selectivity is still abysmal for CW operation, but lets you copy stations a few kHz off frequency. I suspect that a pair of crystals per net frequency were supplied to each team. With a receive crystal, you'd only have to set the receiver bandswitch and peak the tuning control. If you buy crystals for ham-band operation, consider the image frequency 910 kHz away, on the other side of the operating frequency. Select the receive crystal frequency to put the image on a frequency from which you're less likely to receive interference.

Power Supply

A GRC-109 set came with two power supplies. PP-2685 operates from 75-260 V

continued next page

ac, 40 to 400 Hz, and supplies all voltages needed by the transmitter and receiver. A front-panel meter indicates line voltage as soon as you plug in the supply. You then set the rotary switch to the nearest voltage (110 or 130 V ac for the US). If you plan to use the GRC-109 at home, this is the only power supply you need. PP-2684 is similar, but an internal vibrator also allows operation from 6 V dc. (A vibrator is an electromechanical chopper for producing pulsating dc.) The PP-2284 supply can also charge a 6-V battery when operating from ac. Receiver and transmitter plug into jacks on the supply's front panels. The line plug has round pins, but I found a Radio Shack adaptor (273-1406) that lets me plug directly into the ac line. Both supplies contain a 0B2 regulator tube to regulate the receiver B-plus line.

Another way to power this rig is with a hand-cranked generator (G-43/G) that produces 450 and 6 V dc. The generator connected to a CN-690 regulator (or the PP-2684 supply) that provides the voltages needed by the receiver. The generator and regulator are not available from Fair Radio, though they once were. A BA-48 battery pack was also supplied to power the receiver alone. A block diagram in my manual indicates that a UG-12 "Power Unit" could be used with the ac-only PP-2685 supply, but the manual doesn't explain what the UG-12 is. I'd be interested in hearing from anyone who has a spare high-speed keyer, G-43 generator or CN-690 regulator.

On The Air

My GRC-109 worked the first time I tried it. Mine was made by the Admiral Corporation, once known for home appliances, and has serial numbers in the 4XX range. I think my equipment was issued, but I doubt it saw service, as there is no sign of use. the cabinet paint was scuffed and the exposed aluminum was slightly oxidized, but there's no wear on the front panels. The date codes on the transmitter tubes are from late 1964.

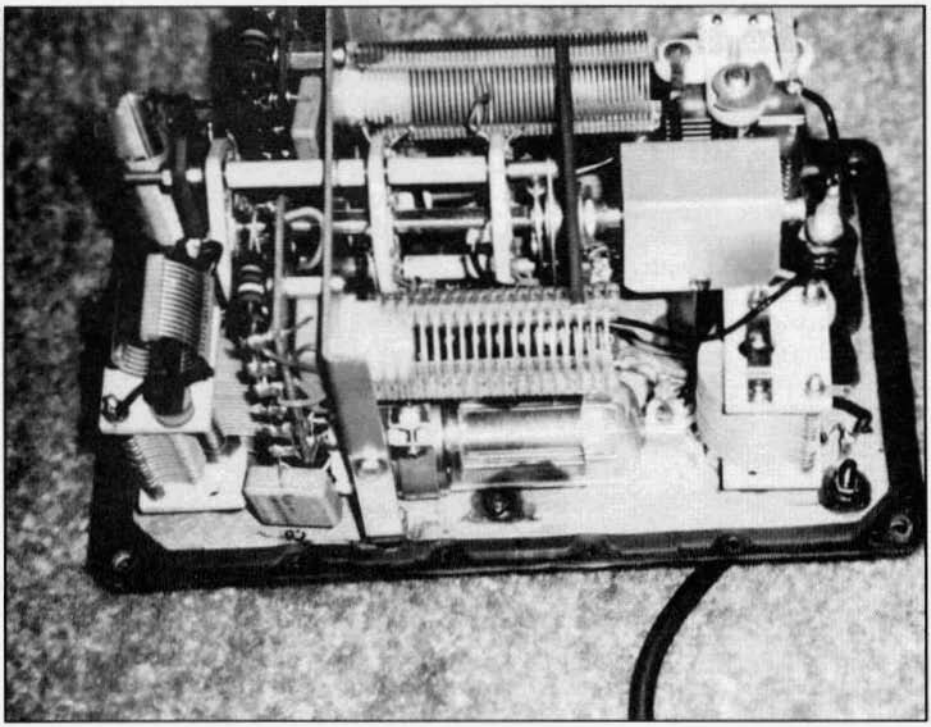
For my first QSO, I loaded up on 7020 kHz, into the shield of the coax that feeds a 14-30 MHz beam at W1INF, the ARRL Headquarters Club station. Red, W2FO, heard me answer his CQ, and we had a good, but short QSO. Short because I was sending with the built-in straight key, and listening without an audio filter. I guess the Special Forces won't be seeking my services, as I fatigued rather quickly.

Because the key is mounted on the panel, I think the equipment was intended to be used with the panels facing up (horizontal). I've been using mine with the panels vertical for several months with no problems. The transmitter tubes are horizontal with either orientation of the case. To prevent strain on the connectors where they plug into the power supply, I raised the power supply case about 3/4 inch with a paperback book.

With a keyer and audio filter, operation is much more pleasant. Crystal-controlled operation requires patience on your part, and some accommodation from the stations you call. Many operators seem to listen only exactly on the frequency where they call CQ. I have crystals for every 5 kHz from 7020-7050, but I rarely call anyone more than a kHz away from a crystal frequency. Still, many stations miss the opportunity to contact this brave, historic rig because they're unwilling to use their RIT controls!

Conclusion

Considering the intended use of the GRC-109, it isn't a bad little radio. Though already dated in 1962, and limited to CW transmission only, the GRC-109 undoubtedly saved many lives in Vietnam. Bergen tells of a siege against the A Shau Special Forces camp (near the Laotian border), when all equipment and power sources were destroyed, except one GRC-109 and its hand-crank generator. Ready access to voice radios had atrophied the CW skills of many operators, but one radioman used that GRC-109 to maintain contact with the outside world until relief got through, two days later. (4) (Let's salute the guys



Inside view of the transmitter. The 2E26 PA is visible at the bottom. The shiny rectangular object at upper left is the bandswitch right-angle drive. Not your average low-power rig!

who cranked the generator, too.) Indeed, Bergen seems almost fond of the GRC-109, and concludes that Special Forces retained it for use worldwide, while discarding "a succession of sophisticated long-range portable radios," because the newer equipment limited their flexibility. (5) The GRC-109 is simple equipment that did a simple but important job very well. ER

Notes

1 J. Kearman, Low Profile Amateur Radio (Newington, CT: ARRL, 1992).

2 J.D. Bergen, Military Communications, A Test for Technology (Washington, DC: US Army, 1986), pp 51-53. (This volume is part of the "US Army in Vietnam" series. Although heavy on the data only a military historian could love, there's enough operational information here to fascinate any fan of military communications equipment. It's available in paperback ($26) or hardcover ($34). (Government Printing Office, Superintendent of Documents, Washington, DC 20402.)

3 Ibid, pp 53.

4 Ibid, pp 164.

5 Ibid, pp 477.

About the author

Jim Kearman, KR1S, is an assistant technical editor at the American Radio Relay League (ARRL) in Newington, CT. A ham since 1962, Jim went to Vietnam in 1968 as a US Air Force forward observer radio operator, attached to the South Korean "Tiger" division. A picture of Jim and some of his other vintage gear was published in September 1993 *QST*. This article appears in *Electric Radio* through the courtesy of ARRL.

Special Event Station Adds To Classic Radio History

by Paul Courson, WA3VJB
P.O. Box 73
W. Friendship, MD 21794

(Dobbins Island, Maryland) -- The first AM Expedition in modern times is a strapping success! Timed with the AMI Discovery Weekend, September 10-12, 1993, this special event station on an uninhabited island in the Chesapeake Bay helped draw attention to the fun possible with vintage radios.

Stephen Ickes lent his call letters to the event, since his home QTH was the closest (in airline miles) to the radio camp -- located about three miles north of the Chesapeake Bay Bridge, and about ten miles southeast of Baltimore. The sound of "WB3HUZ, portable three" generated plenty of excitement as people lined up to talk with us.

One disappointment was 20 meters, where propagation was poor. This limited the results from schedules we had with the West Coast AM Net and a group called IOTA. Islands On The Airwaves, predominantly European and United Kingdom, hunts for rare ham activity from islands worldwide. We had been favorably mentioned in their newsletter on this special use of AM in a vintage station.

We had a great time on 160, 75 and 40 meters, working more than 60 stations in a non-contest, relaxed and conversational style of operating. This easy pace allowed us to describe what it's like to be on an island in the middle of the night with only a gasoline generator powering us to the outside world.

Comparisons with the old TV show "Gilligan's Island" were apt -- we had but one 19-foot powerboat that made six trips to the island ferrying people and gear for the event. Once situated, the camp was a sophisticated (faithful to the era) hi-fi AM station complete with tent lodging, a kitchenette, and farside-tree restroom facilities.

"This is better than my station at home!" exclaimed Steve as we prepared to fire up ahead of our first contact. Others agreed, especially Tim West, N3DRB, who lives in a community that's under severe antenna restrictions.

Our main antenna was a half-wave doublet, cut to 160 meters, fed with open-wire line. It was put aloft in trees on the island through the use of a bow-and-arrow, with fishing line to pull up the support ropes. Height above the bay was about 90 feet, and the wire ran in an east-west direction.

We had a multiple microphone set-up that allowed any one of us to act as a kind of moderator and host -- and actual tx/rx operator -- bringing in selected "guests" among the others along for the expedition who joined in the on-air festivities. In effect, we had a roundtable within WB3HUZ/3 that, in turn, worked single and multiple stations.

We used a tube-type portable broadcast mixing console to orchestrate the audio. This 1960 Gates Dynamote was very popular with AM radio stations of the day, for their coverage of outside (remote) events. For our purposes, it enabled the twelve of us to really share the on-air time as compared with single mic, single operator configuration.

The transmitter was a modified Johnson Viking II, upgraded toward broadcast standards with a Collins commercial modulation transformer, and driven by a hi-fi tube-type Bogen audio amplifier, which in turn was driven by the Dynamote.

Microphones ranged from a vintage Astatic ribbon unit and an Olson desk mic, to contemporary broadcast dynamic mics. These included a Sennheiser 421, and two Electro-Voice models RE-16 and RE-50. These latter two mics gave a spe-

The twelve operators of the Dobbins Island AM expedition. Front row, kneeling, left to right: Buc, W2IPI; Paul, WA3VJB; Steve, WB3HUZ. Standing, left to right: Bob, WA2VMO; Russ, WB3FAU; Dave, K3ZRF; Pete, N2QEI; Ron, WA3WBC; Greg, K3EWZ; Gary, N2INR; Tim, N3DRB and Warren, NY2H.

cial "punch" to the audio when needed during some frequency congestion, since they are designed for outdoor news gathering.

We deliberately avoided communications-quality microphones and restricted audio because of the nature of the event, whose stated purpose was to showcase the natural sound of AM, and its ability to bring a warm and inviting tone to our QSOs in the manner of "broadcast" style ham stations popular 50 years ago.

This philosophy also applied to reception, since we were making a promotional videotape. Receive audio came directly from the hi-fi diode output of a 1967 R-390A, driving another Bogen external audio amp to a bookshelf 3-way speaker. Other taps fed two camcorders and a digital audio recorder.

We were happy to find good receive conditions on 160, 75 and 40 meters, which allowed enhanced bandwidth for most of the time. It was a pleasure to hear (and include in this promotional video) some of the wonderful audio that many stations in the northeast offer.

Twenty-meters was one disappointment, but so was the loss of our helium balloon on Friday afternoon, which would have provided a low-angle vertical antenna for longer range contacts.

High winds all weekend around the Chesapeake Bay region made such an aerial deployment risky. But we thought that with heavy-test fishing line and the antenna wire as sufficient anchors, the balloon would fly just fine. It sure did. The mounting neck ripped away soon after launching, and the balloon, with its sealing clamp apparently still in place, drifted north over Baltimore somewhere and was never seen again.

We gave up an alternative idea to drop a vertical wire from one of the taller trees on the island to ground. The open-wire

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Operating table, WB3HUZ/3 Dobbins Island AM Expedition.

doublet was proving to be a winner on all but 20 meters, and we put the ground radials we had placed in the saltwaters surrounding the island to use enhancing the pattern of the doublet.

The reliability of this old gear is on a par with contemporary radios. We suffered no breakdowns, interconnection was a breeze, and the equipment coped well with occasional AC line voltage fluctuations as the coffee maker cycled on and off.

Indeed, this expedition should put to rest the notion that using anything but the latest plastic radios for field events is a risky endeavor. Add to our expedition the novelty of reviving the sound of how it was done 40-50 years ago (when such events would routinely have been on AM), and it's easy to see why this event might inspire others in the time ahead.

Our thanks and deep appreciation to those who sought us out, gave us some vital encouragement around 4 am when the breeze was pretty chilly, and generally hung out and had a good time with us. Please write with any comments and suggestions for the next time!

AM Expedition Gets Great Reception

The QSL cards coming in from the WB3HUZ/3 expedition show a lot of enthusiasm and support for such events tailored to "Classic Radio."

While AM operations can contribute to mainstream amateur events, it seems the spotlight really shines when we stand on our own. Some early examples:

"A true pleasure to work an AM special event station." -> N2JTD-Paul.

"Looks like a great party — Gates Dynamote, no less — the Viking II sounds great!" -> WA3YPI-Rick.

"I must have jumped in at the right time - I heard it was pandemonium later!" -> WA3JJT-Steve.

"Tnx fer QSO from Dobbins Island and info on AMI." -> W3HVX-Walt.

"I may have been No. 50. . . but you were No. 1 that weekend." -> KD3SK-Bill.

Equipment Prep Made Expedition a Success

The equipment used for the Dobbins Island AM expedition was not that different from what any of us might use at a home station. But there was no luxury of having a workbench nearby to attend to any neglected or unexpected problems that might have been critical under extended operating service and a harsh environment.

The R390-A selected for the trip had already proven reliable as the main receiver at WA3VJB, where it's left "on" for days at a time. The radio also is protected by the fashionable (and now rare) matching cabinet, which includes a fortified rubber shock mount to minimize any impact during transport by boat. This cabinet has tight mesh screening on vent holes to keep out jungle bugs and island dust and dirt.

The receive chain was as follows: R390-A diode output->Bogen AF amp input->hi-fi speaker monitor. Taps distributed local transmit console audio and receive audio to various recorders and "cue" amps.

The Gates Dynamote, as mentioned, was built for portable operation and easily met demands as we brought it back to the kind of rugged service it once routinely saw.

The Viking II was a spare, untested unit off the shelf at WB3HUZ. This allowed Steve to implement audio upgrades and reliability testing without taking him off the air at home.

The modifications included installing a broadcast-quality Collins audio driver transformer, which has the industry standard 600 ohm balanced primary to push-pull grid secondary. This transmitter also features a 200 watt Collins commercial-grade modulation transformer.

The transformer upgrades included the use of fortified mounting techniques to withstand impact during transport.

Also installed: A 47 mFd capacitor off the driver transformer center tap for better regulation of 807 modulator grid bias; increased high voltage filter capacitance (30 mFd); increased 807 modulator screen bypass capacitance (10 mFd); and special aluminum-finned 807 plate caps to dissipate additional heat.

Steve also conducted burn-in testing for subsequent use of new 807 tubes and 6146-B finals in the transmitter, and the rig also enjoyed enhanced B+ from a conversion to solid-state HV rectifiers.

The transmit chain was as follows: Mics->Dynamote->7-band EQ->negative peak limiter->Bogen->Viking II.

We brought, but never powered up, a Kenwood TS-440 backup transceiver. A hand-held, battery-operated Sony shortwave receiver maintained our monitoring capabilities during generator shutdown for refueling. Various other radios included VHF Marine, 2-meter FM, and cellular telephone.

The generator was a Coleman Powermate, 4.5 kilowatt rating, 8 hp air cooled, single cylinder, 4-cycle engine. One gallon of gasoline lasted about 2 hr., 45 mins. (15 minutes less with 900 watt Krups coffee maker on line). The load, in addition to rigs mentioned, included two 25 watt lamps at the radio camp, and one 100 watt drop light at the generator site, located on the far side of the island for noise reduction.

Battery supplies also floated off the AC line to power two video camcorders and one audio tape deck, and there was occasional use of a 400 watt "light bar" during critical videotaping. **ER**

Editor's Note:

It seems to me that more of us should be getting out on 'expeditions' like this. Not only would we be having a good time but we would also be doing a great 'PR' job for AM.

Thermionic Mysteries

by Ray Osterwald, NØDMS
10679 West Dartmouth Ave.
Lakewood, CO 80227

I'm sure many ER readers have experienced lots of visits from that pesky gremlin "Murphy", and it probably seems that over the years you've seen more than your fair share of him! Working with vintage technology as we do, there are times when restoring hollow state gear seems to be 50% skill and 50% sorcery. There are some very strange things that tube circuits can do to an unwary technician.

The causes behind this unpredictable behavior are not shown on any data sheets or listed in the tube manuals. Some of these causes, although they once might have been common knowledge, have been mostly forgotten. For example, why would a certain tube check good on the most reliable tube tester in the shack, but refuse to work in one particular circuit? The really frustrating part comes when the same tube works just fine in a seemingly identical circuit in another piece of gear. Perhaps a little insight into the exotic technology which causes such bizarre problems would clear up some of the mysteries.

Cathode interface resistance caused circuit problems for years, and was a direct result of the manufacturers' efforts to produce high-emission cathodes at low cost. This effect is caused when a thin resistive layer forms between the cathode's base metal and its barium-oxide coating after the tube has been in service for some time. When the resistive layer expands, a capacitor is formed. The base metal becomes one plate and the coating the other. In a new tube, the interface resistance is nearly zero, but over time it can increase to as much as a few thousand ohms. The total capacity can approach .01 uF. This capacity acts as a load on circuit constants, and partially explains why a particular tube might have differing performance in different pieces of equipment. The newly-developed resistance and capacitance has an associated R-C time constant, which will affect an amplifier's performance by changing its rise time and frequency response.

When a fast rising signal is applied to a stage having cathode interface resistance, the interface capacity acts as a direct short across the interface resistance for a short interval. The resultant RC time constant causes a loss of low frequency gain, while the high frequency gain is nearly unaffected. A fast-rise square wave will show cathode interface problems as overshoot on the leading edge. It is most noticeable in broad-band amplifiers and in circuits where the plate current is cut off for long periods. A typical broad-band amplifier is found in the vertical input channels of your trusty tube-type'scope. A tube that spends long periods under cut-off might be found in transmitters, noise blanker pulse formers, or other equipment using gating and multivibrator circuitry.

In the tube computer days, cathode interface resistance was called "sleeping sickness" because the tube would refuse to pass a current pulse when the program required it to do so.

Cathode interface resistance problems were eliminated, but not until years of research were spent by teams of metallurgists and chemists. Tube cathode coatings were traditionally made from various mixtures of carbonates. One of the last steps in tube manufacture was to evacuate the tube's envelope with a high-vacuum pump. At the same time as the

tube was being evacuated, the entire assembly was raised to a high temperature, which broke the cathode coating down into oxides. This formed a thin layer of pure barium over the new cathode, which gave lots of emission over a long period. This is just what we want in a high-performance tube. However, in order to produce the pure barium layer without liberating any oxygen (which would have defeated the vacuum), a reducing agent was added to the cathode base metal. The reducing agent consisted of very small quantities of impurities, usually less than 1% of the total composition. Then, while experimenting with various types of these impurities, and almost by accident, it was discovered that a cathode base material having extremely low silicon content would inhibit the formation of the cathode interface resistance. This low-silicon cathode was used in nearly all of the later tube designs and was generally successful in preventing cathode interface resistance, even after thousands of hours of use.

An effect similar to cathode interface was known as "blackout". This gremlin only shows up when a control grid is driven positive, such as in a class AB-2 modulator, or stages which operate in class C. In a tube with blackout, a positive voltage pulse will cause the plate current to decrease sharply, the exact opposite of the expected result. This gives the effect of a radio blackout and was first noticed with early radar installations during World War Two. A transmit pulse would return from a target and cause the receiver to go dead! It was at first thought that the enemy had discovered some sophisticated new countermeasure, but it turned out to be just another visit from Murphy.

As with cathode interface, blackout was caused by a step in the tube manufacturing process. The exact location was never known for sure, but it was known that somehow a semi-insulating layer was deposited onto the surface of the control grid wires. This layer formed a capacitor, in which one plate was the grid wire itself, and the other plate was the layer of electrons which were eventually collected on the semi-insulating layer whenever the grid was driven positive. Then, the tube developed its own internal bias, a weird sort of internal grid leak.

This semi-insulating layer on the control grid wires sometimes has a negative temperature coefficient, and will drive an oscillator circuit crazy. It will make a class-C oscillator unstable or hard to start. Because of the temperature effects, it might disappear after 5 or 10 minutes, while in another similar circuit it might begin after a similar interval. Troubleshooting obviously becomes pretty frustrating. During the tube television days, blackout caused loss of horizontal sync until the set reached operating temperature, which is why is was necessary to get the set warmed up before Uncle Murphy came on!

The only known way to cure blackout is to swap out tubes until the circuit works. Don't throw out the offending tube though, as it will work just fine somewhere else.

Would you believe that a tube can act like a transistor? It can, when "DC shift" is present! DC shift isn't seen too much with transmitters and receivers, but it is common in tube amplifiers which must respond to AC and DC signals. In a voltage amplifier with DC shift, the gain is less for DC signals than it is for AC signals. This is common with tube-type 'scopes, and the better ones have an adjustment to compensate for it.

DC shift is generally attributed to the "Sproull Effect", which is described as the formation of a semiconductor-like donor depletion region near the emitting surface of a hot cathode. Similar to the way a transistor becomes a current amplifier, DC shift is caused by the voltage drop across the resistance of the cathode depletion region. There is an associated time constant of 1 or 2 seconds, in contrast to

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News From The Southeast

Annual Southeastern Division Swapmeet

by Andy Howard, WA4KCY
105 Sweet Bay Lane
Carrollton, GA 30117

There were several people setting up tables of equipment when I arrived at Prater's Mill around seven o'clock on the morning of September 11. Two AM operators, Jimmy (KQ4S) and Lou (K4MNY) had spent the night at the swapmeet site and were preparing breakfast. As you might imagine, coffee brewing and breakfast in the pan serve as a very nice greeting at that time of the morning after driving over a hundred miles. After a cup of hot coffee and a stroll around the site I got started setting up the AMI banner and my part of the homebrew equipment display. Lastly, my items for sale or trade were set up and I settled in a lawn chair to await the arrival of the thirty or more AM operators expected to participate.

What a great day for a swapmeet! Temperature around seven in the morning was 58 degrees and it was expected to reach 85 that afternoon. Prater's Mill is an old grist mill built in 1865. It is located just north of Dalton, Georgia, in the foothills of the north Georgia mountains. Many years back the area was turned into a recreation site with a large shed and lots of parking space. Being centrally located in the southeast it makes an ideal location for AM operators to get together for an annual swapmeet.

By nine o'clock 30 to 40 AM'ers had arrived along with a couple hundred other hams and the place was really buzzing with activity. There was a vast array of nice gear displayed. Some items seen included a pair of B & W 5100's, an HT-37, a GPR-90, DX-60's, a Globe Chief, several vfo's, a Viking II with vfo and parts galore. There was a good selection of SSB equipment also but as you might guess it did not receive much attention from the AM crowd.

One of the highlights of the meet was the homebrew exhibit. Some equipment included my 4-125A transmitter, a regenerative receiver and a shortwave crystal set. Jim, W4PNM, brought a great looking 4-1000A amplifier that was capable of running class C as well as AB2. He plans to modulate it with a pair of 4-1000A's when the transmitter is completed. Other items on display included a speech amplifier and a 6146 transmitter that was modulated by a pair of 2E26's. This display received a lot of attention from AM'ers as well as the other operators in attendance. I hope that this part of the swapmeet can be expanded even more next year.

Marc, VE3GIX, from Windsor, Ontario, was one of the early arrivals. Marc is an aspiring AM operator who collects vintage equipment. It seems that he listens to the Southeast Swapnet Tuesday evenings and had heard Prater's Mill discussed. About a week before the meet I received a call from Marc wanting information and directions. As he was planning to be in the southeastern area he wanted to attend an outdoor swapmeet. Marc told me Prater's Mill was the best swapmeet that he had attended and was planning on a return trip next year.

I compiled a list of 30 known full-time AM operators. There were others in attendance who work AM occasionally but didn't know them as well as the 30. Also a large number of SSB operators came by to say hello and voice their support for the AM cause. It is surprising how many nice comments are generated by the AMI banner and brochures. There were a total of 17 new AMI members who signed up at the AMI display. People seem to love nostalgia. Give them an AMI brochure and a copy of *Electric Radio* and they are ready to sign up.

Next year promises to be even better. What better way to spend a late summer Saturday than with good fellowship, AM equipment and southern hospitality. Stay tuned to 3.885 for further information on next year's event. **ER**

Part of the very large contingent of AM operators in attendance at Prater's Mill.

Hank-W2IQ, Rex-K4JBJ, Jim-W4PNM, & Andy-WA4KCY are shown discussing the various aspects of building equipment. Note 4-125A transmitter and 4-1000A amp under AMI banner in background.

LETTERS

Dear ER,

It was with interest that I read Jim Hanlon's informative article on the National SW-3 (ER, August, 1993).

For those who have access to older QST's there is an excellent article by James Millen, W1AXL, of The National Company, in the September 1931 issue. Millen fully reviews National's development of the SW-3 in his article which will complement Jim Hanlon's recent presentation.
Joe, K7MKS

Dear ER

In regard to your question about setting up an awards program. I am in favor of periodic events, like an AMI weekend. I am not in favor of awards such as WAS or some such. My feeling is that the awards programs sponsored by ARRL, CQ and others are the root cause of the QRM, rudeness, and quick in-and-out QSOs that have become the rule rather than the exception in ham radio today. Let's keep encouraging AMers to get to know one another and not promote quantity-over-quality communications.
Rob, NS6V

Dear ER

Last week I was fortunate enough to acquire a National NC-300 receiver (S/N 460-0955, built 7/26/58). It was in decent shape electrically and cosmetically except someone had messed up the alignment. I made a preliminary realignment in order to evaluate the overall performance and to drive out any accumulated moisture. During the shakedown period I had to replace the filter capacitor (C62A, B and C) but there was no evidence of other repairs or modifications. National sure used high quality parts.

I want to thank you and Dennis, KØEOO for the update modifications in ER #41. I used all of them except #10. My set had 6DK6 tubes in the V4 and V5 IF stages with plenty of extra gain. I am very, very pleased with the performance of the modified receiver. By the way, if V2 wasn't so hard to work on I would consider changing it to a quiet twin-triode.

I plan to use the '300 with my Invader 200.

Again, thanks for an informative and helpful article.
Albert A. Roehm, W2OBJ

Dear ER

Ten meter AM enthusiasts should circle their calendars. A recent W1AW code bulletin had this to report:

"Currently, solar flux is expected to bottom out for the cycle in January or February of 1997 with an average value of 72. The peak for the next solar cycle, while difficult to predict, is expected to be around the turn of the century when solar flux reaches average values near 200 in August, 2000, seven years from now."

It was nice to see you and your lovely office manager at the Albuquerque Hamfest in August.
Ken, KC5DW

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 net starting at 5:00 CA time; **40 meters** - 7160, 7195, 7290 are the main freqs. Westcoast AM'ers net every Sunday afternoon, 4:00 PM on 7160; **80 meters** - 3870, 3880 and 3885 are the main freqs. Westcoast swap 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 summertime activity, but during the winter signals can be heard anywhere on this band.

From the Editor

Classic Exchange Information

I have to apologize to Stu Stephens, K8SJ and Jim Hanlon, W8KGI and the rest of the folks involved with the Classic Exchange. I missed announcing their September 26-27, 1993 Fall Classic and Homebrew Exchange. I'll announce their 1994 Winter Exchange now and I'll try to print a reminder closer to the date of the event which is February 6-7.

For those unfamiliar with the Classic Exchange I'll quote from their newsletter, "It is a celebration of the older commercial and homebrew equipment that was the pride of our ham shacks and our bands just a few short decades ago. Our object is to restore, operate and enjoy older commercial and homebrew equipment with like-minded hams. A Classic Radio is at least ten years old, an advantage but NOT required to operate in the Exchange. YOU CAN USE ANYTHING, although new gear is a distinct scoring liability. Exchange your name, RST, QTH, receiver and transmitter type (homebrew send final amp tube or transistor) and other interesting conversation. The same station may be worked with different equipment combinations and on each band on each mode. CW call "CQ CX", phone call "CQ Classic Exchange." Suggested frequencies: CW up to 60 kHz from low band edges; phone 3880, 7290, 14280, 21380, 28320; Novice Tech 20 kHz up from lower band edges...

" Scoring: Multiply total QSOs (all bands) by total number of different receivers plus transmitters plus states/provinces/countries worked on each band and mode. Multiply that total by your classic multiplier, the total years old of all receivers and transmitters used, three QSOs minimum per unit. If equipment is a transceiver, multiply age by two. If equipment is homebrew, count it as a minimum of 25 years old unless actual construction date or the date of its construction article in the case of a "reproduction" is older.

" Certificates and appropriate memorabilia are awarded every now and then for the highest score, the longest DX, exotic equipment, best excuses and other unusual achievements. Send logs, comments, anecdotes, pictures to Jim Hanlon, P. O. Box 581, Sandia Park, NM 87047 or to Marty Reynolds, AA4RM, 1395 Carolyn, Atlanta, GA 30329. Include SASE for newsletter."

In a forthcoming issue we will have a report from Jim Hanlon, W8KGI on the Sept. '93 Classic Exchange.

Are you a member of AMI? If not send $2 to AMI, Box 1500, Merrimack, NH 03054-1500. AMI promotes and protects AM, we should all be members.

Good Audio Mania

by Gary Halverson, WA9MZU
1751 Michon Dr.
San Jose, CA 95124

Having the ability to perform on-air evaluations of different microphones and equalizations is a fast and fun way to zero in on the right mic for your voice and transmitter. The right mic with the right equalization can make a significant difference to your on-air "signature" by providing you with a distinctive sound that complements your unique voice characteristics. This is my story.

The MegaMixer

A mixing console is an essential component for the Good Audio Maniac (Staples, ER #49).

Although having a variety of mixers, I was lucky enough to acquire a Collins 212A-1 for the main operating position. This is very impressive two-channel console from the late '40s having six mic preamps, up to 10 remote line inputs and two transcription inputs. A very large mixer with a sloping front panel, it easily accommodates the primary station receiver and an exciter on its flat top surface at a very comfortable eye level.

When the 212A-1 was acquired, a partial restoration had already been performed. All the old gooey tape labels over the rotary attenuators had been removed and the unit had been given a good washdown. Since Collins tended to use oil-filled capacitors in the signal path of their broadcast audio equipment, it was not necessary to recap the individual preamps and line amps. The external rack-mounted power supply was brought up slowly on a variac while watching a wattmeter, just in case the electrolytics were bad. Upon connecting the console to the power supply, I was delighted to find everything working just as it had some 40 years ago.

It's probably rare for a piece of broadcast gear that's been around for as long as this equipment has to not have had some little "tweak" modifications and customization added by two generations of B/E's. Removal of these mods put the functions and controls back to stock, thus making it much easier to follow the original documentation.

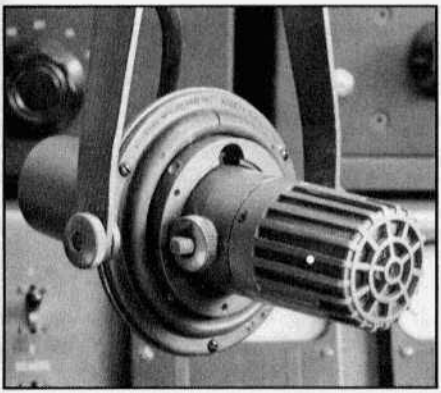
Next, the new audio lines were installed. The original lines were all balanced low-impedance lines containing a twisted pair with a braided shield. Experience has proven that the use of fresh, 100% shielded balanced audio cable avoids feedback problems when using your mixer in close proximity to the transmitter (in the same room). My first experience using a mixer on AM was punctuated by a dazzling fireworks display when I first keyed the transmitter. The shield on the audio line from the mixer to the transmitter leaked like a sieve causing major audio feedback, which fired the transmitter's protective high voltage spark gaps. Had it not been for these spark gaps, I would have undoubtedly joined the ranks of Peter Dahl customers.

Except for the mic lines, all 600-ohm input and output lines were terminated to a patch bay for configuration convenience. A passive equalizer, a monitor amp, VU meter panel, and a Collins 26W limiting amplifier acquired in a horse-trade were also mounted in the rack containing the console's companion power supply. Provisions were made for four mics, including a guest mic. The output of the console was fed to the 26W limiter. The limiter's output was in turn fed to the transmitter's phone patch input.

Mic Surprises

The real fun came in experiencing the different mics. My preliminary tests involved using a good quality pair of head-

Sitting on the Collins 212A-1 console is a 310A-1 exciter and a 75A-1 receiver. Out of the picture, to the right is a rack containing the speech processing equipment.



RCA BK-5

phones (having a good seal around the ear) to monitor the output of the console and limiter **(CAUTION: be very careful of feedback when wearing headphones near an open mic)**. The difference between mics was like night and day. It soon became apparent that not all mics are created equal when it comes to ham AM operation. Several specimens went right back on the display shelf. Subsequent on-air tests confirmed my findings.

I selected a sexy RCA BK-5 as the main console mic, shock-mounted on a boom. This is a high-quality broadcast ribbon mic from the '50's having characteristics somewhat like the famous 77DX. Since it is desirable to equalize microphones individually as opposed to equalizing the output of the console, it was necessary to feed the BK-5 into a Collins 212Y remote preamp, which in turn fed a 116F passive equalizer. The 212Y provides up to 85 dB of gain, necessary to raise the low output level of the ribbon mic, and to compensate for the 30 dB insertion loss of the equalizer. The equalizer output is then fed to one of the console's remote line inputs.

Although some low-end cut was expected, I was surprised at how much 200 Hz attenuation was required to neutralize the mic's excessively "fat" low end. Further experimenting determined that the "V2" position on the mic's response characteristic switch sounded the best. The high end also needed to be brought up considerably, and a pop filter placed on the mic.

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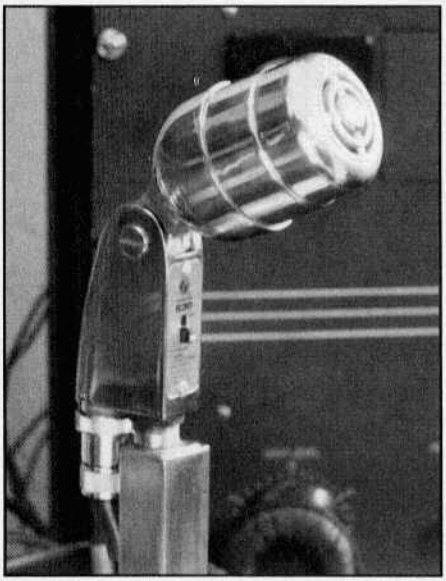


EV-630

RCA 88-A

An Astatic D-104 was going to be the reference mic, however, the only one not already in use at another operating position was an amplified version. This is great, I thought, since the low output impedance and high level output of the amplified D-104 could go directly into one of the console's line inputs. In wiring this mic to the console (no equalization), I was amazed that the DC pulse coming out of the mic (when the push-to-talk bar was pressed) nearly wrapped the VU meter needle around the peg. If this D-104 could ping the VU meters, I feared it could also whack the modulation transformer. Enter an Electro-Voice 630.

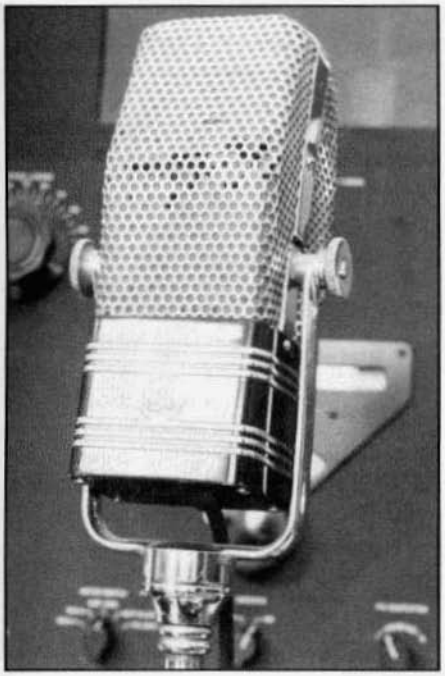
The EV-630 is a general-purpose dynamic mic also from the '50's. Because its output level is lower than that of the amplified D-104, it was necessary to go into one of the console's mic preamps. A high-to low-Z in-line transformer was required to match the mic's output into the console's 600-ohm input.

The guest mic was an RCA 88-A pressure mic on a "baby-boom" allowing it to be swung out of the way when not in use. This is a cute little dynamic from the 40's that looks like a miniature 77DX.

The original non-amplified D-104 connected to the transmitter's mic input was retained as a reference mic, and for transmitter keying since I couldn't find any unused lever switch contacts on the console. The only problem here was the inconvenience of having to turn up and down the mic gain control when making comparisons to the console mics.

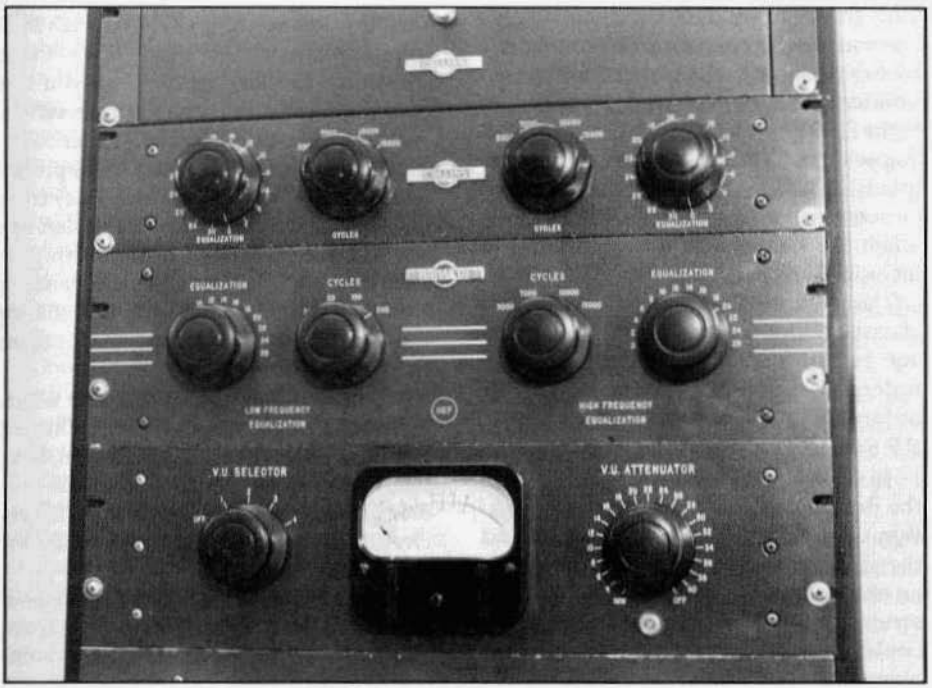
As mentioned previously, the output of the console is fed to a Collins 26W limiting amplifier, which in turn feeds the high-level phone patch input of the transmitter. The compression setting really depends on individual speaking habits. Personally, I tend to move in and out from the mic, and also not maintain a very uniform speaking level. Here, the 26W really picks up the slack.

continued on page 33



RCA 44DX

RCA 77D



Collins 26W limiting amplifier, VU meter panel and 116F passive equalizer.

T-8040 — A Homebrew 80 and 40 Meter Transmitter

by Walt Hutchens, KJ4KV
3123 N. Military Rd.
Arlington, VA 22207

Part Two

The T-8040 was built as a companion to the R-8040 80 and 40 meter receiver so it was to be the same shape and size (7" x 7" chassis and 6" x 9" panel), be similarly lightweight and transformerless and be able to operate AM or CW. The list of 'wants' covered in Part One (*ER*, July, 1993) also included a carrier output of 50 watts or more, full modulation with protection against overmodulation and speech clipping and filtering for maximum talk power. I wanted a conservative design with reasonable protection against loss of drive and other PA tube-killing problems. The outlines of the design (two 22JF6 sweep tubes in parallel modulated by another pair) were discussed in Part One; this time we'll look at some details.

A busy summer here made it impossible to include some of the planned features in time for this article; they (and some changes to the R-8040) will be covered in the future. A package containing larger circuit diagrams, a parts list and more than 10 pages of notes will be available from me for $6 when the final article is ready and will include changes made to that date.

The 33-page (plus large schematics and chassis layout sketch) R-8040 note package is still available; the price is $8 if ordered separately or a total of $12 if ordered with the T-8040 notes.

RF Section

In addition to the 50 watt power level, the design considerations in the RF section were stability, ease of tune-up, and the ability to use either crystal control or an exciter input from the R-8040. While a strictly crystal controlled transmitter could have been done with two stages, operation with either a crystal or low level exciter input required four.

V1A, a 12AU7, operates as a Pierce crystal oscillator with the plate grounded for RF; this is essentially a crystal-controlled Colpitts oscillator. I used with only minor changes a version appearing as Preferred Circuit 101 in 'Handbook Preferred Circuits Navy Aeronautical Electronic Equipment', Vol. 1, 1963. This oscillator works on a wide range of frequencies just by changing the crystal and there is no tank circuit to adjust. To get the best isolation, output is taken from the cathode. The only important disadvantage is somewhat low output but the amount of gain needed for the exciter input is adequate here as well — and one can hardly go wrong running a crystal at a low level.

Since the circuit oscillates on any frequency, it is possible to use 160 meter crystals on 80 or 80 meter crystals on 40. In SPOT position SPOT/KEY switch SW3 applies plate voltage to this tube without operating the keying relay so you can hear the crystal frequency in the receiver.

V1B serves as a class 'A' buffer to increase the voltage and power to the proper level to drive V2; if a half frequency crystal is used, V1B operates as a doubler. The use of this stage following the low impedance oscillator output gives outstanding isolation: nothing you can do will change the transmitter output frequency by more than five CPS.

V2, a 10GK6, is a class-C driver which operates straight through on the channel frequency. Because it has high gain, careful shielding and neutralization are necessary for stability. The V1B and V2 plate circuits are ganged and operated by the driver tune knob.

The final amplifier, V3/V4, is a pair of 22JF6 TV sweep tubes. This tube type was chosen because it has relatively high emission, it is less than 3-1/2" tall, its 0.45 amp filament fits the series string arrangement

The T-8040 Transmitter. The panel was designed to match the R-8040 as closely as possible.

and with 17 watts per tube plate dissipation two tubes can put out over 50 watts without pushing.

In fact, the 17-watt rating is certainly conservative. Since there is hardly a more 'Continuous Commercial Service' than 12 hours per day closed up inside a cheap TV set, the equivalent ICAS rating is probably 25 watts or more even before the cooling fan is considered. During testing, I routinely ran the final at over 200 watts dissipation for a few seconds with no sign of damage.

One important disadvantage is a 22 mmF (instead of 15 mmF for the 6146) input capacitance; the capacitor in series with the final grid was needed to allow reaching 40 meters without a bandswitch.

The pi network output circuit is conventional. A two-turn loop around the midpoint of the coil gives the necessary low-impedance output for the R-8040 receiver; on transmit the receiver antenna lead is disconnected from the loop and grounded. Taking the receiver antenna connection from the transmitter tank gives an additional few dB rejection of out-of-band signals.

Two band transmitters are sometimes built without bandswitching the final tank but doing so means reduced power on one band or the other. The physical layout of the bandswitch and the driver tank would allow bandswitching the driver if desired in order to produce an all-band transmitter.

Speech Circuits and Modulator

Since the amount of capacitance needed in the power supply is proportional to the current which must be supplied, the modulator had to be as efficient as possible. I decided on a pair of 22JF6's in the screen grid driven class-B circuit both for efficiency and (since no screen supply is needed) minimum complexity.

To help get rid of the frequencies below 300 cps ahead of the clipper, the modulator was planned around a Radio Shack 21-1175 CB mic. The response of this dynamic unit peaks at 2000 cps and drops 6 dB below the peak at 350 and 5500 cps — fairly typical 'communications' charac-

continued next page

T-8040 Transmitter from previous page
teristics. Additional advantages are the built-in preamp and gain control and (in this not too quiet shack) the noise cancelling construction.

The output of this microphone is around 100 millivolts peak-to-peak at normal speech levels and the maximum mic gain setting. This is raised to about half a volt by the mic transformer. A 12AT7 is used as a speech amplifier; negative feedback from the output plate to the input cathode improves linearity and sets the gain at 150.

A series diode clipper circuit follows the speech amplifier; it is adjusted by a control on the back of the set to limit the audio signal leaving the clipper to that required to produce full modulation — roughly nine volts. With the mic output at maximum this represents 18 dB of clipping, which is about the value for maximum intelligibility. When band conditions are good, reducing the gain control (a thumbwheel on the mic case which operates an audio taper pot) from '10' to around '8' eliminates the clipping, giving more natural voice quality.

Clipping a signal produces harmonics — multiples of the input frequency which may be outside the useful speech bandwidth; the choke and two capacitors at the input to V6A filter those out. The clipper and filter aren't installed yet so the values shown in the diagram are probably not the final ones.

Since the grids of a class 'B' stage go positive, they need considerable driving power. Often this is done with a power tube and interstage transformer but near the ends of its frequency range a transformer shifts the phase of the signal. Not only does this phase shift mean unwanted distortion but it prevents using more than the bare minimum of negative feedback around the modulator tubes and 'iron' which are the parts most likely to be nonlinear. (As the frequency goes up, the phase shift makes what was planned as negative feedback into positive feedback and the stage oscillates.) Driving the grids with cathode followers from a phase inverter greatly reduces phase shift.

V6, a 12AT7 phase inverter, drives the halves of a 5687 (a high transconductance dual triode) which operate as cathode followers directly coupled to the 22JF6 grids. Negative feedback from the modulated voltage output to the phase inverter input improves the linearity, reduces the hum level, and fixes the gain of this section at about 100.

This phase inverter circuit may be unfamiliar. V6A is driven by the speech amp. If the drive to the V7A/B grids was equal and of opposite phase, point 'A' would be at a constant zero volts so V6B would get no input and produce no output. In that case, however, point 'A' would have half the output voltage of V6A which would cause V6B to produce a large enough output to more than cancel the effect of the V6A output at 'A'. What actually happens is that point 'A' runs with just enough signal to deliver outputs of opposite phase and almost equal voltage from V6A/B — the difference in the outputs is proportional to one divided by the voltage gain of V6B.

A 40-watt autotransformer intended to convert 240 VAC to 120 VAC is used as a modulation transformer. This is a better part for this job than I expected: the reactance of a half winding is about 21,000 ohms at 60 cps so the low end frequency response is good and the half winding resistance is less than 30 ohms. The modified Heising circuit keeps the DC final plate current out of the autotransformer; this is important since it is not designed for use with DC current in the winding.

The only part of the audio chain which isn't inside a feedback loop is the clipper/filter circuit.

Power Supply

The filaments are in a series string; the tubes chosen add up to 122 VAC at 0.45 amps.

A half wave rectifier supplies the low B+ of 160 volts. This voltage is filtered by a choke and capacitor for use on the speech

The T-8040 transmitter and R-8040 receiver in the beginnings of a wooden case. A removable top cover will hold headphones, line cord, flashlight and other essentials such as reading material for those times when both bands are dead.

stages and the crystal oscillator and buffer. The unfiltered 160 volt output is used by the modulator driver and forms the first step of the half wave tripler which delivers the 470 volt high B+ for the 10GK6 driver, finals and modulator.

L1 spreads the rectifier current pulses and thus reduces the peak current; a choke is used instead of the usual resistance because it gives much better voltage regulation. Using a choke with diodes rated at 3 amps average current makes a tough HV supply; when I accidentally shorted the 470 volt output during testing only the line fuse had to be replaced.

Line operated sets should not send voltages to the outside world since the direct path to the line could cause a fatal shock if the outlet used is wired incorrectly. Since the voltage which operates the keying relay goes to the mic or key, a small transformer-operated supply provides 12 VDC which is isolated from the line. This voltage also runs the blower.

Miscellaneous

Keying is done by K1, which switches the receiver antenna connection and turns on the PA screen, driver, crystal oscillator and speech amplifier. The VOICE/CW switch isn't hooked up yet so CW operation isn't allowed. The TUNE/STBY/OPERATE switch turns off the B+ in STBY and adds an extra resistor in the PA screen circuit in TUNE.

Few builders would include a blower in a rig this size but the reasons are the same as in a larger set: cooler operation means longer tube and parts life, and less heat reaching the frequency determining circuits means better stability. Mounting the fan on a plate above the tubes not only gives efficient air flow but makes it hard for a wandering hand to reach the plate caps.

The fan is a midget 1-9/16" square unit from Radio Shack. One disadvantage if using a Radio Shack fan (any of their fans in my experience) is that you have to spend an hour or so balancing it unless you

continued next page

want to listen to a rotational frequency rumble and (probably) replace the fan in a few hundred hours. Because it reduces bearing friction balancing also increases the amount of air the fan moves. It's not hard — use a wad of masking tape stuck on the hub to locate the light side, then carefully clip the opposite blade — but it is tedious.

The R.S. mic and their small parts seem to be okay but geez. . . those fans, their unspeakable clip leads, and a whole lot of other stuff. Ford has discovered that quality sells and even IBM is beginning to believe that what your customers think of you might be important. Radio Shack, do you know how many other nouns customers substitute for 'Shack'? Is anybody there even listening?

When the PA cathode current goes above about 600 mA, K2 opens the keying line turning off K1. The capacitor across K2 holds the relay open for something like 1/8 second, then the keying circuit is closed again and if the overload condition is still there, the cycle repeats. The clatter from K1 serves as an overload warning. K2 is a reed relay so it operates very quickly; the average cathode current during overload conditions is only a few percent of the normal reading.

The small cathode resistors let you select a matched pair of finals. Just hook a multimeter to the jacks and swap tubes until you get the lowest voltage when the set is keyed. Since these are 1/4 watt carbon film resistors they also serve as fuses in case of a heater-cathode short or an overload not handled by the relays. You can't put this much resistance in the modulator cathodes but they are connected with no. 30 wire to provide protection there too.

Metering is provided for the 470 volt supply, the driver and PA grids, and the PA and modulator cathodes. The 'COMP' (compression) position is for a function which isn't yet installed.

On The Air With The T-8040

When I finished the first part of this article I had made a couple of AM contacts with the set; only 'details' remained to be straightened out. You might not be surprised to hear that those details took three months of work. However, Editor Wiseman is of the opinion that readers want more than one article per issue, so you will be spared. There were actually few problems that either an experienced designer or a builder working from an existing plan would have hit.

The T-8040 actually delivers about a 60 watt carrier. Because the high voltage isn't that high and falls somewhat under full sine-wave modulation, the 'scope seems to show that the set doesn't modulate over about 80% in the positive directions, but when transmitting normal voice it does hit 100%.

The carrier has a 60 cps ripple or about 4% which is a lot more than I like (older Handbooks call for 0.5% or less on a phone transmitter) but even when I ask no one seems able to hear it. Most of the hum comes from the speech amplifier and can be eliminated with further work. The likely sources are (1) capacitive coupling across the mic transformer of the 0.25 volt 'trash' signal between the chassis and the line 'neutral'; (2) inductive pickup from the nearby 160 volt filter choke; and, (3) heater-cathode leakage in the tube.

The modulation is crisp and clean and brings good reports. In between knocking off the remaining problems, I'm having a lot of fun using the set. And I'm looking forward to making it transceive on the R-8040 frequency and finishing up the case so the pair can be used more easily in portable operation.

Conclusions

The T-8040 shows 'transformerless' transmitter design at its best — and perhaps also at its worst. The use of receiving-type parts makes it outstandingly light and compact for the power. Lighter and smaller parts definitely simplify construction, for example the chassis is aluminum but reinforcement was needed only under the modulation transformer.

On the other hand the need to isolate the common from chassis ground is a pain and there are almost as many parts as for a much larger and heavier set. Though they are smaller and less expensive they are not tiny or cheap; the 7" x 7" chassis is well filled and unless you have an unusually good junkbox, costs will run well on the high side of $100. For example, 22JF6's are a few dollars each (flea markets, more if from a mail order dealer), filter caps $4 or so, the fan is $20 from Radio Shack, press-on lettering, paint, tuning caps. . .

The PA overload protection and cooling fan made construction somewhat more work but they have been well worth it. This is the first transmitter I've built that didn't need at least one set of new finals during initial testing.

Looking at the design shortcomings, tuning the driver over the range 3.8 to 7.3 Mcs in one band was a mistake. The input capacitance of the 22JF6 finals totals 44 mmF. With the compact 150 mmF/section tuning capacitor I used it is not possible to cover the whole range with that much capacitance directly across the driver plate tank; with a series capacitance which allows reaching the high end, it was a pain to get enough grid drive. A better way to do this would have been to extend the bandswitch and used separate fix-tuned circuits for each band.

When designing the set I did not calculate the current pulses drawn from the 470 volt B+ on modulation peaks. Big mistake. When I measured them at around one amp I understood why the scope showed a waveform which did not appear to hit 100% in the positive direction. I'll beef up the supply when I find the right caps but I wish I had allowed more space in that corner of the chassis.

Operating the 12AT7's and 12AU7 with the filaments in parallel is a design trade off; if one of these tubes burns out or is left out of its socket the other two will go in a blue flash. (Is anyone really wondering how I know this)? This problem could have been avoided by using three 0.45 amp tubes in series but those tubes (the 9AU7 and 12AZ7) are much less common. The 12AT7 and 12AU7 have the added advantage that they are also used in the R-8040.

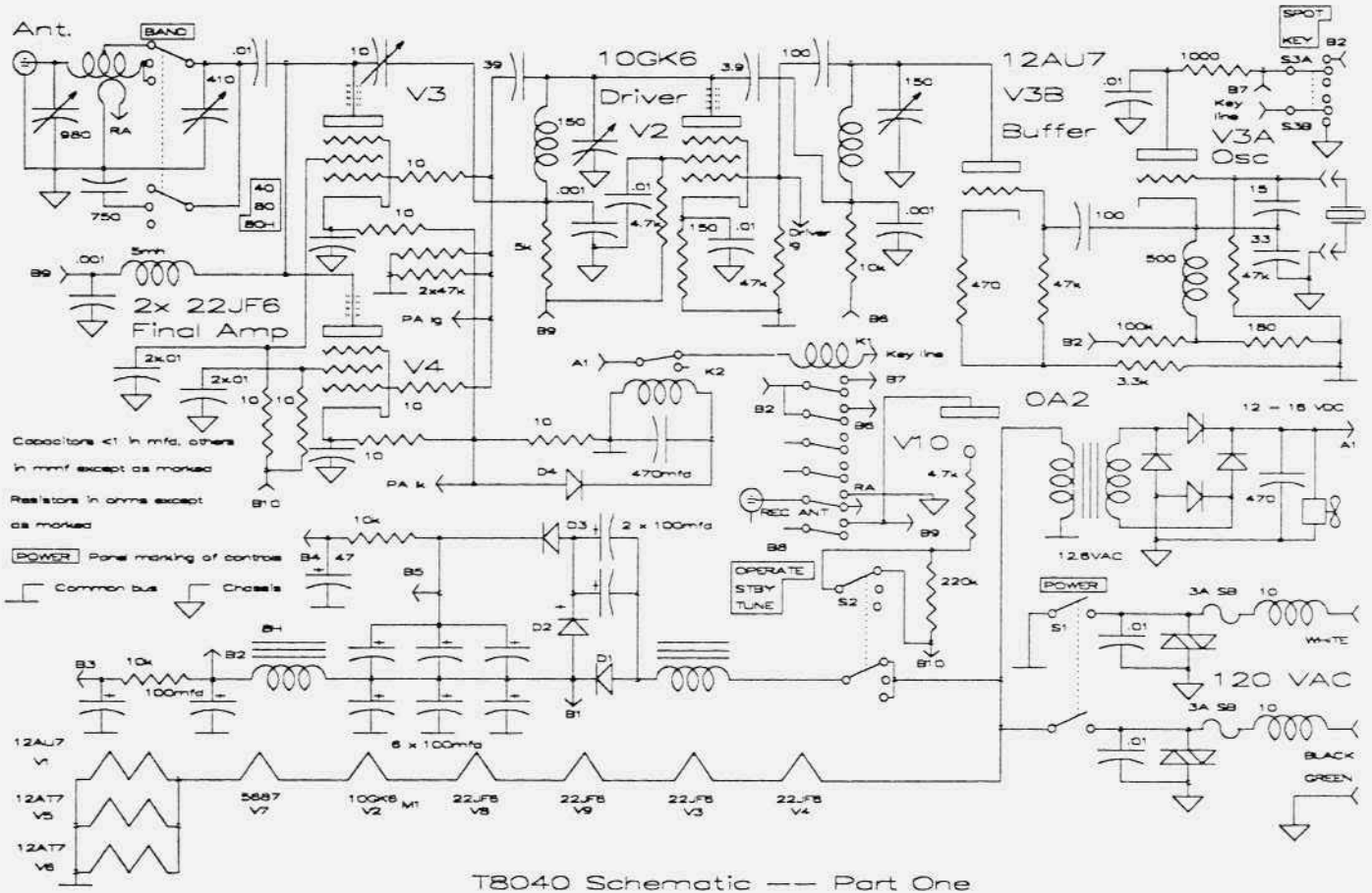
The use of the midget 6PDT relay to switch the 500 VDC line is a weakness. It isn't designed for high voltage use and in a damp climate insulation failure is likely unless the set is dried out in STBY before each operating period. This relay plugs in; an extra is part of the kit of essential spares. It would have been better to use a separate relay to handle the high voltage.

There are a couple of mistakes in the panel layout. The mic jack should have been located at the right of the panel where it would fall above the headphone jack of the R-8040 when the units are stacked; this would keep the mic cord from dangling in front of the receiver dial and look better too. If the FT-243 crystal socket had been moved slightly there would have been room for a small rotary switch and built in HC-33/U crystals for the popular 80 and 40 meter AM frequencies.

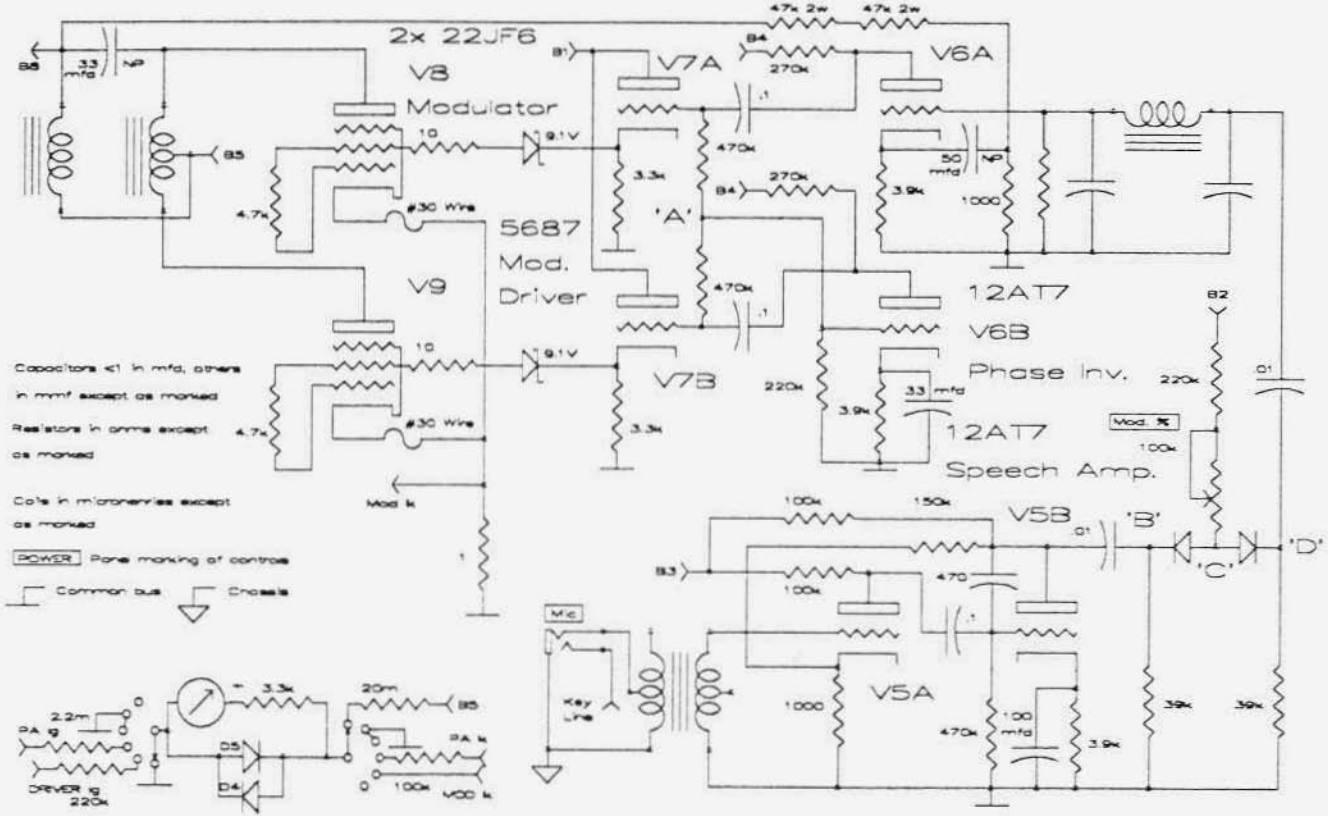
But the 'glitches' are no more than that: the T-8040 and R-8040 combination is already in full time service on the AM frequencies. With only 75 watts standby power consumption the combo doesn't heat up the shack; in fact since the transmitter is ready to go in 30 seconds, you can turn it off during long periods of listening. The package is small enough for almost any operating table or workbench and should make an outstanding 'vacation portable' unit.

The set demonstrates that there are interesting possibilities in 'hollow state' ham designs even today. I did a much better job than planned of proving that you don't need to build a legal limit rig to have a real learning experience. And two Weller soldering iron tips and nearly a pound of solder from the start of the R-8040 project it is great to be able to say, "Transmitter and receiver here are homebrew, OM" at last. **ER**

T-8040 schematics are on the following two pages.



T8040 Schematic — Part One



T8040 Schematic — Part Two

Thermionic Mysteries from page 15

cathode interface, which has a time constant of a few microseconds.

With modern tubes having close electrode spacings, such as in the frame-grid and shallow-grid designs, DC shift was one of the engineering trade-offs. It was never fully eliminated, as research into improved cathode materials was discontinued in the mid-1960s. Note that DC shift is the likely cause of an S-meter zero adjustment which won't stay put. Often, changing to another AGC tube or meter control tube will cure the problem, for a while.

Stray emission, or the emission of electrons from elements other than the cathode, can cause more problems. This stray emission is caused when a tube overheats, or is operating out of its design maximum ratings. One familiar effect in transmitters is control grid emission, caused when a large value grid resistor is used, or an old one shifts higher in value. The tube can literally run away and destroy itself, and some designs used a protective fuse in the grid circuit. In vintage TV sets, stray emission from the screen grid could drive the horizontal deflection system into non linearity, causing reduced picture width and other irritating problems.

When the heater gets too hot, signal-grid emission can occur. This causes various eccentric effects in circuitry common to the signal grid, and depends upon the tube application. In low-level audio stages, heater to cathode stray emission can cause hum. This caused designers to either run the heaters from pure DC, or to bias AC heaters with DC. The value of DC should not exceed the total heater to cathode breakdown voltage, which is usually somewhere around 100 volts.

Some very exceptional effects can be caused when charged particles collect on the bulb or on the mica insulators. These charges can cause a linear amplifier to become non linear, but only over small portions of its total response curve. "Mica charge" has been known to cause multi-octave oscillators to quit running in certain ranges. It has also caused problems with horizontal and vertical deflection in TV receivers. Fortunately, unless the stage is operated with electrode voltages above the design center values, effects due to these stray charges are not usually a problem and are therefore under our control and not Murphy's.

Mica charge was largely minimized in later designs by cutting special slots in the mica element spacers. These slots serve to interrupt high voltage leakage paths. Designers also used a special high resistance coating of alundum on exposed mica surfaces to break up leakage paths.

The vacuum tube served us well about seventy years, and made possible the modern gizmos most folks now take for granted. Just because they can occasionally become eccentric doesn't diminish the outstanding sight of a row of glowing filaments at work. **ER**

Call Signs from page 2

The US call signs issued in 1912 consisted of a number and two letters. Don Wallace in Long Beach, California, was issued 6OC. (From 1909 to 1912 he used the self-assigned call WU). The sixth district consisted of California, Utah, Nevada and the territory of Arizona (it became a state in 1912). The license had to be renewed each year, and if you moved across district lines you had to have a new call issued. When Don started college in Minnesota in 1916 he was issued 9BU. Up to this time virtually all amateur wireless transmissions were made by spark transmitters.

The Great War, World War I, saw a tremendous advancement in vacuum tube development. After the war large numbers of tubes became available to radio amateurs. By 1922 a five-watt tube could be procured for about $8. The CW signals generated by tubes were to make long distance communications possible.

By 1919 amateur call signs were being

issued again in the USA. Don Wallace was back in college in Minnesota and was issued 9ZT. The first US-Europe QSO took place in November, 1924. Deloy of France, 8AB, worked Schnell, 1MO in Boston.

As European countries issued a number and two letters to their amateurs, it was not easy to distinguish DX stations from local stations (except that they were weak!). The early DXers developed an unofficial prefix system to help indicate their location from their call sign.

When Don worked France the following month, he signed A(America)9ZT and Deloy signed F(France)8AB. Stations in Great Britian used the G prefix, Japan used the J prefix, New Zealand the Z prefix, etc. This system seemed to work pretty well for a short time, then lots of Australians were being worked by stateside stations, and they also used the A prefix.

The American stations considered this turn of events for a while and decided that U for United States was the logical choice. Don Wallace had moved back to Long Beach, California in 1926 and was assigned 6AM. When he worked Australian 5BG the call signs exchanged were A5BG and U6AM. This system seemed to work for a short time and the US stations started working a lot of Soviet Union stations, who also used the U prefix.

By 1927 the convention for stations making overseas contacts was to use a continental identifier. Don Wallace used NU6AM (North America, United States), the prefix for China was AC (Asia, China), Japan was AJ, Australia was OA (Oceania, Australia), France was EF (Europe, France), SB was South America, Brazil, etc. Through all of this Don Wallace's license from the Department of Commerce (after 1927 the Federal Radio Commission) read 6AM. Of course, stateside stations working among themselves would sign just the number and two or three following letters.

This system would remain in place until 1928, when the IARU assigned prefixes to specific countries. At this time the W prefix was assigned to the USA, and the now-familiar call W6AM was issued to Don. For a thorough history of amateur wireless in the USA see "Don C. Wallace, W6AM, Amateur Radio's Pioneer" by Jan D. Perkins, N6AW. The book is available from ER; see page 39 in the Classified section for ordering information. **ER**

Audio Mania from page 22

The Envelope, Please

Although what I heard in the console headphones pretty much got me in the ballpark, having some good ears on the other end told a much better story on how each mic sounded in comparison to the D-104 reference mic. I was lucky enough to have had some eminently capable ears including John, W6BM; Bill, K7INK; and Dennis, KØEOO. The results are:

RCA BK-5 (equalized): "Good. A pleasant warm, high-fidelity sound with a nice bottom end."

EV-630: "Not much different from the BK-5."

RCA 88-A: "Kinda mushy sounding. Not a lot of highs with much more noticeable room noises in the background."

The guest mic has since been replaced with a Shure 556 (aka the "Elvis mic").

Bottom Line

Clearly, each mic has its own personality, but perhaps the most surprising result of this exercise is that looks are often deceiving. The high quality broadcast ribbons, such as the RCA 77DX and 44BX require substantial equalization to tailor them for HF AM operation, while some homely junk-box mic can sound just as good without all the hassle. While there's no guarantee you'll find the mic that makes you sound like Burt Parks or Arthur Godfrey, it's fun to try.

Oh, as for the plain vanilla D-104 reference mic? Well there's a good reason the D-104 has been around so long . . . **ER**

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WANTED: Harvey Wells R9 or R9A rcvr; APS-90 pwr sply. Bob Nickels, KEØT, 1444 S Rotzler, Freeport, IL 61032.

FOR SALE: Racal RA6790/GM rcvr - $1275; (2) Collins 75A-4 w/filters, spin knob - $575 ea; Collins 30L-1, RE w/plastic insert - $650; MPI ps - $85; 180S-1 WE - $175, send SASE for list.U ship. Bob, WB2FOF, 129 Marly Dr., Syracuse, NY 13219. (315) 468-2691 eves.

WANTED: For Heathkit linear SB-220: band switch, complete or rear ceramic element only & 20/40/80 coil #40-1666. Hans Zimmermann, HB9AQS, POB 209, CH-3780 Gstaad, Switzerland.

FOR SALE: ART-13 - $75; BC-348 - $100; MN-26 - $60; TV-10 - $75. Gary, (612) 698-4851

FOR SALE: 2 x 813; 4 x 866A; 4 x 866Jr; 2 x 812A; 2 x 811; 18 x 807 - $220, I ship. H.K. Fredickson, VE5HF, 218 Skeena Crescent, Saskatoon, Sask. S7K 4G8, Canada. (306) 242-9275

FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3ICH, 13192 Pinnacle Lane, Leesburg, VA 22075. (703) 822-5643

FOR SALE: New list of 1000's of tubes! Includes new, used, antique, collectible, Majestic and Western Electric types. Send SASE to Jim Cross, 2817 Parklawn Dr., Dayton, OH 45440-1538. (513) 298-5827

FOR SALE: ART-13 parts & other interesting stuff. SASE for "The Bone Yard List." eLKay electronics, 231 Shenandoah Trail, Warner Robins, GA 31088-6289.

WANTED: Manual or copy for Eldico R-104 rcvr (Eldico "S" line); Eldico SSB 100M mobile xmtr. Interested in other Eldico parts etc. **FOR SALE:** Collins 30K-4, w/310C vfo and accessories, currently on the air, very good condx.(7 on scale of 10) - $2500/offer or creative trade. Skip Green, K7YOO, FAX 507-452-0376, MSG 507-452-4989

FOR SALE: Sidewinder xmtr, 6-M coverage, pwr 50W, *QST* ad Sept. '60, - $179.85; PTR-3 matching pwr sply - $69.95, no additional info. Jim Musgrove, K5BZH, (512) 459-5564

FOR SALE: Used technical books - radio, electronics, math, military, magazines, etc. $1 for large list. (stamps ok). Softwave, Dept. ER, 1515 Sashabaw, Ortonville, MI 48462

WANTED: 32V-3, 51J-4, NC-303, HRO-60, Ranger I or II. James, N6IFO/4, 3442 N. Cook Rd., Powder Springs, GA 30073. (404) 429-8189

FOR SALE: Collins 204F-1 5KW amp; (2) 4CX1000A finals, very clean w/orig. manual - $3350. Joel, KQ4HZ, 195 Livingston Ave., Babylon, NY 11702. (516) 587-7945 eves.

WANTED: Xerox copy of J8-prefix QSL cards pre-1950; Hallicrafters S-38, S-72. Dong-Hyun Cho, HL2DDK, Biology Dept., Kang Won National University, Chun Chon 200-701, S. Korea

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FOR SALE/TRADE: Teletype Corp model 33 ASR pedestal mount, complete, good condx, all manuals included - $50. Pick-up only. Fred Clinger, 417 Beechwood, Galion, OH 44833. (419) 468-6117

WANTED: IF xfmr, 50.75Kc for a SX-117 Hallicrafters rcvr, their P/N 050-200735. Bill Nickle, AF7D, 1025 Hunter Ridge Dr., Arlington, TX 76013. (817) 274-5071

FOR SALE/TRADE: Still have a few 19" cabinets from last months ad. Reduced to $38 + UPS, + free AC whisper fan. These cabinets cost over $130 new! Will trade for 1920's radio tubes/parts. Bob Bakinowski, 1524 St. Tropaz, Tucson, AZ 85713. (602) 624-8029

WANTED: BC-224A; BC-224B; BC-224C; BC-224D; SCR987; SCR718; APR-2; APR-3; APR-6; SCR241; SCR242; SCR246. Dean, 6725 Portland, Richfield, MN 55423.

FOR SALE: Bendix 847 - $65; Westinghouse H204 (Bunis) - $40; Philco 50-922 - $50; Zenith 4K035 - $45; Watterson 527 - $40; Mitchell - $35; Philco 46-250 - $40; Motorola 5X11U - $45; Emerson Big Portable - $35; Philco 40-130 - $60; GE 408 - $40; Detrola 579 - $40; RCA 68X63 - $40; Federal 101 R/P - $40, S/H extra. Polaroids $1 each + SASE. Bud Santoro, 3715 Bower Rd., Roanoke, VA 24018. (703) 774-9153

WANTED: Plans/info to convert Motorola MOTRAC to 2 meters. John Nelson,NYØQ, Box 610, Nucla, CO 81424.

Classic Amateur and all Lafayette Radio Manuals.
Will match or beat any published price. List available. Satisfaction guaranteed. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

FOR SALE: New reprint "Tubes and Circuits" by Wholesale Radio Laboratories, circa 1942-43 - $8 ppd. James Fred, R1, Box 41, Cutler, IN 46920.

WANTED: SC-101; SC-301; KW-1; 30K-1 thru 5; 302C1; 75A thru 75A-4 rcvrs and spkrs, any condx. Purchase entire estates, pick up 48 states and top $ paid. Rick, (800) 462-2972

FOR SALE: Collins KWM-1, KWM-2A; 75A-4. Joel Levine, WB2BMH, 67 Derby Ave, Greenlawn, NY 11740. (516) 757-7641.

WANTED: Manual or schematic for National HPS rcvr & pwr sply. Photocopy OK. Jim, W6OU, 529 Kevin Way, Placentia, CA 92670. (714) 528-5652

FOR SALE: VG to exc. SX-88, manual, new Jan tubes - BO over 1K by Oct. 30. **WANTED:** HT-9; HT-1; SX-11; SX-17. Gordon Baldwin, POB 116, Lake City, MI 49651.

FOR SALE: New 826 tubes - $25; new Command set tubes: 1625 - $3.50, 1629 - $2.50; new BC-645 IFF xcvr, 400 Mc - $15; new APN-4 Nav rcvr - $15; BC-series Command sets rcvrs: 190-550 Kc used - $20, 6-9.1 Mc used - $25; xmtrs: 4-5 Mc used - $15, 5-7 Mc poor - $10, 5-7 Mc new - $25, 7-9 Mc poor - $10; Command set racks: 2-xmtr used - $20, 3-rcvr used - $20. shpg xtra. Dave Parker, WB9WHG, POB 37, Iron Ridge, WI 53035. (414) 625-3919

WANTED: Heath IT-12, SR-160 tuning knob (Johnson 122 VFO). **FOR SALE:** orig. W6AD Collins 516F-2 solid state ps mod, guaranteed - $28. Joe Hargis, WSØE, 2505 S. Aspen, Springfield, MO 65807. (417) 882-3197 eves.

FOR SALE: WW II Jefferson-Davis model 350A-1 xmtr/rcvr, complete w/all cables & AC pwr sply. This covers 1.5 to 12 MHz w/a pair of 807's in the final, modulated by 807's. It was designed for front line airfield operation - $100, good condx. Call or write for details. Sam Kelly, 12811 Owen St., Garden Grove, CA 92645. (714) 893-2092

FOR SALE: R-390A service: Module repair and alignment to complete remanufacture, new front panels, knob sets, VFO calibration,expert service, reasonable, any condition accepted. Rick Mish, (419) 726-2249

WANTED: Parts, assistance to reconstruct Stromberg Carlson 160L Acoustical Labyrinth! France is not on the moon, will pay all expenses. Reinhard Wieschhoff, 7, rue du Debuche, F78120 Rambouillet, France.

FOR SALE: Electronics suite from U.S. aircraft carrier. MF-UHF rcvrs, xmtrs, radars, PPI displays, RTTY cnvters, terminals. Much more.Bob Mantell, W6VQT, 3135 N. Ellington Dr., Los Angeles, CA 90068. (213) 851-2786

WANTED: WW II Japanese military radio equipment & literatures; KWM-1 w/516F-1 in mint condx; Hammarlund PRO-310. Takashi doi 1-21-4 Minamidai Seyaku Yokohama, Japan.

FOR SALE: Gonset G-50 6 meter communicator, very good condx - $85; Heathkit DX-100B, good - $175; AT-1 near mint, BO; Hammurland HQ-100, near mint - $175; HQ-129X, fair cosmetically, exc. electrically - $95; Johnson Ranger, very good - $175; Valiant, exc -$325; Kilowatt Matchbox, exc - $275; Matchbox, exc - $175; Multi-Elmac AF-54 w/ pwr sply, fair to good - $75. **WANTED:** Hallicrafters SX-88; SX-112; HT-20; HT-31; manuals for RCA CR-88A & Hy-Gain Galaxy GT550A. Steve, WB4IJN, 601 Black Oak Blvd., Summerville, SC 29485. (803) 821-6931

FOR SALE: Heathkit AC-1 ant. tuner; Fisher tube stereo amp x-100-B; early black HRO dials right angle drive w/caps; large roller induct. **WANTED:** Collins CW filter F455Q-5 for 75S2, manual, copy OK; Heath HR/HX 1680 rcvr/xmtr. Joe Perratto, K2QPR, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-7362, anytime

WANTED: The Committee to Preserve Radio Verifications, a committee of the Association of North American Radio Clubs, is seeking individual QSL's or entire collections for an already well established archive of old QSL's. Our main interest is in standard broadcast & shortwave broadcast QSL's. If you know of any such QSL's that need a good home contact: Jerry Berg, CPRV Chair, 38 Eastern Ave., Lexington, MA 02173. (617) 861-8481

FOR SALE: Radio tubes; repair and restoration of all vintage amateur and commercial radios, 25 years experience. Herbert Stark, 321 N. Thompson St., Hemet, CA 92543. (714) 658-3444

WANTED: Collins literature, manuals, catalogs, SM2, SM3, MM2 mic's, TD1, 647T dipole ant, 35C low pass filter, 55G1. Rick Coyne, KD6CPE, POB 2000-200, Mission Viejo, CA 92692. (714) 855-4689

WANTED: Espionage equipment. Historian purchases spy radios, code and cipher machines and any equipment, devises or manuals pertaining to the world's intelligence organizations. Keith Melton, Box 5755, Bossier City, LA 71171. (318) 747-9616

FOR SALE: Heath Nostalgia - 124 page paperback covers Heath history in pictures and stories. $9.95 postpaid (plus tax in WA). Heath Nostalgia, 4320 - 196th SW., Suite B-111, Lynnwood, WA 98036.

WANTED: Military T-195/GRC-19 xmtr; Heath SB-401 xmtr; orig. manuals for SB-301 & SB-100. Geoff Fors, WB6NVH, POB 342, Monterey, CA 93942. (408) 373-7636

FOR SALE: Gonset G-76 xcvrs, (1) repainted w/factory AC pwr - $175, nice; (1) like new w/ factory AC & 12 volt DC crystal calibrator & EV mike - $375; Heath DX-20 - $45; RME 152 - $35; freq meter BC 221T w/books - $45, exc. + UPS. Delmer Woodley, KØCZH, Rt3-Box 13, Milford, IA 51351. (712)332-5673

WANTED: SCR-287-A liaison set components: BC-375 tuning unit; TU-5-B (1500-3000 Mcs), TU-6-B (3000-4500 Mcs), TU-7-B (4500-6200 Mcs); SCR-274-N Command xmtr; BC-458-A (5-7Mcs). Michael Neidich, K2ENN, 145 E. 15th St.-6A, NYC, NY 10003. (212) 777-1332

FOR SALE: Plate xfmr, Chicago, new in crate, primary 115 V, secondary 4660 V @ 775 VA - $50 plus shpg. Ron, KC6WTC, POB 783, Santa Rosa, CA 95402. (707) 539-8319 afternoons

WANTED: Very early Hallicrafters and Hallicrafters/Silver Marshall equipment including Skyriders with entire front panel dull aluminum color, S-30 radio compass, S-33 Skytrainer, S-35 panadaptor, wood console speakers - R-8 & R-12, HT-2, HT-3, BC-939 antenna tuner, parts, advertising signs, paper memorabilia of Hallicrafters. Also want RCA model AVR-11 airport tower receiver. Chuck Dachis, WD5EOC, "The Hallicrafters Collector", 4500 Russell Dr., Austin, TX 78745. (512) 443-5027

WANTED: Manuals for the following Nems-Clark's: DCA-5100A-1, R-1071-1, RFT-109A, RFT-101D, PSD-104E, PSD-105E, 1673, SSM-101-11-157. Edward White, WA3BZT, 809 Seymour Rd., Bear, DE 19701-1121. (302) 322-1313

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

FOR SALE: Navy type CJB-26003A "flameproof" keys, new in original boxes - $47 shipped Conus. Trade for working IC-22A, TCS, or ??. George Babits, WA7HDL, (208) 756-4147

WANTED: Central Electronics 100V or 200V xmtr; 32V-2 cabinet; Heath SB610/620; Hallicrafters SX-88; TMC GPR-92. Jay Spivack, N7JDT, 177 Telegraph Rd. #303, Bellingham, WA 98226. (206) 739-0098

FOR SALE: Collectors qual. Swan TV-2B, orig. manual, box, as new - $125; Swan 500, 117XC spkr sply, manual - $125; Swan 400, 117C spkr sply, vfo 420 - $200; Hammarlund HQ-170 exc., manual - $150; Skytec tubester set 7A7 for Collins S-line rcvrs, new, sealed - $100; early 1950's vfo using Collins PTO 70E-8A & 32V dial faces, built in sply, Bud wrinkle case - $75, all + shpg. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, NY 11758. (516) 798-1230

FOR SALE: Hewlett-Packard model 330B distortion analyzer w/instruction book, exc. Bill Riley, (503) 345-2169.

Western Heritage Museum Omaha, Nebraska
"a magnificent home for your equipment"

Leo Meyerson, WØGFQ, (founder of WRL) needs donations of gear and related materials for the amateur radio exhibit at Western Heritage Museum in Omaha, Nebr.

This permanent display is the only one of its kind in the country and is something that all hams can be proud of. We expect 50,000 visitors annually.

Your tax deductible donation will be permanently noted on a plaque that will be prominently displayed.

For more information contact Leo at (402) 392-1708, May-Nov.; 619) 321-1138, Nov.-May.

FOR SALE: Collins kHz dials for 75A-1, 75A-2, 75A-3, 32V-1, 32V-2, 32V-3, KW-1, KWS-1 - $30 per dial or $35 exchange. Butch, KØBS, (507) 288-0044

WANTED: List, indexes or directories of WW II Navy tech. manuals or equipment. Willing to help to identify WW II Navy 5-digit type numbers. Send SASE. Ray, W6RIC, (805) 985-6048

FOR SALE: Oscilloscopes- USM-281A/H.P 180 A - $200; USM-281C/TEK 760BN - $395; signal generators, URM-25F - $89; H.P. 606A lab quality H.F generator, vg condx - $150; H.P 608D/TS-510AU - $89; H.P 233 - $39; freq counters, H.P 5245M new color mainframe, high stability timebase, exc. - $200; H.P 5255A 12.4 Gig plug-in, HO-6 option - $125; H.P 5326A w/DMM - $125; USM-207 500 MHz w/HI-Stab T.B. - $150; H.P 100E freq standard, mint - $95; L.T.V G-175C rcvr, 30-260 MHz, exc. - $200; lge weather balloons, last offering for this year - $10; new H.P 410B probes - $25; USM-159 freq meter w/accessories, exc. - $49; H.P 410B/ME-26 V.T.V.M. w/probe - $20; H.P 214A pulse generator - $100; lge Sola line conditioner, like new - $60; Ballentine #300 A.C. voltmeter w/acc. & case - $20; R-390A crystals - write. Shpg additional. Joe Bunyard, 1601 Lexington St., Waco, TX 76711-1701. (817) 753-1605

FOR SALE: Viking II parts; QF1-A audio filter - $40; Collins 32V-1, exc. condx - $275 PUO; Atlas PC100-C board for 210X - $15. **WANTED:** Working car radios - 1979 Mercury AM/FM and 1963 Buick AM; 100 kc octal socket xtal. Tom Marcellino, W3BYM, 13806 Parkland Dr., Rockville, MD 20853. (301) 871-7463

WANTED: Citizen Radio Callbook magazine for 1920 and 1921. Bob Arrowsmith, W4JNN, PO Box 166, Annandale, VA 22003. (703) 560-7161 collect

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FOR SALE: We rebuild twist-loc, wet style, rectangular, can capacitors. Mail your can to us, typical in shop time is 10 days. We custom build tubular & can capacitors & rebuild your capacitor. Inquire. Frontier Electronics/Everett Hoard, NØNVQ, Lehr, ND 58460. (701) 378-2341

WANTED: Old panel meters & parts, any condx. Any catalogs or books showing pictures, manufacture, or repair of meters. Chris Cross, POB 94, McConnell, IL 61050.

FOR SALE: Gonset #126, 54-144-220 Megs - $60, w/UPS; GPR-90 - $395; Valiant II, F/W - $295. Bud, W7IYG, (208) 466-2803, after 8 PM MDT

FOR TRADE: BC-375; BC-348; FT 154; URM-25; BC-728; T-1154 (British); AN/PRC-508 (backpack AM/CW/SSB, 2-8 MHz) w/accessories. Will trade for any military radios of interest. **WANTED:** R-388A; RBU or RBV panadaptor. Tom Brent, Box 1552, Sumas, WA 98295. (604) 826-4051

WANTED: Globe King 500 rack cabinet. Jim Roseman, W9UD, 2716 W. 3rd St., Coal Valley, IL 61240. (309) 799-7447

FOR SALE: R-392, manual, pwr sply - $250; ARRL Handbooks, '62, '64 & '65 - $20 ea, all ppd. Herman Gibbs, KD8PD, (216) 263-2212

FOR SALE: Johnson Valiant II - $250; Viking II, factory wired, w/12AU7 keyer - $150; Ranger - $150; Match Box - $100; Hallicrafters SX-100, spkr, orig. owner - $175; HT-37, mint - $150; Conset 2-meter Com. IV xcvr - $40; D-104 mic - $50; Heath VF-1 vfo - $35; HG-10B vfo - $35; HP-23B pwr sply - $45; IM-28 VTVM - $30. John Maver, W6MQK, 1049 N. Holliston Ave., Pasadena, CA 91104. (818) 798-9345

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: Manuals or copies for Heath IM-4180 FM deviation meter and Regency HR 2B FM xcvr. Jeff Duntemann, KG7JF, 8105 E. Paraiso Dr., Scottsdale, AZ 85255. (602) 483-0192

WANTED: McIntosh and Thordarson amplifiers; poor to junk Collins 75A-2, 3 and 51J series rcvrs; poor to junk Hallicrafters louvered spkr. Serious sellers only! Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53228-0803. (414) 545-5237 (24 hrs) collect

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WANTED: Restorable 75A-4. Will trade 2 restorable SX-28's. Or make offer on 28's. Victor, WD8DWR, 3635 Orvall Dr., Fort Gratiot, MI 48059. (313) 385-9479

WANTED: WW II & Korean mititary sets, xmtrs, rcvrs & test equipment. Send list of equipment along with price. Richard Mollberg, K6PWF, 2340 Almond Ave., Concord, CA 94520. (510) 283-6786 eves

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MESSAGE: McElroy is coming. W1IMQ's big biography of T.R. McElroy, World Champion Radio Telegrapher. Illustrated; over 150 pages; every Mac Key. Limited hardcover edition $39.95, order by November 1 to assure availability. Softcover $19.95. Add $2 shpg per order. Publication early December. Artifax Books, Box 88-E, Maynard, MA 01754.

FOR SALE: Hallicrafters R-47 - $25; Heath SB-10 - $40; SB-303/CW - $75; SB-600 - $25; SB-604 - $30; Drake MN-2000 - $175; B-1000 - $40; NB-7 - $50. Dan, KF9BP, (414) 255-9165

FOR SALE: Collins 51J-4 rcvr, good condx - $400; manuals - R-390A (TM11-5820-358-35) - $50, BC-348 H/K/L/R (AN16-40BC2242) - $35; Hallicrafters S-38C manual (copy) - $5. Mike Currie, POB 940375, Plano, TX 75094. (214) 423-9625

WANTED

Collins promotional literature, catalogs and manuals for the period 1933-1983. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. (805) 259-2011. FAX (805) 259-3830

FOR SALE: Collins 75A-4 filters: 6 pole ceramic for high quality AM. 3 bandwidths available: 4, 6, or 9 Khz - $83.50 ea.; single pole CW crystal filters - $88 ea. 10% discount for two filters. Money back guarantee. Calif. residents please add sales tax. Vector Control Systems, 1655 No. Mountain, Ste. 104-45, Upland, CA 91786. (714) 985-6250

FOR SALE: US Navy WW II TCS rcvr (Collins), HB pwr sply, schematic, missing nameplate and tuning chart, fair condx - $50. Dave, W1DWZ, (508) 378-3619

FOR SALE: Vintage parts. Send stamp and request "Vintage Flyer". USA only. Copies of some obsolete Readrite/Triplett equipment manuals. Bigelow Electronics, P.O. Box 125, Bluffton, OH 45817.

FOR SALE: Measurements 111B crystal calibrator - $35; C-87/ART-13 control box, new - $10; equipment, parts, magazines, manuals, books, list - $1. Joe Orgnero, VE6RST, Box 32, Site 7, SS 1, Calgary, AB, T2M 4N3, Canada. (403) 239-0489

FOR SALE/TRADE/WANTED: Vintage tube CB's, all makes/models available; old radio books. LSASE for lists (specify). Charles Zafonte, RFD #1, Box 75, Fort Kent, ME 04743. (207) 834-6273 eves.

FOR SALE: New 50-page catalog of WW II military communications sets and aviation collectibles - $2 US, $5 foreign, refundable. Sam Hevener, W8KBF, "The Signal Corps", 3583 Everett Rd., Richfield, OH 44286-9723. (216) 659-3244

TRADE: Edison standard 2 minute cylinder machine, nice working, want Collins 32S1 with 516F2, VG or better. J. Mente, N9UEM, 916 Olive Rd., Homewood, IL 60430. (708) 957-9455

WANTED: Manual or copy for a General Radio impedance bridge, model 1650-A. Cecil A. Palmer, W5NWX, 4500 Timbercrest Ln., Waco, TX 76705. (817) 799-5931

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 and large tubes and sockets from the old Eimac line; 250T through 2000T for display. Maybe you have something to trade? John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

WANTED: Johnson gear, all models, any condition. Also parts and literature. Please state condition and shipped price. Wen Turner, AD7Z, Box 451ER, Cal-Nev-Ari, NV 89039.

WANTED: Collins 270G-3 or 312A-1 spkr; escutcheon for 75A-4 and Electro-Voice model 419 stand. David A. Clark, K5PHF, 9225 Lait Dr., El Paso, TX 79925. (915) 591-4184

FOR SALE: Collins meatball lapel pin - $5.95 + $.75 S & H. George Pugsley, W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029.

FOR SALE: Parts rigs - Signal-One CX-7 - $325; HW-100 - $45; Super-Pro - $45; BC-348 - $45. Lane, KM3C, (305) 526-0910

FOR SALE: SX-10, VGC - $215; parting HRO-60R, no coils; Johnson TR switch - $40; Collins CC-1 case - $35; whipload 6 - $22; Swan SWR-1 meter in orig. box - $20; Radio City Products tube tester, w/1944 chart - $25; 110 VAC coax relay - $27; BC-348Q, w/AC ps, VGC - $100. Joe Sloss, K7MKS, (206) 747-5349

WANTED: Dust cover for 51J4/R-388; Sangamo .001 and .0015, 5000-V mica block; SB-610 scope xmfr. Hank, W2IQ, 635 Chestnut, Dandridge, TN 37725. (615) 397-9796

FOR SALE: USSR issue radio sets: R-105M - $225; R-109M - $400; R-108M - $400. All exc. condx w/acc. in transit chest. Mike Murphy, (619) 561-2726 or (619) 444-7717

ELECTRIC RADIO PARTS UNIT DIRECTORY

If you need a part for a vintage restoration send $2 and an SASE (.52 postage) for a 6 page list of parts units. If you have a parts unit, consider putting it on the list. Your dead unit can help bring others to life!

Repair & refurbishment of older tube-type amateur equipment. Fully FCC licensed; 35 years experience. Chuck Banta, N6FX, Claremont, Calif. (LA area) (909) 593-1861

FOR SALE: Narrow bandwidth (600 Hz) mech. filters for CW reception with Collins 51J-type rcvrs - $45 each. Limited supply. Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. (313) 453-8303

FOR SALE: Have you received your 1993 catalog of coil forms, literature, tubes and other radio parts? If not send $2 to Antique Radio Labs, R1, Box 41, Cutler, IN 46920 for your copy.

FOR SALE: New replacement pwr xfmr for HRO 7, HRO-50, HRO-60, NC-173, NC-183, NC-183D, SX-99 and possibly others. Keep a spare on hand. $25 each plus shpg. Evan Haydon, NØCMR, 4308 N. 15, Lincoln, NE 68521. (402) 435-4083

FOR SALE: Excellent HT-37 - $115, PU only. **WANTED:** Manual and AC pwr sply for G-76. Don Hilliard, WØPW, Route 5, Box 219, Neosho, MO 64850. (417) 451-5892

FOR SALE: Dunlop 500 - $50; Philco 39-7 - $50; Marshall 638-735 - $65; Truetone D1802 - $50; Silvertone 4552 - $50. S/H extra. Poloroids - $1 each plus SASE. Bud Santoro, 3715 Bower Rd., Roanoke, VA 24018. (703) 774-9153

WANTED: All types of military electronics, especially RDF and radar items, manuals too. Also need URD2 antenna. William Van Lennep, POB 211 Pepperell, MA 01463. (508) 433-6031

FOR SALE: Hallicrafters SX-62A, R46B spkr - $175; Heath HX-20 xmtr, near collector quality, professionally built HB sply, mic - $135; Realistic DX-160A, spkr - $125; Heath HP-23A/SP-600 - $65; Vibroplex standard bug - $60; Heath IM-25 VOM - $35; Booton PC-1A RF voltmeter $35; Ten-Tec Triton 4, loaded - $425. Lane, KM3C, (505) 526-0910

FOR SALE: B&K model 44 CRT tester - $25 + $5 shpg; TV Isotap, RCA WP25A - $25 + $5 shpg; Jerrold 704B field strength meter - $35 + $10 shpg; Roton telephone pwr sply w/several handsets - $20 + $7.50 shpg; B&K TR-200 audio isolation xfmr used with B&K model 1040B Servicemaster - $15 + $3 shpg; Dynascan AV-1A RF probe - $15 + $3 shpg; B&K TV analyst w/manual - $25 + $15 shpg. James Fred, R1, Cutler, IN 46920. (317) 268-2214

FOR SALE: 30's vintage Doolittle 250 watt AM broadcast xmtr. Needs some work - BO. Harry Daniels, (605) 578-2525

FOR SALE: Heath rcvr SB-303, works, needs some work - $100. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (201) 728-2454

WANTED: Hallicrafters SR-75 xcvr; SX-62; BC-348; SX-42; S-38D. Bob Braeger, WA6KER, 6634 Navel Ct., Riverside, CA 92506. (909) 682-5084

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

FOR SALE: RIT for KWM-2 and S-Line. No modifications for KWM-2. $59.95 tested/42.95 for kit. SASE for details and order info. John Webb, W1ETC, Box 747, Amherst, NH 03031.

WANTED: Tube audio amplifiers; Heath, Macintosh, Fisher, Dynaco, etc. **FOR SALE:** R-390A EAC (1967) S/N 51xx, complete, near mint. Mike Nowlen, WB4UKB, 12911 New Parkland Dr., Herndon, VA 22071 (703) 481-9614

FOR SALE or TRADE: Conar twins 400/500, manuals, cabinets still have protective film - $75 or trade for Knight-Kits. John Vercellino, WB9OVV, 6921 Springside, Downers Grove, IL 60516-3114. (708) 964-3020

WANTED: Crystal for HRO IF filter, or complete assembley, 1938-42 model or equivalent. Also knob for selectivity control. Bob Binkley, N4HUR, 8436 Reflection Lane, Vienna, VA 22182. (703) 560-6228

WANTED: Collins 353C-31 mechanical filter adapter for Collins 75A-1. Will trade my 353C-14 (1400 Hz bandwidth) for your 353C-31. Gerald Park, W8QS, 1022 Cresenwood Rd., East Lansing, MI 48823. (517) 351-5106

WANTED: Repairable or parts units tube-type SSB/CW gear, accessories or power supplies-Heath, Drake, etc. Byron Tatum, WA5THJ, 1920 Maxwell, Alvin, TX 77511. (713) 331-2854

FOR SALE: Original Hammarlund manuals (not copies): 100, 100A, 105TR, 145, 145X, 145A, 150, 160, 170, PRO-310, HC-10 - $20 each plus $3 shpg, FM-5, HFM-40, HFM-30 - $5 each plus $3 shpg. John Kelly, N3GVF, 17510 Sir Galahad Way, Ashton, MD 20861.

GIVE AWAY: 1936 RCA BTA250K AM broadcast xmtr, complete, restorable. You move, 1360 lbs. Tubes in rig - $50. Jim Alexander, KØHIP, 1511 N. Jackson, Russellville, AR 72801. (501) 968-7270

FOR SALE: Collins 51S1, R/E - $850; 75S3B, R/E - $495; KWM-2A, W/E - $550; 62S1 - BO. **WANTED:** Clean Viking 500; 312A-1 spkr; HRO-60; 75A-3. Michael, WM1O, (914) 834-7678

FOR SALE: QST in binders - 1922 - 1960, whole years or lot. Some misc. issues. Jan D. Perkins, N6AW, 524 Bonita Canyon Way, Brea, CA 92621. (714) 529-2283 (h)

"WACO 5NWX Filters"

Single Line -- $7.95 each,
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Double Line -- $14 each, plus shpg.

Modular plugs.
Just unplug phone and insert filter.
If these don't work then none will!

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(817) 799-5931

FOR SALE: Restoration of vintage radios; 25 years experience. Phil Goodman, K4FXB, 4112 Commodore Dr., Atlanta, GA 30341. (404) 457-4195

FOR SALE: Heathkit amateur radio repair by RTO Electronics, 4166 Maple St., Berrien Springs, MI 49103. (616) 473-3201

WANTED: Articles describing a DC to DC pwr sply using 88 MHY toroids. CQ? QST? 50's? 60's? Mel Stoller, K2AOQ, 100 Stockton Ln., Rochester, NY 14625. (716) 671-0776

FOR SALE: National plug-in coil set consisting of 7 sets (3 coils per set, A-G) for either the ACS or FB-7 w/preamp - BO; 1948 Stancor ST-202A w/coils, book & spare 35T - $125/swap; Eldico SSB-100F xmtr clean w/book - $150/swap; Collins 312B4 - $100. **WANTED:** WE or Machlett 279A/379A or 251A/351A xmting tubes. Can trade dud towards good tube. Gary, WA9MZU, 1751 Michon Dr., San Jose, CA 95124. (408) 266-2218

WANTED: Near mint HRO-60T w/acc.. **FOR SALE/TRADE:** Fully restored HRO-7R. Pete, WØEWQ, (215) 849-5830 eves.

WANTED: Directional coupler for Johnson Matchbox. George Carroll, N2GBY, 301 New Jersey Ave., National Park, NJ 08063. (609) 848-6699

FOR SALE: Drake TR4/NB, AC-3, MS4, exc., works great - $300; R4A, exc. - $190. Plus shpg. Gary Elliott, NO5H, 808 Clarice St., Delhi, LA 71232. (318) 878-8032

FOR SALE: Put a class knob on your classic Collins 75A-4. 'Jupiter Superknobs' are solid brass, six times heavier than fragile plastic original vernier knob - Price reduced - $99 + $5 shpg/48. Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. (313) 453-8303

WANTED: Pre WW II radio magazines, books, photos of stations, QSL cards, broadcast and ham collections bought. C. MacNeill Book Dealer, WA8ZNX, 3165 12 Mile, Berkley, MI 48072. (313) 543-1177 days

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FOR SALE: Viking Valiant - $175, PU only; tubes 1-837, 3-1625's - $2ea; 2-250th - $25ea. Chuck, (417) 863-7415

WANTED: Manual for Heath IM-1210 multimeter. **FOR SALE:** Heath HW-16 & HG-10B vfo; Swan 406B remote vfo. Marty, (817) 497-6023

WANTED: A channel control box for SCR-522 xcvr & dynamotor (28-V) & connectors & cables. Steve Kalista, 9 Maple Dr., Jim Thorpe, PA 18229. (717) 325-4120

FOR SALE: Replacement meter glass - $1.50+. books, tubes, testers, 160+ utility pole insulators; **WANTED:** Panel meters & parts, any type. Chris Cross, POB 94, McConnell, IL 61050.

FOR SALE: Photo copies for AT 1,VF1, DX 60A, Navigator, Viking 2, CE20A, BC458, 1A, R4B, NAT 270, HQ 170 - $10 ea. Craig, KB6XV, 14 Governors Ct., Sacramento, CA 95817.

WANTED: Any tech info for Hickoch model 6000A tube tester; R-390A "parts" rcvr. Shawn Daniels, 335 Bowles Ave., St. Louis, MO 63026. (314) 343-5263

WANTED: Manuals/copies for NC-188, Globe Chief, DX-40. Bill, KA9CWK, RR1, Box 84, Hillsboro, IN 47949.

TRADE: My Harvey-Wells TBS-50 for your tombstone or cathedral. A. Bruno, 24 Butternut Dr., New City, NY 10956. (914) 354-8899

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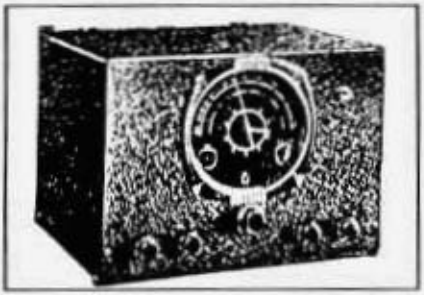
We rebuild xfmrs to original specifications. Top quality-Fast Service. Max Kunz, Top Tech Inc., 10811 Fairbanks North Houston Rd., Houston TX 77086. (713) 440-9909



WANTED: Any condition, Hallicrafters Sky Master and EP-132 as shown. Also want SX-46, S-48 and S-49. Chuck Dachis, 'The Hallicrafter Collector', 4500 Russell Dr., Austin, Texas 78745. (512) 443-5027

FOR SALE: Signal-One CX-7 parts rig - $325; Vibroplex standard bug - $60; Heath HP-23A/SP-600 - $65; DX-160A, w/spkr - $125; HX-20, w/sply and mic, near mint - $135. Lane, KM3C, (505) 526-0910

WANTED: Military TM's for communication equipment. Have several to trade. Send list of what you can offer. Bill Neill, 1231 Crescendo Dr., Roseville, CA 95678.

WANTED: Pierson KP-81 rcvr manual/schematic. Cash or gear in trade. Bob Mattson, KC2LK, 10 Janewood Rd., Highland, NY 12528-2607. (914) 691-6247

FOR SALE/TRADE: HA-230; SX-62 or 62A w/R46. **WANTED:** Tuning eye rcvrs: SX-11, S-14, NC-100X, RCA AR 111, home allwaves even. Jim Dillon, 201 Seward St., Juneau, AK 99801. (907) 586-3223, 10-6 PDT

WANTED: Excellent to mint condx NC-183D, Hallicrafters S20-R or HQ-120X. Bernie Doermann, WA6HDY, 300 James Way, Arroyo Grande, CA 93420. (805) 481-6558

WANTED: Manual and schematic for Magnecord rack mount tape recorder w/model PT6-6J amp and PT6-6A tape transport. Brad Sagendorf, 2 Windsor Rd., Huntington, CT 06484. (203) 926-1671

FOR SALE: New 2A3, 10Y, 6L6 (many types), 811A, 250TH, VT-4C, 6E5, 6550, 813. Send $2 for list. Andrea Moretti, Via Colle Bisenzio 31, 50040 Usella FI, Italy.

FOR SALE: Pair of Collins R-390 rcvrs, 1 good, 1 parts unit - $75 for both; BC-610 tuning units, coils and BC-614E speech amplifier - offer or trade. Mike Heltborg, WA7NPA, (206) 837-3560 eves.

FOR SALE: Pristine SP-600-JX-21 - $350; VG SX-28A - $125. Both PU only. VG Collins 75S1, w/500 Hz filter, 32S-1, 516F2 - $750 prefer PU; Vector Control Systems 455A4-CW filter - $50; Heath DX-40 - $75. **WANTED:** 1957 Allied catalog; orig. Viking I manual; current meter for Heath IP-32 ps; street address for W6WQJ from 59/60 callbook. Dave, WA6VVL, 1118 Paularino Ave., Costa Mesa, CA 92626. (714) 979-5858

WANTED: Unmodified BC-314 and BC-344. Please good to excellent condx only. Ray, (407) 676-4952 (7 AM - noon EDT only).

FOR SALE: Collins KW-1 owners. Put in the originals. New RCA 4-250A's in factory sealed cartons - $100 each. **WANTED:** Excellent 75A-4. Don Gies, K4GIT, 2790 SE 73 St., Melrose, FL 32666. (904) 475-3306

WANTED: BC-614 speech amplifier; JB-70 junction box; CX1599 cable - T195 to R-392. Kevin C. Stromgren, WA1JUJ, 529 South Lane, Granville, MA 01034. (413) 357-6153

FOR SALE: HRO-50T; Weston model 537 AC/DC radio set tester, circa 1927, w/data on 40 or so old radios, Crosley, Atwater Kent, etc. Call anytime. Joe Perratto, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-2189

FOR SALE: Limited quantity of orig. manufacturer new knobs for Collins 75A, 32V and KWS-1 series, 1:1 main tuning - $20; large pointer (1.75" skirt) - $10; medium pointer (1.5" skirt) - $8; small non-skirted pointer - $5. Shpg included. Money back guarantee. Jerry, AB8U, (513) 429-5457

WANTED: WW II Japanese, German military radio equipment and literaure; National NC-183 with spkr in mint condx. Takashi doi 1-21-4 Minamidai Seyaku, Yokohama, Japan

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FOR SALE: Collins KWS-1, RF deck good, pwr supply complete, case needs refinishing, stored in Palos Verdes, Calif., can inspect there - $800 plus shpg. Will consider partial trade of clean 51J4, 75A-4, 75S3B/C or Johnson 500. Will accept 51J4 or 75S3 with inop. PTO. Lon, K5JV, (713) 358-4207

WANTED: 51J4 mech. filters F500B-14, F500B-31, filter choke 678-0432-00, top dust cover; R390A 1967 EAC IF deck. John Tiedeck, WA2SDE, 212 Grandview Rd., Media, PA 19063. (215) 566-8049

FOR SALE: USM 207 counter to 600 MHz - $100; URM 26B generator 4-405 MHz; Collins R-390A, serial 4809 - $200. Walter Chambers, K5OP, POB 241371, Memphis, TN 38124-1371. (901) 761-9381

FOR SALE: Autek QF-1 - $20. **WANTED:** Ryder manual set. See our ad this page. Manuals for vintage equipment. W7FG, (918) 333-7893

FOR SALE: GRC 109 rcvr, 3-24 MHz, AM/CW/SSB, sealed box - $45; R1051B rcvr, 2-30 MHz - $400. Bob, WB2FOF, (315) 468-2691 eves.

FOR SALE: Dial calibration is easy with our Tri-Mark crystal calibrator. Uses 9-V battery or rectified filament voltage. Three outputs provide rock steady signals from broadcast to UHF. Great pocket signal source. Kit $17.95; assembled $24.95. $4 S&H, Visa/MC. We have a large selection of HV capacitors for tube circuits. $1 brings catalog and coupon. USA/Canada only. Two Fox Electrix Co. POB 235, Tivoli, NY 12583. (914) 757-5800

WANTED: Still looking for a PRC-74, also SP-44, SB-620, RAX-1, BC-611. Joseph Pinner, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766

FOR SALE: Heath monobanders - 20/40, no pwr splys - $35-$45. **WANTED:** Globe King, Viking 500, T-368, etc.; cabinet for a GPR-90. Bill, KE7KK, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

FOR SALE: 30L-1 - $525; TRADE: HRO-5A1 coils, PW dial. **WANTED:** 51J4. Carter Elliott, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383 (h), 980-7698 (w)

WANTED: Cabinet for SX-101 series rcvr; S-meter and main tuning knob for S-76 rcvr. Tnx. Sam Ash, N4VIB, (706) 695-5658

WANTED: Technical information on T-350-XM xmtr. Unit is pictured in center of photo on page 2 of ER #49. Bob Deuel, KA7COS, 1058 Linda Ave., Ashland, OR 97520. (503) 482-8752

WANTED: Meter for 51J4; Collins 75A-3, 32V-3; spkr; mech. filters for 75A-3 and 75A-4; MacElroy or Speed-X bug. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

FOR SALE: Limited quantity of new blue with white stitching handles for Tektronix 545A etc. scopes, complete with new chrome mounting hardware - $7.50; also replacement rolls of special silver bearing solder (3 feet) for Tek scopes - $.50 each. Add $5 S&H. Stan Griffiths, W7NI, 18955 S.W. Blanton, Aloha, OR 97007. (503) 649-0837

WANTED: WRL-70 xmtr; HB xmtrs for display, must be museum quality; thousands of QSL cards to paper walls of Amateur display. Call Leo, (402) 392-1708, Western Heritage Museum, Omaha.

WANTED: National SW-4 regen rcvr, looks like SW-5 but only 1 coil used per band, super cash or trade. Robert Enemark, W1EC, Box 1607, Duxbury, MA 02331. (617) 934-5043

FOR SALE: Tube tester, model AN/USM-118A (Card-O-Matic) with test and calibration cards - $150; Systron-Donner 6152A freq. counter, 0-500 MHz, sensitivity 10 mV, high stability time base, outstanding counters - $89. Mike Currie, POB 940375, Plano, TX 75094. (214) 423-9625

WANTED: Hammarlund HC-10 and CV-157/URR 55B convertors, cash or trade, Lon, K5JV, (713) 358-4207

WANTED: Schematic/manual for Heath AM-1 antenna impedance meter and Eldico AT-1 antenna scope. Al Bernard, NI4Q, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: WW II German equipment and tubes, manuals and other parts. Bob Graham, 2105 N.W. 30th, Oklahoma City, OK 73112. (405) 525-3376

HEATHKIT FANS: Don't mourn their passing; enjoy learning more about their past in historic pictures and personal insights from many company oldtimers in 124 page book - $9.95 pp. Heath Nostalgia, 4320 196th S.W., Suite B-111, Lynnwood, WA 98036-6754

WANTED: Teletype Crypto gear, as built by Crypto AG., Ericsson, IBM, Kleinschmidt, NSA, Siemens & Halske, Teletype Corp., etc. Dave Ross, KA6EPI, (206) 465-2117

FOR SALE: Code keys, telegraph items, parts radio quack, meters, etc., 9 page list - $1 plus LSASE. J.H. Jacobs, 60 Seaview Terrace, Northport, NY 11768.

WANTED: Manual or info on Sprague model 600A interferance locator. Contact Doug, N2QPX, 4 Portland Pl., Yonkers, NY 10703. (914) 968-3560

FOR SALE: BC-939B/TN-339GR tuner - $100; Drake T-4XC, s/n 29k, AC-4 - $200. Bill Gode, KB9IY, 1540 Kaywood Ln., Glenview, IL 60025. (708) 998-0974

FOR SALE: Collins F455J mech. filters for 75A-4, 500 Hz - $150; 1.5 kHz - $125; F-455-Q6 - $125; Collins mfg for Bendix 1.5 kHz - $125. Lon, K5JV, (713) 358-4207

FOR SALE: Repair! All makes and models, homebrew, maximum labor per unit - $96. Dan Rupe, W7HBF, Telo Technology, 1302 S. Uplands, Camano, WA 98292. (206) 387-3558

FOR SALE: R-390A connectors, "C" connectors: clamp type for RG-8, 213 - $4.50; kings silver crimp for RG-58 - $2.95; chassis mount female - $4.95; twinax connector for balanced line/antenna - $2.95; miniature BNC (used internally), very rare - $3.95. Adapting jumpers: "C" to BNC male or female, "C" to PL-259, or "C" to N male. Specify 3 or 6 foot length - $7.50 each. Texas Connectors, POB 940375, Plano, TX 75094. (214) 423-9625

FOR SALE: Immaculate Drake SPR-4 w/19 xtals - $350. Will consider trade for clean 51J4 with inop PTO or other similar rcvr. Lon, K5JV, (713) 358-4207

FOR SALE: Unused Eimac 4CX1000A - $400 OBO. Jim, KR1S, (203) 666-1541 x 279 (d), 667-2568 (n).

FOR SALE: 7-tube Bogen amplifier, clean, like new, PP 6L6 output - BO; control radio set C-1200/GRC, US Army, new - $10; brass key, new surplus - $25. Joe, W6CAS, (916) 731-8261

WANTED: E.F. Johnson Viking Courier amplifier and 500 xmtr. Bert, N8NN, 2150 Silentree Dr., Vienna, VA 22182. (703) 448-8016

WANTED: Technical Radio Co. speech amp. Victor, 7224 NE 8, Portland, OR 97211. (503) 289-6373

FOR SALE: Racal HF communications rcvr RA117E and matching xmtr drive unit MA79. All tube 1.5 to 30 MHz, diecast chassis, 19" rack mount. Racal 1 KW ATU. Roller inductors. Vacuum capacitor. Tunes 1.5 to 25 MHz. 50 ohm input. Please call for more details. Nigel, (404) 949-1097 (h), 994-3900 (w).

WANTED: Heath AT-1; Turner model 99 mic; Johnson 122 vfo. Bill Brossman, K9IUF, 547 Lake Connie Rd., Carollton, GA 30116. (404) 834-0460

FOR SALE: Amplifier tubes - 4-1000A, used, output is 20% low, good emergency backups - 3 for $100; Signal-One CX-7, needs work - $325. Lane, KM3C, (505) 526-0910

FOR SALE or TRADE: Clean 32S1, all original; very clean 75S1, 500 Hz filter notch var. BFO, all mods with Collins parts, works great, WE 312B4 fair, mint RE 312B4, will trade for restorable Johnson 500 or clean Collins 75S3B/C PTO, can be inop if unit is clean. Lon, K5JV, (713) 358-4207

FOR SALE: Bauer model FB-5V (AM) broadcast xmtr - $1350. U-haul. K7BDY, (602) 537-2450

FOR SALE: Heath C3 cap tester; VF1 vfo; AT-1; Narco Omnigator MK3; pilot lamps; books; parts. List available. Gus Enquist, VE3MAL, RR 1, Redbridge, Ont. P0H 2A0, Canada. (705) 663-2387

WANTED: Operators/Service manual for SP-600-JX21 and RME DB-23 preselector; cabinet for SP-600 and R-390A rcvrs. John Keil, 4618 Norwalk St., Union City, CA 94587. (510) 471-4838

WANTED: Manual or info on Sylvania modulation meter model X-7018. KØOCC, 8240 Grogan Ferry Rd., Atlanta, GA 30350. (404) 396-1312

WANTED: Tubes, new or used - 8005, 6550, 6CA7, KT88 and tube audio amps. George Schwarz, 18504 Arrowhead, Cleveland, OH 44119. (216) 486-6489

FOR SALE: (2) Valiants - $200; CE 100V - $200; HT-32 - $100; SB-10 - $45; R46B - $35. PU only. Mike, W1JZ, (508) 529-4427 B4 8PM.

WANTED: Hallicrafters DD1 Skyrider diversity, only in very good condx. Jose Cangas, EA4JL. Contact in the States Kurt Keller, (203) 431-6850

FOR SALE: Cornell-Dubilier capacitors: type "PM" molded tubular, axial lead, values available in NOS 10 packs, .0005 @ 600V, .003 @ 600V, .01 @ 600V, .015 @ 400V, .03 @ 600V, .05 @ 600V, .22 @ 600V, .47 @ 400V, .5 @ 200V - all values $5 per 10 pack; CDE "Tiny Mike" ceramic capacitor kits. Each kit contains 8 popular values, 150 to 5000 pF @ 500 VDC, mid-'50's vintage, NOS - $1.25 per kit; authentic CDE vibrators - #5715, 6-V, 4-pin standard, #5820, 6-V, 5-pin synchronous - $10 each; Mepco/Electra computer grade caps, 200 pF @ 400 VDC - $3 each. Please add 10% for shipping. $5 minimum order. Bill Kleronomos, KDØHG, 224 Main, Box 1456, Lyons, CO 80540

WANTED: Lafayette HE25 and KT390 xmtrs and Lafayette BCR101 rcvr; also Clegg solid-state all-bander schematic or manual. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

FOR SALE: Exchange or donate - hard to get units, parts, tubes, tech. info or anything pertaining to radio. SASE. Cdr. Glenn W. Ritchey, USN Ret., W7SAB, 219 Naval Ave., Bremerton, WA 98310. (206) 373-9631

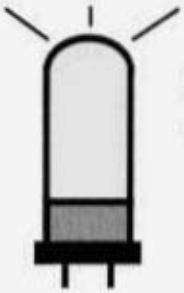
FOR SALE: Swan 250 6 meter AM/CW/SSB xcvr, clean, w/AC pwr sply & original manual - $180; Drake R-4A rcvr - $150. Gary Stigall, WA7RGQ, 3619 Pershing Ave., San Diego, CA 92104. (619) 294-7895

FOR SALE: HF/KWM-380 digital keypads that are electrically and functionally identical to the original model AC 3805A keypad. These are newly manufactured units, packaged in a colormatched and weighted low profile enclosure. A small quantity will be built and I'm taking orders for these units. Price is $199.95, plus $5 S/H with a 30 day moneyback guarantee. Specs available with a SASE. Jerry Brouwer, AB8U, 3041 Rising Springs Ct., Bellbrook, OH 45305.

WANTED/FOR SALE: Vintage tube CB's. Send card or call with models you have for sale. LSASE for list. Steve White, WB5UGT, Box 1086, Clute, TX 77531-3814. (800) 374-6477 (9008) leave message.

FOR SALE: Two Knight T-60's w/manuals - $60; **WANTED:** Johnson Thunderbolt, HQ-110, D-104. Woody Linwood, WRØS, POB 23, Franktown, CO 80116-0023. (303) 660-1616

WANTED: Radio Shack DX-400; Uniden CR 2021; RME 4350; TMC GPR-90/92; RCA model CRM R6A; SX-101 MK II; Heath SB-610 monitor scope. Rick, K8MLV/Ø, 1802 W. 17th St., Pueblo, CO 81003. (719) 543-2459



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