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ELECTRIC RADIO

celebrating a bygone era

Number 175 December 2003

S. Claus, Radioman

ELECTRIC RADIO

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Electric Radio is dedicated to the generations of radio amateurs, experimenters, and engineers who have preceeded us, without whom many features of life, now taken for granted, would not be possible. Founded in May of 1989 by Barry Wiseman (N6CSW), the magazine continues publication for those who appreciate the intrinsic value of operating vintage equipment and the rich history of radio. It is hoped that the magazine will provide inspiration and encouragement to collectors, restorers and builders.

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

Regular contributors include:
Bob Dennison (W2HBE), Dale Gagnon (KW1I), Chuck Teeters (W4MEW), Bruce Vaughan (NR5Q), Bob Grinder (K7AK), Jim Hanlon (W8KGI), Brian Harris (WA5UEK), Tom Marcellino (W3BYM), John Hruza (KBØOKU), Bill Feldman (N6PY), Hal Guretzky (K6DPZ)

Editor's Comments

I would like to take this opportunity to thank every ER reader for their nice comments and constructive criticism sent in over the past year. Your support and encouragement are greatly appreciated, and I wish that it were possible to thank everyone personally. From the feedback I've received this year, everyone likes what I've been doing with the magazine, so I plan to keep doing it! Many readers have expressed concern that the cost of a subscription will increase, or that the focus of Electric Radio will change. Please be assured that there are no plans to increase the cost of Electric Radio, unless a big increase in postal rates leaves me no choice. I'm sure that everyone has noticed that I've increased the size of the magazine at no extra cost to the readership. Electric Radio is going to remain focused on AM, CW, restoration of vintage equipment, and radio history. Happy Holidays!

Saturday, January 25 should be a good day to schedule the dynamotor event because I can't see that there should be many contests running that weekend. It would probably be good to start at 5:00 PM EST and continue until there are no more contacts available. Some good frequencies might be CW on 3547 and 7047 kc, and phone on 3880 kc. Let's hope that it works out better than the event last summer did.

I've been asked about a Broadband Power Line update, but there is very little new information to report. There apparently is a field trial underway in a Virginia suburb that has no licensed radio amateurs and no overhead power lines which I'm sure is a convenient arrangement for proving that BPL won't cause harmful interference. There is also nothing to cause an interruption of Internet service. I will report on any relevant findings as soon as new information comes to light.
73, Ray, NØDMS

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Cover: Reproduced from the cover of Radio Magazine 79 years ago this month, Santa Claus is making his rounds in a mail plane, which is fitted with the latest RDF equipment.

The RME-84 Receiver

by Chuck Teeters, W4MEW
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Augusta GA 30909
Cteet70@aol.com
Photography by Reggie Fraser, KG4HAD

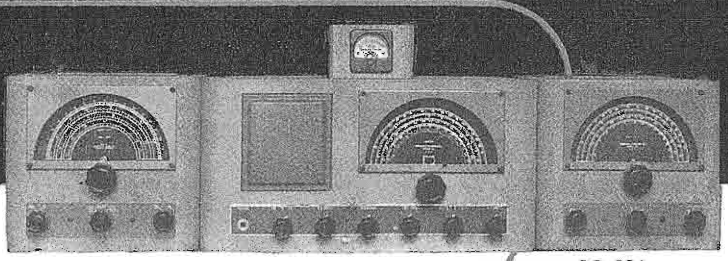
Because of funerals and hospitals, the Shelby, N.C. Hamfest, August 30th was my first this year. Not being able to drive, I got a ride with KN4AV. This eliminated any selling and limited my purchasing to one fifth of the trunk space. Thankfully, no super buys in boat anchors showed up, but I did run across a decrepit looking RME 84 receiver. Missing all the knobs, band spread/logging dial, and most tubes, in a cabinet that was rusted from top to bottom, it had not generated any buyer interest. A bit of haggling and it was my only purchase. My total expenditure was $16 including the admission ticket and lunch.

The RME 84 was the receiver I used in grad school at Northwestern. With a 6V6 40-meter crystal oscillator/transmitter stuck in the top of the cabinet powered by the receiver power supply, it provided many pleasant breaks from the school routine. I remembered the RME as a small, light, dependable receiver that heard everything I wanted to work. I had purchased the 2-year-old used receiver from Allied Radio in Chicago in 1948. The receiver was relegated to standby duty when I returned to Fort Monmouth N.J., and a borrowed BC-1 004 Super Pro. I sold the RME to a new ham in 1953. It was still working as good as the day I got it. I had never taken it out of the cabinet, changed a tube, or touched up the alignment. My thoughts were that if I could bring this receiver back to life, I could find out how good the RME 84 really was. I have found that in the past my receiver performance memories are better than the radios really were.

The RME 84 was the first effort by the Radio Manufacturing Engineers to build and sell a low priced receiver. Unlike Hammarlund, Hallicrafters, and National who sold low, medium and high priced receivers, RME only produced one receiver at a time. The first was the RME 9, which they sold from 1932 to 1935. Their best selling receiver was the RME 69, which they sold between 1935 and 1940. They followed the WW2 ham radio shut down with the $180 RME 45 in 1945, and then in 1946 they added the $98 RME-84 to their product line. The 84 was competitive with the Hallicrafters S-40 and the National NC-57 in price and performance. However the RME 84 lasted just 18 months before production stopped due to poor sales, the NC-57 was on the market for 36 months, while the S-40 and follow-on models, A, B, C, and the '85 lasted for over 13 years. The RME 84 production run was probably less than 800 units over the 18 months the unit was built. The only change through out the run was when the audio output tube was changed from a 6G6 to a 6AK6 and the nomenclature was changed to RME 84A.

When I got the Shelby 84 home and on the bench, I opened it up. This was easy as nothing was fastened together-chassis to cabinet, speaker to chassis, phones jack to front panel, or filter choke to chassis. Nothing major was

Unmatched in performance!



VHF 152A
TYPE S

RME 84

DB 22A
TYPE S

THE VERSATILE RME 84

The RME 84 is versatile because it can be used for home, portable or mobile operation. It operates off 110 AC or a 6 volt power pack with cable attached. Optional equipment for the RME 84 is the RME VP2 — power pack and the carrier level "S" meter, CM-1, both with cord and plug.

It's an all band coverage receiver for phone or CW — RME's first entry into the lower priced communications field, and built to RME's rigid specifications of quality components and quality workmanship. Other features include:

- Excellent over-all sensitivity
- All gear and planetary tuning mechanism
- New "loctal" tubes
- Four tuning ranges: .54 to 44 MC
- One preselector stage
- Automatic noise limiter
- Self contained shock mounted PM speaker
- Seven tube superheterodyne circuit, excluding rectifier.

THE VHF 152

Utilizing the extremely effective double conversion system, the VHF 152 Converter provides peak performance on 2, 6, 10 and 11 meters when used with any communications receiver. Wide bandspread on each band is obtained through 180 degree travel over a 7" diameter scale with accurate calibration.

ANTENNA CONNECTIONS

Provision is made for the use of four separate antenna connections. Thus each band has its own especially designed antenna input circuit. Other features include an individual power supply, shielded output cable, calibrated dial, all-gear planetary tuning mechanism, voltage regulator, VHF oscillator circuits that are temperature stabilized and new high gain miniature tubes.

Illustrated Folder Available For Each RME Product

TIME WILL TELL

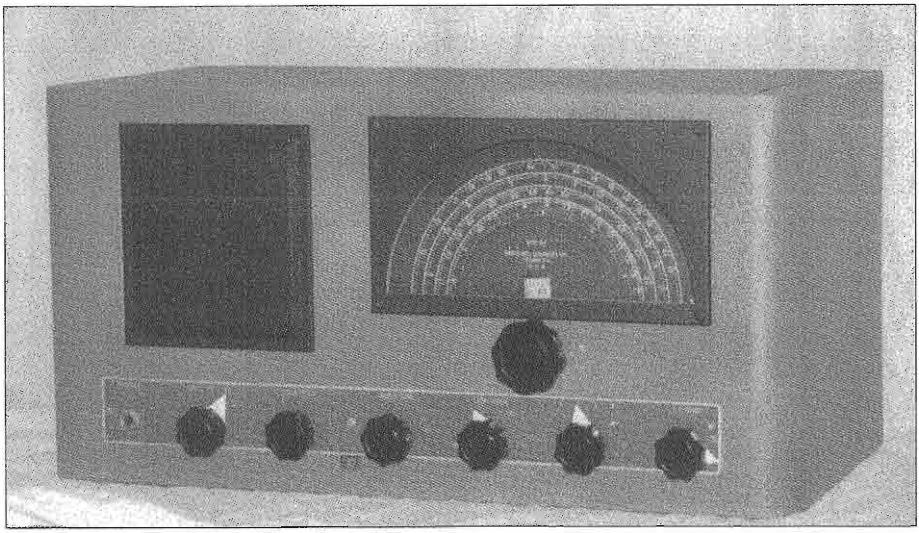
RME

FINE COMMUNICATIONS EQUIPMENT

RADIO MFG. ENGINEERS, INC.

Peoria 6, Illinois U. S. A.

RME was a frequent advertiser in Ham publications for many years. In this full-page ad from the 11th edition of the Radio Handbook, published in 1947, the RME 84 is shown alongside the 157A VHF converter, the DB22A preselector, and the matching S-meter.

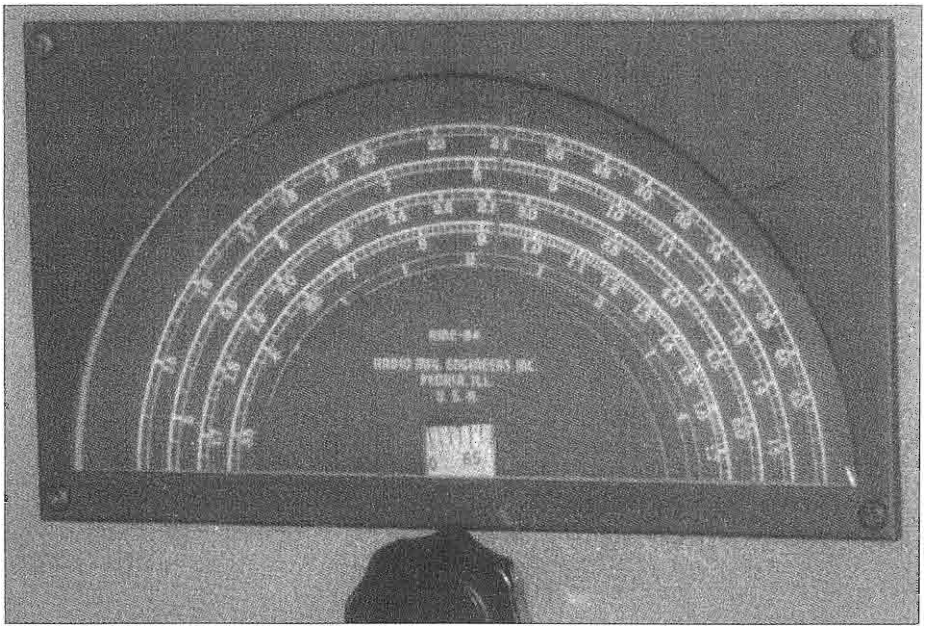


This is the front view of my RME-84 after restoration was completed. When I found the receiver, all of the knobs and the bandspread dial were missing.

missing however, except the inner logging/band spread dial scale. The output transformer was a replacement, mounted on the chassis instead of the speaker frame, and a two-section unit had replaced the three section electrolytic filter. About half a dozen paper caps were hanging loose, and several resistors were charred. The major damage was a burnt up 10-watt bleeder resistor and a wire wound replacement tacked on to its remains. This was right next to a bundle of wires feeding the external power connector. RME did not use color-coded wiring, everything around the bleeder was brown or burnt charcoal color.

The first step to restoration was to find my copy of the schematic that I had held onto for 50 years. Schematic located, I stripped off the loose parts, cleaned up the chassis, lubricated the frozen control shafts, and started in on the burnt wiring. It was not as bad as it looked when I pulled it apart, only 2 cooked wires. The RME 84 has an external power socket for battery operation. The socket had connections to the bleeder resistor, the AC line switch, the filaments, and high and low B plus. With the proper jumpers on an octal plug the receiver works on its internal AC power supply. With different connections, a 6-volt, 90 volt, and 135 volt battery pack would run the receiver. In either case, the front panel switch on the tone control controlled the primary power and the stand-by switching operated normally. Also when set up for battery power the bleeder resistor was disconnected to reduce battery drain.

With the bleeder replaced, new filter caps, and the power wiring straightened out, the power transformer, 5Y3 rectifier, and the rest of the power supply checked out OK. A trip to the attic produced set of tubes, three 7B7s in the RF and two IFs, a pair of 7K7s for the second detector, BFO, noise limiter and 1st audio, a 7S7 converter and a 6G6 audio output. A clean up of the tube sockets, tubes installed, and everything lit up, but no noise. A shorted .01 across the output transformer primary was replaced, and I had a working audio system. Replacing two leaky coupling



The bandspread dial from a Hallicrafters S-19R fit the RME-85 perfectly.

caps cleaned up the audio. A shorted screen by pass was killing the RF and IF amplifiers. Replacing it, I had some background noise but no signals. There was no plate voltage on the 7S7 oscillator section. There was no decoupling resistor in the B plus lead. It must have been removed and someone forgot to replace it. I installed a 22K resistor and the receiver came to life. A few more leaky caps replaced and 3 new one-meg resistors, and it was working.

RME uses a mechanical band spread system, unlike its competitor's two-dial systems. The RME 84 has a 5-to-1 planetary drive from the tuning knob to drive a 0-to-100 logging dial, and then a 10-to-1 gear drive to turn the main dial from the logging scale. Overall, it provides a ratio of 50-to-1, and is very smooth in operation. Everything was there except the backlit logging dial. A check of the miscellaneous parts department turned up a 0-to-100 band spread dial from a Hallicrafters S-19R, which fit perfectly. Other than the characteristic yellow of old Hallicrafters dials it was a perfect replacement. When the drive was cleaned up and lubricated it was a good as new, no backlash, no slipping and no sticking. RME uses a painted aluminum escutcheon on the lower front to label the controls. When I pulled this off the cabinet and buffed it up, it was in excellent condition. The steel cabinet however needed to be taken down to bare metal, primed, and painted to restore it to its original condition.

With the chassis installed in the refinished cabinet, I let the receiver run for 24 hours. The only failure was the section of the power switch in the filament circuit. I guess 3 amps was too much for the old switch. Not expecting to run the radio on batteries, I jumpered the switch. The switch section in the AC lead only has 1/2 amp going through it and it was ok, so I left it alone. The alignment starts with the IFs, and they were on the money except for the secondary of the first can. Some-

body must have tightened a loose screw at one time! The RF alignment is provided with slug-tuned coils for the low frequency band ends and trimmers for the high-end alignment. The most interesting alignment is the mid-band oscillator adjustment only on band 4, 15 to 42 MHz. Overall the dial tracking was excellent with small errors showing up at the extreme high and low ends of each band, probably about a 5% error at the most, and only in the area, frequency wise, where the bands overlap.

I measured the IF selectivity and found it was 6.2 KHz at 6db down and opened up to 14 KHz at 30 db down. The IF selectivity could be tightened up to less than 4 KHz with the tone control in the full bass position, but I liked the sound better with it opened up and making use of the selectivity in my ears for interference rejection. Sensitivity was about 13 uV across the broadcast band, getting a bit worse on the low end. 160, 80, and 40 meters gave sensitivity measurements around 3 to 4 uV, 20 meters was 7 to 8 uV, and 10 meters measured just over 10 uv. The automatic noise limiter in the RME 84 is as good as they get, comparable to the HQ-129X with noticeable distortion on voice, but taking out all the pulse type noise. The noise limiter switch is the only unlabeled control on the receiver, and has the appearance of being an afterthought.

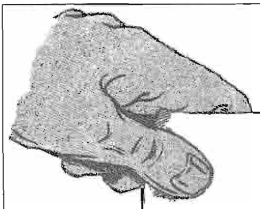
The main dial has calibration marks every 10KHz on the broadcast band, every 50 KHz on 160 and 80 meters, every 100 KHz on 40 and 20 meters and every 200 KHz on 10 meters. The bandspread, or logging scale, provides 6 KHz per division on 160 and 80 meters. On 40 and 20 meters each division is 20 KHz, and on 10 meters each division is 50 KHz. Oscillator drift in the first 30 minutes is about 8 KHz on 10 meters down to under 2 KHz on the broadcast band. After 30 minutes the receiver settles down and only needs an occasional touch up during a 30 minute QSO. The only bad thing I can say is the BFO is touchy, so I leave it alone most of the time.

The RME 84 is the only receiver that performs as well as I remembered it performing. The few dollars and time spent on restoring it has confirmed for the first time that my memory is not always off base. I have run up 10 to15 hours of QSO time on the RME 84 and find it superior to the early S-40, and National NC-57, but inferior the HQ-129X, which I consider the best receiver for the money of the post WW 2 era. The only real complaint I have with the RME 84 is that it is not as small and light as I remembered. 28 lbs in a 10" by 18" by 9" high case is not small or light. Of course my lifting power might have decreased a bit over the years, which might cloud my evaluation. However if you find an RME 84 try it out for yourself, both lifting and operating. Regardless, it is a nice receiver and I'm going to keep this one for quite a while.

ER

To join AMI send $2.00 to AM International, PO Box 1500, Merrimack, NH 03054. Make it your New Year's Resolution to support our AM Organization!

An on-line index to Electric Radio may be found at www.qsl.net/n9oo/ersearch.html or under the "links" tab at www.ermag.com.



Mailbag

To:
Electric Radio
PO Box 242
Bailey, CO
80421

Dear ER:

Ralph DiMuccio's story of his attempt to operate the Boy Scouts Jamboree of the Air is a very sad one. However, I think he made a tactical mistake.

Knowing that 7290 kcs was the main 40-meter AM frequency, I'd have declined to operate SSB there regardless of assignment. I'd have said, "I'm sorry, but that frequency is sometimes used by a fairly rude group and we're likely to have more trouble than it's worth." Had we unknowingly started on a frequency claimed by AM'ers I'd have QSY'ed at the first problem. Either way, I'd have said, "You know, there are a few jerks like that everywhere and the best thing to do is simply walk away." That communicates a useful (and true) lesson; at the same time it avoids claiming for ham radio a black eye, which is not specifically ours. Or did you think these aren't the same louts who zoom by you on the shoulder when traffic is backed up, or annoy half the theater with drunken remarks during a movie?

The old saying remains true: "It is unwise to mud wrestle with a pig. You will get muddy, and the pig will win." I've run quite a bit of AM myself and only a few AM'ers are rude. But a couple of the East Coast crowd seem to have taken up the mode mainly to be out of step and in the face of others; if AM were to become the standard tomorrow, they'd switch to SSB in a heartbeat. And too many others either tolerate or participate in the sort of schoolboy nonsense that Ralph describes.

Walt Hutchens, KJ4KV

Dear Editor:

Here's yet another response to Bruce Vaughan's article, "Ham Radio's Future," ER #173.

While the reality is ham radio as we know it is (pardon the bad pun) going down the tubes, let me cite a couple of things I consider strengths, with an eye toward whether they could help save it.

CW is one of the last bastions of civility not only in ham radio but modern life in general. Virtually no profanity, racism, gay bashing, angry politics, etc., coupled with an emphasis on good operating skills and appreciation for the "magic" (propagation, the chance for exciting QSOs) of it all. CW ought to be saved. More in a minute.

I choose to cut the League a break, because as an organization with somewhere around 100 employees it has a vested interest not only in ham radio but in its own furtherance. The League is the national and international voice for us and I think it has done a good job overall. The League has been accused of dumbing down the hobby, but there is a curious contradiction there. For instance, I just got from them a list of publications they sell, and I would say most of them exceed the interest or ability or operating privileges of a Technician class ham. In that sense the League is encouraging upgrading.

I'm a VE, and what I've seen locally is what I hear is going on everywhere - -people pass their Technician test and plateau right there. They join the "SFG (Same Five Guys) 2-meter Net." My daughter calls it NMGOH, pronounced NUME-gah – "Not much going on here" – which is how most check in.

We could give those Technicians a friendly boot in the butt if we made their license — their *entry level license* – good for only a year or two. (Yaaas, I know this notion has been tried before with some disastrous re-

[continued on page 17...]

Beam Power Tubes

by John Hruza, KBØOKU
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My introduction to beam power tubes came in the winter of 1951-52 when I built my first transmitter on a 7" x 9" open chassis with a fiberboard panel. It was a cathode-keyed tuned-plate power oscillator using a 6L6. There was a second tube on the chassis– a 5Y3GT with a power transformer salvaged from a junked television set. The rectifier worked half-wave with both plates in parallel into a capacitor-input filter. Good thing none of my neighbors had TVs – they could have read my call sign on their screens!

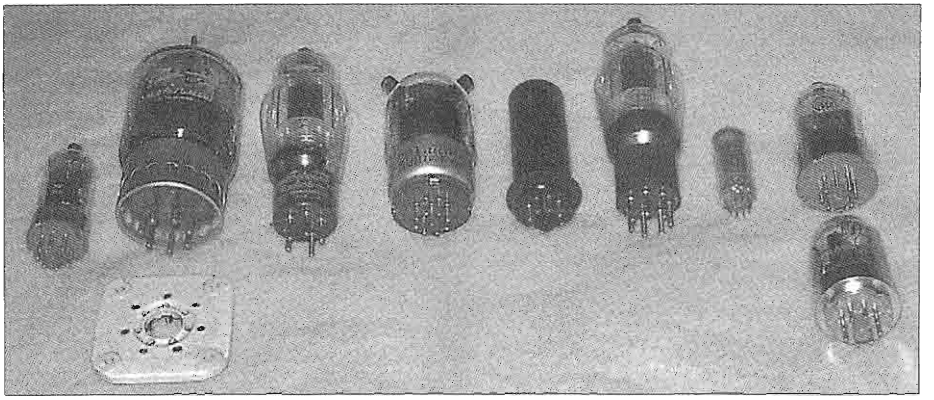
The design was based on one from a prewar ARRL Handbook that had been built on a breadboard. It wouldn't oscillate on the steel chassis, so I opened the grid leak and shorted the screen and cathode resistors. I had nothing left but the crystal, the tube and the plate tank circuit. At 600 VDC I dipped that tube to 125 MA at resonance. I was running 75 watts into a tube rated 30w maximum by the manufacturer!

The 6L6 only lasted for about 10 minutes of key-down, enough for an hour or two of operating. Then I had to use the folded up hand towel I kept handy to pull the tube out, and plug in another. But they were cheap. They were used as audio output tubes on large broadcast/shortwave radios. After a few years they got gassy and started to hiss at the listeners. The sets came back to the shop; the technician replaced the 6L6s and threw out the old ones. I scrounged my tubes from the shop trash bins after school. I did have to pay for replacement 5Y3s, though, when I transmitted too long and the plates turned red and sagged against the filaments.

The 6L6 was the first of the beam power tubes, announced by RCA in late 1935. It was intended as a replacement for the type 45 power pentode audio output tube, but by midyear 1936 it began to appear in RF circuits in QST. The June issue featured a 6L6 crystal oscillator, July a high fidelity amplifier, and September had a tri-tet oscillator and frequency multiplier. The 1937 ARRL book "Building an Amateur Radiotelephone Transmitter" showed 6L6s as push-pull modulators. The tube sold at that time for 98 cents.

By late 1936, RCA was selling the first beam power tube designed especially for transmitter service, the 807, initially rated 40w input but increased within a year to 60w. At only $3.90 its cost was well below that of comparable ordinary transmitting tubes. Not much later Raytheon offered the RK-39, also rated 40w. In January 1937, Ken-Rad announced the 4.25w 6V6 as an auto radio audio output tube, and RCA introduced the 2w 25L6 for the same service in series-string ac-dc radios. In July 1937 Raytheon brought out the 375w (120w out) RK-47 and 800w (250w out) RK-48 transmitting tubes. By January 1938 RCA, not to be outdone, announced the 450w (160w out) 814 and 800w (375w out) 813.

After that came a veritable flood of beam power tubes. The 35L6 and 50L6 joined the 25L6 to avoid using a ballast resistor in different tube lineups. The 35L7 and 50L7 combined a beam power tube with a rectifier diode in the same octal-base package. The 7A5 was rated 1.9w with a loctal base. After the war the 35C5 and 50C5 contained a 4.5w beam power tube inside a 7-pin minia-



Here are some examples of transmitting type beam power tubes. From left to right: Raytheon 2E26, Eimac 4E27A/5-125B above an EF Johnson forced-air cooling socket, Westinghouse 807, RCA 815, RCA 1622, RCA 1625, RCA 5763, RCA 6146 which is above a Sylvania 6146B.

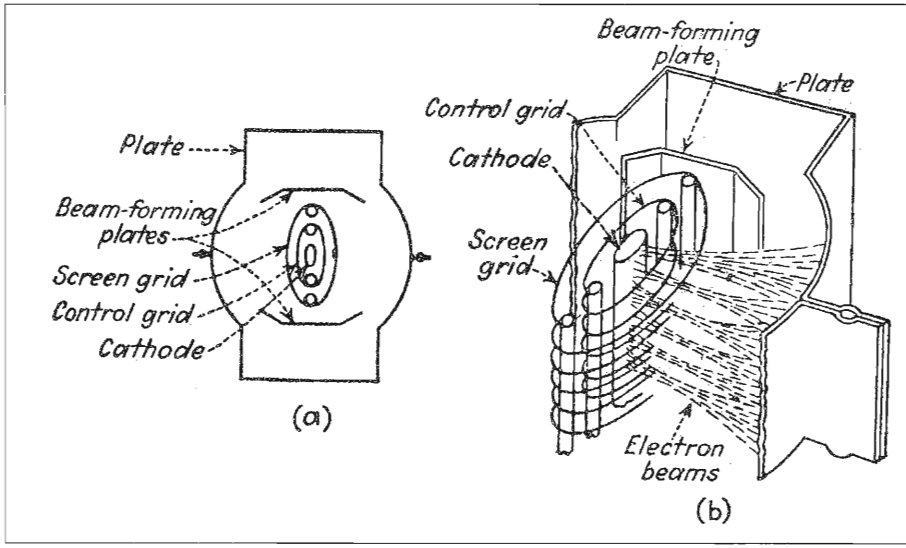
ture envelope. The 5763 was a 9-pin miniature with a huge 17 watts input. The 2E24 and 2E26 handled 40 watts at VHF frequencies and the 90w 6146, an improved version of the 75w 807, worked up there as well. Later, the 6146B did it with 120w into its plate.

Why did the beam power tube so suddenly and completely take over so many vacuum tube functions? There are two main reasons, the first of which is called power sensitivity. The beam power design simply added beam-forming plates to the basic power tetrode/pentode design. These plates are mounted at the ends of the grids, just beyond the posts that support them. The plates are held at cathode potential, thus focusing the electrons that would otherwise escape at the ends of the grids back to the anode plate of the tube. This greatly increased the electron density at the plate, thus allowing a much greater power output for a given power input. Beam power tubes are not much better as voltage amplifiers than ordinary power tubes, but they are excellent power amplifiers. And this also lets them operate at a much lower plate voltage than comparable ordinary tubes.

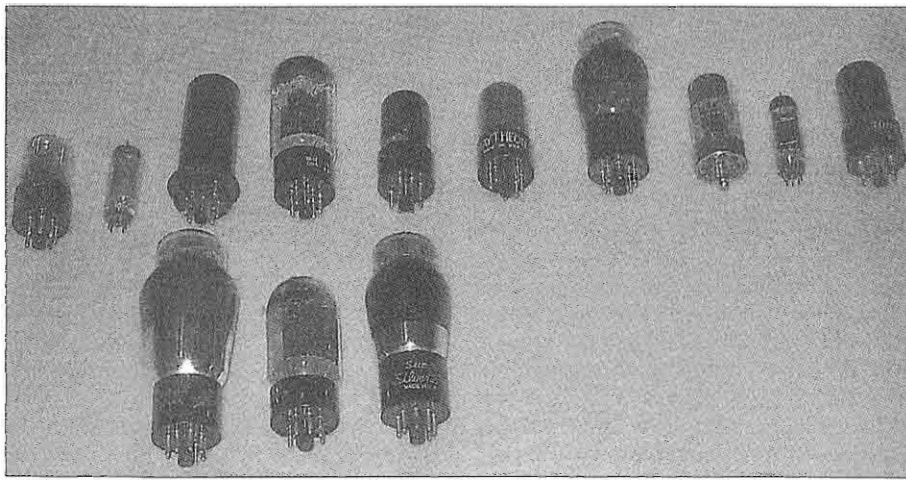
Second, the fact that almost all the electrons that are given off by the cathode pass the control grid and go directly to the plate, which makes for greatly improved linearity. A beam power tube has virtually no re-emission or reflection of electrons from the plate. The solid-state people have not, to this day, developed any device that can handle high power with the linearity of a beam power tube. That is why both today's high fidelity audio fan and popular musician still prefer amplifiers with beam power tubes.

There are many additional advantages to this design. For example, the minimal loss of electrons means that there are few available for heating the glass bulb even without getters or other means of mopping up stray electrons. This means that the glass remains relatively undamaged, minimizing gas leakage into the vacuum. Similar minimization of internal damage to tube elements also helps to prolong tube life. Thus, actual tubes retain their theoretical characteristics much longer. This helps explain why my power oscillator tube could survive as well as it did, given the rather brutally excessive power I drove through it.

Other advantages include minimal effective interelectrode capacitance due



In this figure, a horizontal cross section of a beam power tube is shown in (a), and a cut-away view of a 6L6 tube is shown in (b), which clearly shows the electron beams as they are formed by the grid structure and the two beam-forming plates. By confining the electron beam in this manner, a "virtual cathode" forms between the screen grid and plate that prevents secondary emission, and also reduces screen-grid current. (from Eastman, Fundamentals of Vacuum Tubes, McGraw-Hill 1941)



Beam power receiving tubes were also quite common, and here are some examples. From left to right are a Sylvania 3Q5GT, GE 6AQ6A, NU 6L6 which is above a Sylvania 6L6G, GE 6L6GB above an RCA 6L6GC, a Tung-Sol 6V6GT above a Silvertone 6V6G, a Raytheon 6W6GT, a CBS-Hytron 6Y6G, a Raytheon 7A5, a CBS 50C5 and lastly a Tung-Sol 50L6GT.

to the heavy space charge near the plate. Beam power tubes thus require little if any neutralization. When neutralization is required, it is very noncritical and thus easy to adjust and doesn't need frequent readjustment. Also, this means that the plate is a true anode. Design of the plate is about the only factor controlling the power handling ability of the tube, as witnessed by the 5763. Minimal electron losses means maximum efficiency; thus a very powerful tube be can fitted into a very small package.

ER

Typical Beam Power Tube Specifications -

	Cathode		Plate	Input	Output	Max	
Type	Volts	Amps	Volts	Watts	Watts	MHz	Notes (Octal base unless noted)
1T5GT	1.4	0.05	90	0.17			portable radios
3Q5GT	2.7ct	0.05	90	0.27			portable radios
35A5	35.0	0.16	110	1.4			
70A7GT	70.0	0.15	110	1.5			+ 125v 60ma diode rect, ac-dc radios
32L7GT	32.5	0.3	110	1.5			+ 125v 60ma diode rect, ac-dc radios
35L6G	35.0	0.15	110	1.5			ac-dc radios
70L7G	70.0	0.15	110	1.8			+ 125v 70ma diode rect, ac-dc radios
7A5	7.0	0.75	125	1.9			Loctal base
25L6	25.0	1.25	110	2.2			ac-dc radios
50L6GT	50.0	0.15	110	2.2			ac-dc radios
6W6GT	6.3	1.25	135	3.3			
6Y6G	6.3	1.25	135	3.6			
6AQ5A	6.3	0.45	275	4			7-pin Miniature base
6V6	6.3	0.45	300	4.25			
35C5	35.0	0.15	110	4.5			7-pin Miniature base
50C5	50.0	0.15	110	4.5			7-pin Miniature base
6AS5	6.3	0.8	150	5.4			7-pin Miniature base
25C6G	25.0	0.3	200	6			ac-dc radios
1622	6.3	0.9	300	10			
5763	6.3	0.75	350	17	12	50	9-pin Miniature base
6L6/6L6G	6.3	0.9	375	33	17		also KT66, KT88 & 5881
2E24	6.3	0.65	600	40	27	125	
2E26	12.6ct	0.4	600	40	27	125	6893 is 12.6v
1624	2.5	2.0	600	54	35		5-pin Medium base
RK41	2.5	2.4	600	56	36		5-pin Medium base, RK39 is 6.3v
807	6.3	0.9	750	75	50	60	5-pin Medium, also 807W & 5933
1625	12.6	0.45	750	75	50	60	7-pin Medium base
815	12.6ct	0.8	500	75	50	125	dual tube working push-pull
6146/6146A	6.3	1.25	750	90	70	60	8032 & 6883 are 12.6v, 6159B 26.5v
6146B/8298A	6.3	1.125	750	120	85	60	
4636				300		890	
8226				340		400	or 105w to 1215MHz
RK47	10.0	3.25	1250	375	120		5-pin Medium base
814	10.0	3.25	1500	450	160	30	5-pin Medium base
4E27A/5-125B	5.0	6.5	3000	500	375	75	7-pin Medium base w/forced-air hole
RK48	10.0	5.0	2000	800	250		5-pin Jumbo base
813	10.0	5.0	2000	800	375	30	7-pin Jumbo base
8977			8400	5kw			broadcast TV audio final amp
9007			8400	27kw			broadcast TV video final amp
4CX7500A							Svetlana ceramic TV final amp

Note – Different reference materials show different specs. I tried to use those from the period when each type was at the peak of its popularity for amateur service.

Installment 6

W. J. Halligan
Newspaper Reporter and the State of Radio 1923-1924, Part 3
General Vignettes and Epilogue

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Full Outline of Part 3: The Broadcast Phenomenon

A. Radio Programs
B. Broadcasting Technology on the March
C. Vignettes Inspired by the Culture of Broadcasting
   1. Applause Cards
   2. General Vignettes
D. Epilogue
   1. The Initial Purpose of Broadcasting
   2. Bearing the Expenses of Programming
   3. Sources of Revenue
   4. Rebroadcasting as Precursor to a National Broadcasting System
   5. Transatlantic Tests
   6. WGI

General Vignettes

Letter received telling how a certain fan serenaded his best girl over the radio. For some reason he was unable to call at the house, so he carried on his wooing with the aid of his trusty transmitter. [3/8/23]

Radio has become the greatest booking office in the world. A short time ago a lady violinist, student at the New England Conservatory of Music, was asked to play a few selections at a local broadcasting station. She did not know that theatrical bookers from coast to coast have entered the vast army of broadcast listeners until she received five offers to go on the stage, two of them coming from Chicago. [3/12/23]

WJAX, broadcasting station of the Union Trust Company, Cleveland, has arranged a novel and interesting schedule for this evening. One part of the program will be devoted to a checker game between Alexander Cameron, of Northeastern, O., and Maynard B. Smith, of Cleveland. [3/15/23]

The concert of the Huntington School Glee and Mandolin club, which was interrupted by wireless messages from the disabled Italian steamship Giulia, will be given again at a date to be announced later. [3/24/23]

Some of the artists who have taken part in broadcasting concerts have told of acute attacks of "stage fright," although they had faced great audiences in the theatres and opera houses. It was the great unknown element in their huge audiences that fazed them. The fact was before them that their effort was received by persons at unknown points and with unknown characteristics, for the radio audiences runs from the small boy who makes his own to the most distinguished critic.
Then, when broadcasting, personality is badly handicapped. The facial expressions are lost and personal magnetism is missing. The artist must depend entirely on his voice. [5/15/23]

Great interest is being shown in the broadcast of hockey games seen from the Arena through WNAC, the Shepard

Stores. Of the great crowds which rush to the Arena to attend the games, not all are able to obtain admission. But disappointment no longer falls upon these hockey enthusiasts when they learn that all seats are taken, for they can return to their homes and there listen to the games via radio. We know many who enjoy these broadcasts better than actually seeing the games. [1/8/24]

"Buddy" Murray, stage manager of the "Lady in Ermine," is a strong supporter of radio broadcasting. He is authority for the statement that his show was doing only a fair business in Boston when a broadcast was given through WNAC. Immediately every seat in the house was sold out and it was impossible to obtain a seat for the last 13 days in this city. This appears to conflict directly with the statement of another theatrical producer who declares that radio broadcasting is ruining the stage business. [1/8/24].

Members of the Greenwich Village Follies at the Shubert theatre not only heard their own show as it was broadcast from WNAC, the Shepard Stores, but they also depended on the radio for their calls and cues. The radio receiver was maintained by William and Joe Mandell, principals of the show, who built the set themselves and installed it in their dressing room where they entertained members of the company during the performance. It is interesting to know that not a person missed his or her cue during the evening. [1/24/24]

The battle between the National Association of Broadcasters and the American Society of Composers, Authors and Publishers has become more brisk with frequent exchanges of shot from both camps. The Broadcasters charge the Composers with using holdup methods to force radio broadcasting stations to use their copyrighted music. They cite instances to support the charges. As a result several prominent music publishers have resigned from the composers' society and have gone over to the side of the broadcasters. [2/18/24]

In order to demonstrate to the American radio fans the rapidity, distance, and accuracy with which code messages are transmitted and received, a unique contest will be held from the Crosley radio station at 10 p.m. Wednesday, Feb 27. This contest will begin after the regular musical program and those who read or send code should find it particularly interesting. Details of the contest will be given that night in code from WLW station in Cincinnati. [2/18/24]

Thousands who have listened with enjoyment to programs broadcast from WTAT have many times asked who the announcer at the Edison Light station is. He is none other than Jack Caddigan widely known song writer. Jack's faculty of spreading joy to radio listeners is not always confined to work before the microphone, be it known. This was evidenced after he received a letter from a crippled, seven-year-old boy living in East Boston. The boy in his letter told how much he enjoyed concerts from the Edison station and explained that although he was unable to coast or play games with other little boys, he did have "lots" of fun listening to the local radio stations with his crystal set. Soon the boy will, at the invitation of announcer Caddigan, visit the Edison station where he will have many good things to eat and he will see the artists perform before the microphone of WTAT. We learn, too, that his listening henceforth will not be confined to the crystal set and all because of Jack. [2/25/24]

We may all attend Oxford, Haidelberg [sic], the Sorbonne or some other famous foreign university—by radio. Classes are being planned for broadcasting English and other instruc-

tion on power sufficient to transmit the lectures across the Atlantic. [2/25/24]

Radio dances have become one of the most popular forms of entertainment in the Yukon during the past winter, says "Popular Science Monthly" for April. Residents of Dawson and many small settlements along the Yukon River have tripped the light fantastic to broadcast music played by the best orchestras in the United States. [3/12/24]

Radio demonstrated its usefulness once again during a recent concert from WBZ, Springfield. Charles Pearson, of Newton, musical student at the New England Conservatory, sang into the microphone one night recently and was heard by relatives in Georgia who had never seen him. [3/17/24]

Perhaps the first speech to be broadcast almost around the world by radio was that given by the Prince of Wales at the opening of the British Empire exposition yesterday. The almost world-wide broadcasting chain system of the United Kingdom was put into use. [3/19/24]

First effort to make radio an important factor in the coming presidential campaign is being made by W. G. McAdoo, one of the contestants. McAdoo plans to erect a $30,000 transmitting plant at his home in Los Angeles, from which he expects to broadcast his speeches, and save much traveling. [3/19/24]

Many requests are received by the studio director of the Crosley Radio Corporation for programs to be broadcast by WLW, but probably the strangest one ever received came from an undertaker who wanted a solo broadcast at the time of a funeral service held in his mortuary. [3/24/24]

Weekly programs from the United States are being attempted for broadcasting in England. At the same time, programs will be sent across to America. [4/2/24]

WOC, Davenport, Ia., has started a woman's exchange of household hints which has proven so popular that a booklet of these hints and recipes is planned for distribution. Women listening in on WOC send in their own recipes, the best of which are rebroadcast for others.[4/28/24]

Both Democrats and Republicans will be free to let loose at station WAAM, Newark, N.J., and their remarks will not be censored. But the station owners make it known that whatever is said will not necessarily represent their own attitude. [5/12/24]

When dramas are broadcast by radio, the action ordinarily seen by an audience has to be transmitted by sound. An entrance or exit, for instance, is designated by a slamming door. A bell helps sometimes to announce a newcomer. A telegraph key or locomotive whistle signifies a railway station scene. And so on. [5/12/24]

D. Epilogue

The onset of broadcasting represents in the annals of science a triumphant milestone. Three nineteenth-century advances in the study of electricity are among its more noteworthy antecedents. First, Michael Faraday in the 1830s developed the principle of the transformer. He showed that it is possible to raise or lower the voltage of an alternating current via induction between two closely coupled windings. His observations led him to postulate that a form of vibration propagates both light and electromagnetic waves through the atmosphere. Second, James Clerk Maxwell conceptualized in 1867 a mathematical formulation of Faraday's vision in which he predicted that both light and electromagnetic waves travel similarly through space at a speed of 186,000 miles per second. Third, Heinrich Hertz in 1888 drew upon an electrical-oscillation experiment to provide empirical support for the Faraday-Maxwell theory. When Hertz demonstrated the presence of electrical

waves in space, his findings astounded the scientific community.

The three nineteenth-century scientists extended enormously our understanding of electromagnetic phenomena, and subsequently, a legion of physicists, electrical engineers, and experimenters applied their talents to create increasingly sophisticated wireless apparatus. Technological attention was centered mainly on the communication needs of amateur, maritime, military, and commercial enterprises. Evolving theory and ongoing practice were too remote and esoteric for average persons who were occupied with the give and take of daily life. However, the KDKA broadcast of November 2, 1920, revealed convincingly that newly attained refinements in vacuum tube transmitting equipment showed that voice and music could be broadcast with a degree of clarity that compared favorably with that of a phonograph record.

The new form of entertainment enraptured the populace en masse. Citizens who had heretofore been apathetic toward radio, began fantasizing about how broadcasting would envelop their lifestyles. For most people, the new phenomenon was both unanticipated and unfathomable, but mental simulations of its potentialities blossomed swiftly. Radio denoted an invisible fourth-dimension among the natural forces of the universe. Owen D. Young (Boucheron, 1923, pp. 254-255), Chairman of the Board of RCA, proclaimed that "for the purpose of communication it has destroyed time and space." He asserted lyrically: "broadcasting has appealed to the imagination as no other scientific development of the time. Its ultimate effect upon the educational, social, political, and religious life of our country and of the world is quite beyond our ability to prophesy." Voices and music indeed poured through physical barriers from all directions into the privacy and solitude of domestic living rooms. It was time, many believed, to start listening for signals from advanced civilizations, such as might be thriving on Mars and other planets.

Broadcasting was here to stay; of that, everyone was certain. Douglas (1987, p. xv) describes the intrusion of broadcasting on the social consciousness as a "craze." She says that it was cast in the pages of the press as a "'fever' tearing through the population, inflaming all in its path. The fever seemed to come from nowhere, it had a power and force all its own, and few were immune to its symptoms. 'In all the history of inventing,' exclaimed a typical editorial, 'nothing has approached the rise of radio from obscurity to power.'"

The "craze" to which Douglas alludes, is documented by the exponential proliferation between 1921 and 1924 of listening devices in every locale of the country. As the radio mania swept across the nation, the number of broadcast receivers reaching the marketplace attained staggering proportions. Only ten to twenty thousand receivers in the United States in 1920 were privately owned. The number reached 100,000 by the end of 1922, 600,000 during 1923, and 2,600,000 during 1924. Fifteen million sets were in homes by 1929 ("Editor," 1938).

As the broadcasting phenomenon unfolded, those who were responsible for application of the new technology—entrepreneurs, manufacturers, and performers—sought answers to the following five questions: (1) What should be the primary purpose of broadcasting? (2) Who should bear the expenses of producing quality programs? (3) What sources of revenue might be available? (4) Will "re-broadcasting" evolve into a national broadcasting network? (5) What are prospects for international broadcasting? Bill Halligan skirted

around such ideological/technological queries. After all, the young journalist in the early 1920s was outside the power loops associated with broadcasting. His attention was centered, therefore, on its functional aspects rather than its ideological implications. He was less concerned with where the evolution of broadcasting was taking society than in how its present-state affected average persons. Yet his vignettes serve to highlight fundamental issues related to the above questions. Solutions to them that arose in the mind-set of 1923 are, therefore, discussed below:

The Initial Purpose of Broadcasting

When Westinghouse broadcast over KDKA the presidential election returns of 1920, the program was intended less to entertain the public than to enlarge the market for its receiving apparatus. Executives in the Board Rooms of RCA and its subsidiaries were ecstatic as they witnessed the market expansion. The monopolistic conglomerate hastened its effort to enforce its patents. Clearly, millions of dollars were at stake as insatiable demand arose for both manufactured receivers and components for building them.

Although Westinghouse carefully selected a prominent, intensely interesting moment for its first broadcast, early competitors gave scant attention to program development. Fortunately, any catch-as catch-can, erratic offering sufficed, since people were eager to listen to whatever they could hear, and minimal expectations prevailed. Bill Halligan's listing of radio fare, including typically local soloists, glee clubs, bands, school musical groups, dramatic clubs, and church choirs, is illustrative of the primitiveness of early programming. Doubtless the fare thrilled listeners, but little of it was likely to have been screened in advance by station managers, and most of the presentations were probably dreadful. Collison (1922, p. 435), complained that too often programs sounded lousy because microphone placement and acoustics were neither understood nor implemented properly. Orators, he said, "should be neither asked nor permitted to bore several hundred thousand people with some lengthy discourse on abstract subjects." He argued presciently that "the general public has purchased receiving apparatus to be amused and interested, and if the broadcasting stations do not maintain a high standard they will defeat their own purposes."

The giant corporations associated with RCA, however, chose to concentrate their manufacturing facilities on reception equipment, and to ignore problems and headaches associated with developing the content of broadcast programming. Manufacturing was their raison d'etre. They were assured of success. They thoroughly controlled circuit and component patents. Competition was non-existent, providing patent violators could be restrained. The market for their products thus seemed unlimited. Why should they engage programming, which was an uncharted field that was fraught with variables that they could not manipulate readily?

Bearing the Expenses of Programing

Except for when microphones were placed in front of a phonograph machine that was playing a record, live performances dominated programing in the early 1920s, as revealed in Bill Halligan's vignettes. Artists volunteered services in return for publicity via a listening audience that was often promised, without substantiation, to be in the thousands, and sometimes, even tens of thousands people. A committee of the Society of Composers, Authors, and Publishers asserted in 1923 that music publishers were "vitally interested in radio broadcasting as a great future user of music and that our rights in the use of copyrighted

music in public performances must be protected. However, we appreciate the fact that radio broadcasting is still in a chaotic and experimental state, and that while ultimately it will have to be placed on a commercial basis if it is to develop its potentialities, nevertheless the commercial side of the broadcasting problem has not yet been solved. In view of these facts, and also because we desire to cooperate in developing the music possibilities of radio, we believe that we should allow the use of our copyright compositions for broadcasting without charge for the present and without prejudice in our rights" (cited in Morecroft, 1923b, p. 270).

The Society, meeting in plenary session, rejected the Committee recommendations. It favored instead a process of collecting royalties from a broadcast station that transmitted, whether by phonographs or otherwise, copyrighted material. It proposed a flat royalty rate to be based on the presumed size of the listening audience. Station managers, in turn, argued that they were not accruing profits and could not afford royalty payments. They contended, too, that inasmuch as an artist was receiving royalty payments from the sales of recorded music, whether the music is broadcast either live by the artist in studio or by phonograph record, the ensuing publicity should enhance sales and provide indirectly additional royalty.

The station managers, perhaps sensing flaws in their reasoning, organized themselves in 1923 into the National Association of Broadcasters (NAB). The new Association set forth to work out a compromise with, at least, the composers of popular music. The plan called for the composers to send their new songs to a panel of the NAB, which would select songs to be broadcast. If the pubic responded favorably, the song would be published and sold in music stores. Only the composer would reap royalties from the sale of the song. The NAB, as its reward for putting the song before the public, would share with the composer mechanical royalties—those earned from the sale of phonograph records and piano rolls. The NAB thus reckoned that adoption of its proposal would ensure that both composers and broadcasters had everything to gain and nothing to lose (Morecroft, 1924, 4, p. 274). Members of the Society saw the scheme differently; they believed that the NAB had more to gain whereas the composers had more to lose. Accordingly, the proposal passed into oblivion [see General Vignettes, 2/18/24].

[Next month, Bob continues the Epilogue of Part 3.--Ed]

ER

[...Mailbag, from page 7]

sults.) Then they would need to learn some code — five measly words a minute, come on — and some more theory and get ready to work the world instead of just Curly and Moe.

But we are still left with the challenge of why a young person, say, who can turn on his computer and connect pretty much flawlessly with almost anybody they want to in the world would want to take a test to connect with strangers under iffy conditions. We need to sell the magic, the sizzle, not the steak. Flawless computer connections have all the magic of a root canal.

How to do it? OK, get ready for a big belly laugh: Create a glitzy book with some notable personality on the cover (Walter Cronkite, I love ya, but you're not the one this time), a book maybe as good technically as "Now You're Talking" — but maybe just more of an overview of ham radio, not a study guide — but jazzy and "hip." Then TALK IT UP ON OPRAH.

Look, if Michael Moore of "Bowling for Columbine" and "Dude, Where's My Country?" (a best-seller) fame thinks Oprah ought to run for president, why wouldn't we want somebody with her clout to talk about ham radio for us? Can you picture well-known

[continued on page 24...]

OH NO--NOT ANOTHER ARC-5 ARTICLE!

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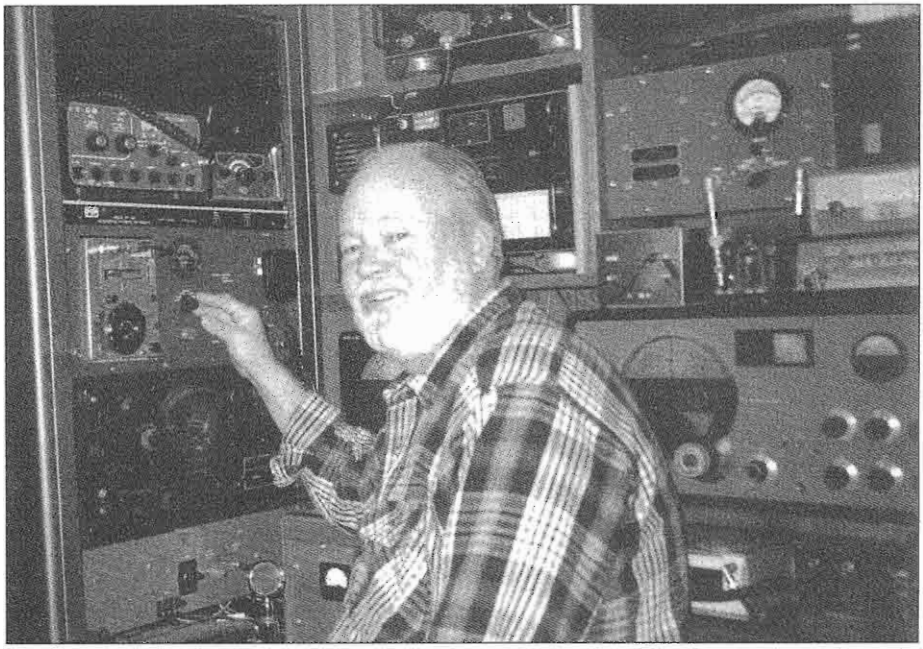
OH YES! But this one is not for the military collector purist. We are not gonna set up and operate these radios as if they were installed in some WWII bomber. Actually, the sets in pristine condition which have never been modified are not the subject of this dissertation, but rather the butchered, wretched, carved up rigs that every OT has or has had are the critters we are going to tame.

The little ARC-5 series of transmitters and receivers have been called the "shmoos" of Ham radio. For those who happened along after the demise of Lil' Abner (probably about the same time as the demise of the ARC-5 sets), "shmoos" were critters that pretty much looked like bowling pins with feet that jus' loves to be et'. They were reported to be good for about anything you would want. The ARC-5 series is pretty much like that. At one time they were everywhere, and cost from half a buck to ten bucks. Those days are pretty much over...except for the real "junker" sets that have the extra holes, controls, tubes and all sorts of modifications on top of other modifications. I once picked one up at a hamfest that had power transistors all over the front panel. It was someone's mobile rig at one time, I suppose. It was ugly; even though the work was well done electrically, that rig is now operating nicely on 160 meters AM phone. This is the kind of project I am going to promote in the following paragraphs.

First off, there are about a bazillion (give or take) sources of ARC-5 modifications and some of those will be listed at the end of my ramblings here. As mentioned above, these sets were manufactured during WWII for use in Army and Navy aircraft. There are several basic sets covering overlapping frequency ranges and the frequencies of any can be changed to suit the needs of the moment without much in the way of rocket science. This is nice since the models that do not cover a ham band or desired frequency can be had cheaper than those that cover ham bands as is. I strongly urge anyone champing at the bit to tear into an original condition ARC-5 first seek out a military collector, he will probably trade you several sets suitable for this project for one in excellent condition.

These sets work well as received but there are a few changes that will make them a bit more suitable for the twenty-first century airwaves. These improvements are: the addition of a buffer stage, and a stabilized power supply. Most ARC-5s will FM slightly with modulation. It is probably not technically a problem, but I find it annoying to turn on the BFO while listening to an AM signal and hear the beat "wobble" with speech. Some are worse than others; all MOPA sets will do this to some degree. Keep in mind also that many SWL's will be listening with receivers set up for SSB, FMing will be quite apparent to these listeners, this also makes zero-beating accurately more important than the AM ham would think necessary. There have been many keying modifications published that will remove the CW equivalent of this, known as "chirp." As before, the amount of

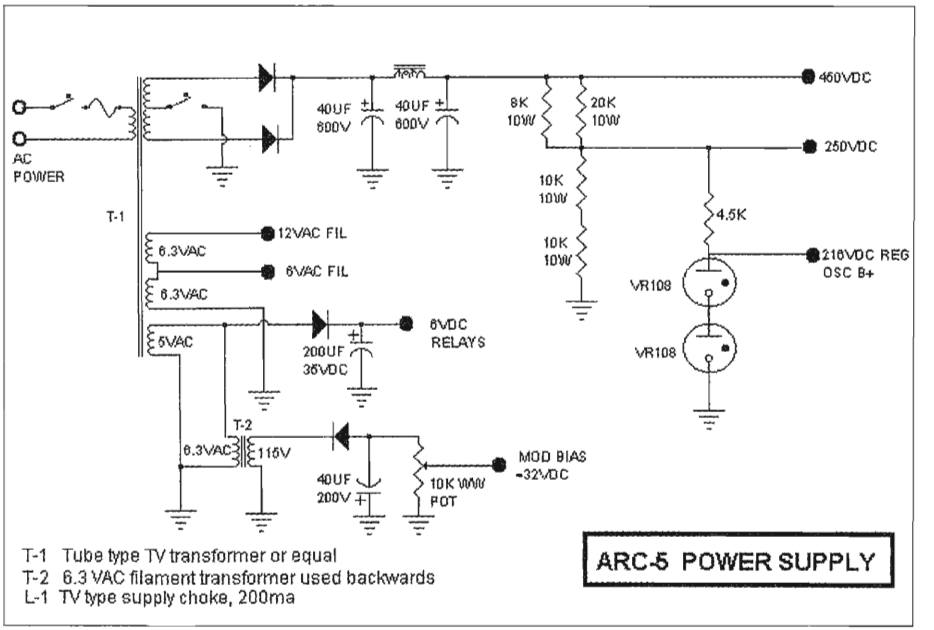


Frank is at the controls of his ARC-5 station. Notice the BC-348 directly underneath the transmitting equipment, and the powered-up SX-42 behind him. This article is *not intended* to promote modification of historic aircraft radio equipment, but rather it provides a method to rescue units which might never be used otherwise, or worse yet, disposed of.

chirp/FM depends on several things, not the least of which is power supply dynamic range and regulation. A well-designed buffer between the VFO and the PA stage will remove any FMing caused by load variations presented to the VFO by a keyed or modulated PA stage. I chose to use PA cathode keying, which provides usable, if "token" CW.

I took my hamfest "prize" home, put it on the bench and marveled at the modifications. Four TO3 style power transistors were mounted on the front panel and a 25-watt modulation transformer was installed where the antenna loading coil used to be. The good thing about a "much modified" (read, butchered) set is that it does not much matter what you do to it, you will not make it worse. I pretty much stripped the chassis of wiring and modifications. This was an 80-meter model and I wanted to fix up some of these rigs to plug into a rack panel that will contain a modulator/power supply/metering and control circuits. My idea was to make each have the same operating conditions and connections. The bands I wanted to play with were 160, 80 and 40 meters. Other bands could be added later. Believe it or not, there are modification articles that will put these rigs on 20, 15, 10 and 6 meters, and also to run double or single sideband. The work involved is, of course, commensurate with the desired end result. Check out the reading list at the end of this article for details on the more elaborate possible modifications.

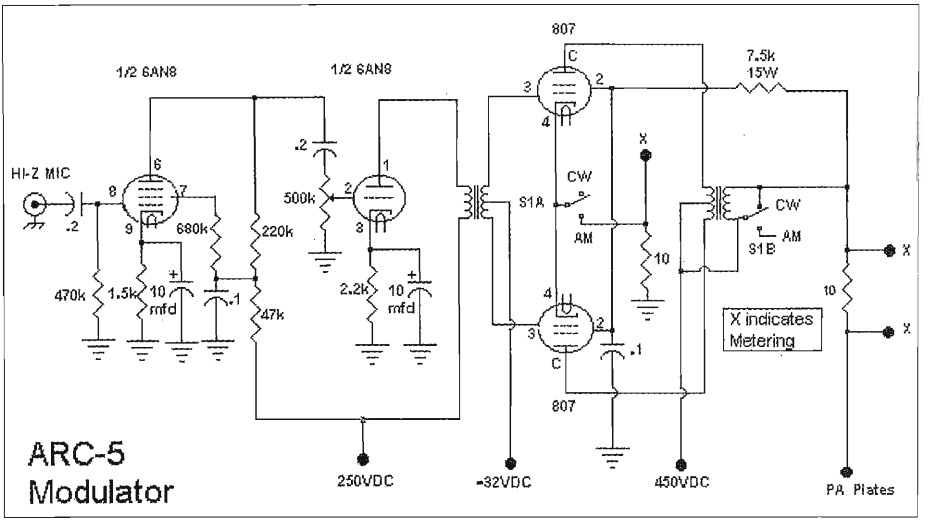
The ARC-5 series of transmitters can be run at about 90 watts input with no strain. I usually run mine at about 50 watts input (Plate DC current times



This schematic, and the three schematics that follow on the next two pages, are intended to be used as concepts for building your own circuits. Therefore, no specific construction details are given in the text.

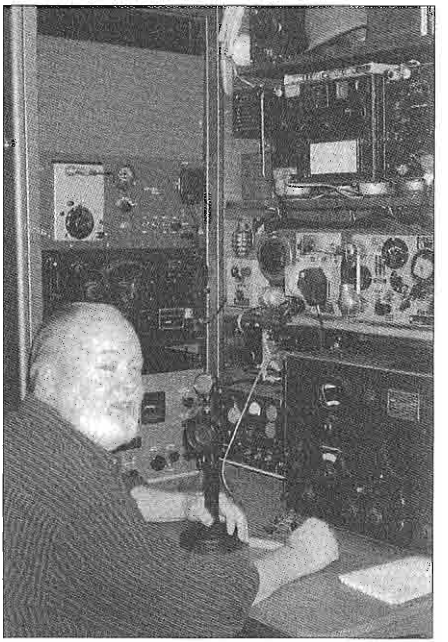
voltage). I modified the hamfest prize to tune the 160-meter band by rewinding the VFO coil and careful adjustment. I removed the crystal and the "eye" tube, which were used for calibration checking and used the empty socket locations for the new buffer stage and its associated parts. The tube selected for the buffer is not particularly important, just use a tube with filament voltage the same as the rest of the tubes in the set (12.6V). I used a 12SK7, because it is designed for RF work and mainly because I have a bunch of them. I found that it gave plenty of drive and that I could increase or decrease it at will by juggling the screen voltage and or the plate inductor. A 12A6 would be another good choice.

I have heard two main schools of thought on the drive level required for the two 1625s (a 12 V version of the 807 with a different socket). The books I have looked at say around 5 ma per tube in class C RF amplifier service. Some of the modification articles say

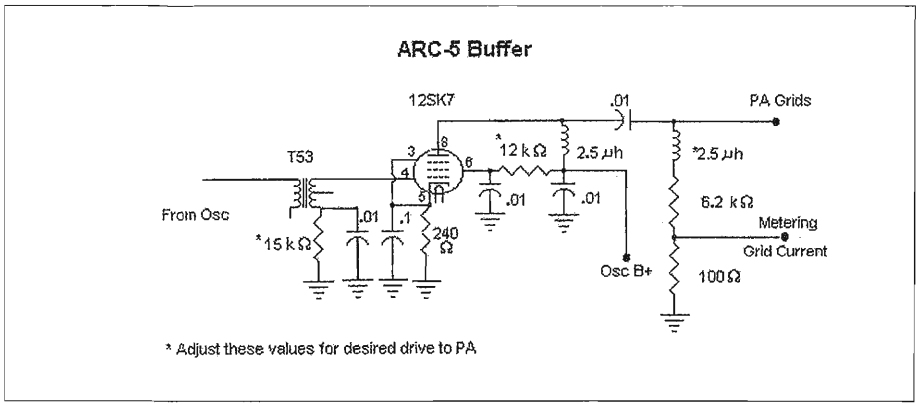


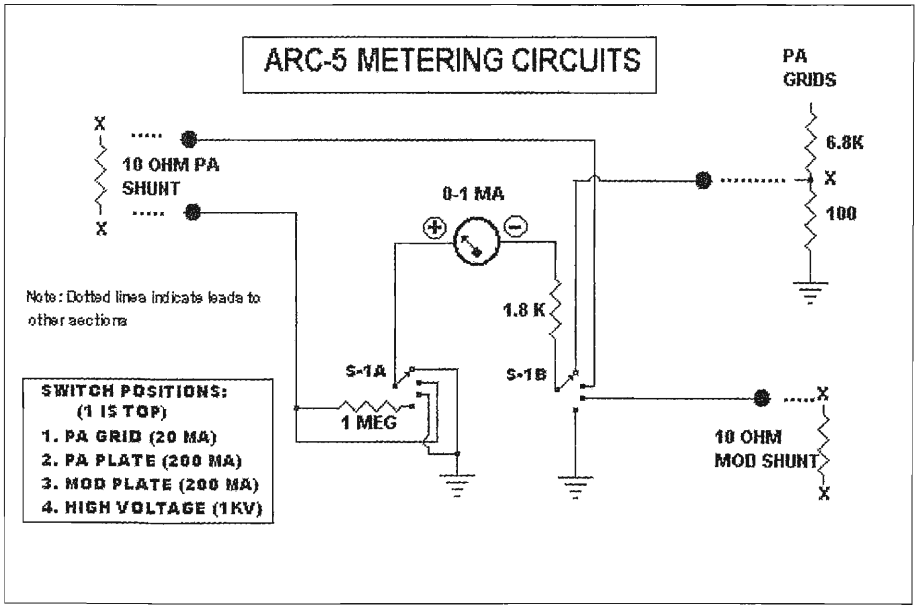
that as little as 2 ma is OK. I set my ARC-5's to run at 6 ma (two tubes in parallel = 3 ma each). This works fine. I suppose it would be worth experimenting with but I doubt that much improvement in overall performance would be forthcoming. These little rigs accept and even seem to enjoy abuse.

Well, this started out to be just a sort of an ARC-5 idea article but it seems to be getting a little detailed and longer than anticipated. The ARC-5 modifications are in print and generally available. I did what I needed to get the ARC-5 to perform like I wanted, and then used it for my "standard." I then took an 8 1/2 inch rack panel and mounted a rear shelf on it deep enough to accommodate the ARC-5 equipment and wide enough to allow installation of a modulator/power supply chassis which I would need to build. I cut out an opening 7 and a half by 5 and half inches near one end so that an ARC-5 transmitter could be inserted and would then rest on the shelf. I built the power supply and modulator chassis pretty much using junk and standard circuits. Diagrams are included here but this is not a construction article. Your junk box will be different certainly. My control and metering circuits are more complicated than they have to be but that is just because they were designed while being built and a lot of the "this would be nice" stuff that was thought of in the



Frank's low-power military operating position has a lot of historic equipment that is fun to operate.





process was added midstream.

I have two of these sets completed, and can change them out in a minute or less. The rack mounted control/modulator/power supply panel is great and is something a ham of the late 1940's, 1950's or early 1960's would have been proud of. Now, what did I do with that ARC-5 I was gonna put on 6 meters?

ARC-5 Modification Information

"Command Sets" Published by Cowan (CQ Magazine) 1957 (This is the Bible of ARC-5 info)

"Surplus Radio Conversion Manual Vol. 1,2,3 " Distributed by Editors and Engineers, LTD.

"Surplus Schematics Handbook" Published by Cowan Printings 1959 through at least '67

"CQ New Mobile Handbook" Published by Cowan 1956

There are many more articles in Ham magazines of the period. Many of these are available on CD for those using computers, which is handy as you can print out the portions desired.

ER

An Alternative Method for Regenerative Receiver Design

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I have noticed in recent issues of ER a continued interest in regen receiver construction, and it has rekindled memories of my own interest in them dating back well over 50 years. Until recently it has been somewhat of a mystery as to why they work as well as they do, and I have never seen any really detailed technical discussions on this matter.

Long ago I moved on to an abiding interest in superhet receivers, probably inspired by reading articles on the subject in QST, the ARRL Handbook, The Radiotron Designer's Handbook, and the Radio Receiver Design book by Sturley. But I retained some of my earlier curiosity about regen receivers, and noticed that many investigators (including Armstrong himself) commented on the increase in demodulated signal output when the amount of regeneration was increased to a point just below oscillation. The only way that could happen is if the resonant impedance of the tuned circuit feeding the detector is increased, so that the signal coupled to the circuit, capacitively or inductively, from an antenna or prior RF amplifier, is stepped up to a higher level. In either case what is needed is a higher Q in the tuned circuit feeding the detector, and my claim is that the regenerative detector functions in part as an early version of what is now commonly known as a Q multiplier - Heathkit and probably others made such devices to use at IF frequencies for peaking and notching purposes, and similar devices for similar purposes have been described for AF use. Thus the genius of Armstrong was to

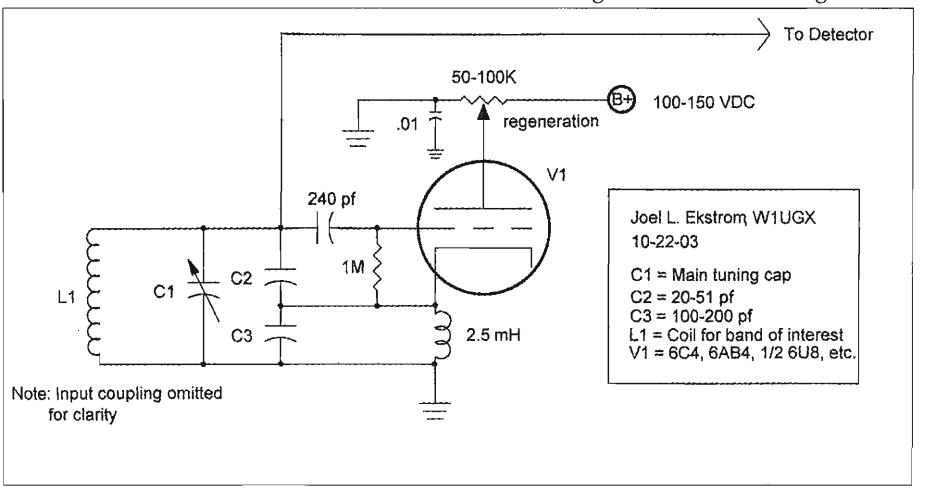


Figure 1: An RF Q-multiplier form the basis of my alternative for the design of regenerative receivers. Nothing in this schematic is hard to find or build.

combine the functions of Q multiplication, signal demodulation, and audio amplification in a single tube. However it is not necessary to do things in exactly this way. Any tuned circuit can have its Q increased by setting it up as an oscillator, but reducing the feedback to a point below that at which self-sustaining oscillations take place. Indeed several circuits to do this are described in the Receiving Systems chapter of the 1967 ARRL Handbook, and probably elsewhere. In the ARRL Handbook examples, the Q-multiplied circuits are feeding superhet mixers, but that is not important as far as the principles are concerned.

The zinger in all of this is that a regen receiver circuit employing separate tubes for Q multiplication and detection/audio amplification was described about 60 years ago on pages 144-145 of a book titled "Radio for the Millions" and published in 1943 by the Popular Science Publishing Company, and about 55 years ago I built the radio described there and it worked as advertised—great little set—no tickler or tapped windings to worry about and no plug-in coils—just a switch to select the desired RF coil. Translated to more modern tubes the schematic would look something like Figure 1 (page 23), and of course variations are possible. The regeneration could also be controlled using a bypassed pot between the bottom end of the RF choke and ground, instead of varying the B+ on the plate, the purpose of course being the control of the tube transconductance. The values of C2 and C3 can also be varied to suit the designer and obtain optimally smooth regeneration. The value of C2 should be kept as small as possible in order not to significantly reduce the tuning range available with a given maximum C1. Note that the circuit is similar to circuits used in Colpitts oscillators. The input coupling could be via a link, a small capacitor (like that used in ARC-5 receiver) or a high impedance primary resonant with the antenna capacity to a frequency well below the lowest frequency used with a particular coil.

For the detector, a grid leak detector was used in the 1943 book, but a plate detector or infinite impedance detector could also possibly be used, and they do not load the tuned circuit as much as the grid leak detector. However they have less gain and possibly more distortion, and would require more audio gain.

I hope this modest discussion will inspire some experimentation on the part of ER readers, and perhaps some articles reporting results.

ER

[...Mailbag, from page 17]

and attractive country singer Patty Lovelace — a ham – on Oprah? I can. Oprah's on-the-air book club created best-sellers overnight.

My point is it doesn't matter whether you like Oprah or not, we need to flip over the defensive notion that we are moribund and *brag* about how exciting this hobby is, *brag* about the magic of uncertainty, and of good operating skills and the chance to connect with people around the world. We are a fraternity, and we make friends all over, even if Kurt Vonnegut makes fun of us for having a CW "friend in Alaska."

There's no way we can pretend to like the possibility that some day you might be able to get your ticket for a dollar and two cereal box tops. But we shouldn't underestimate people (especially young people) either. Any first grader knows more about getting around on computers than I do, they learned it, it is a form of technical savvy.

They may not want to talk to a steady diet of 60-year olds on CW anymore than they'd want to talk to us in a chat room. But they'll do the studying and take the tests if there's something in it for them, especially if looks like someone in the in-crowd likes and believes in it.

Does the glitzy book with snappy text and Oprah have a prayer? Maybe not. But if we stick with "fuddy-duddy" and not "magic" we won't have a prayer either.

Who among us will do the book with Madonna on the cover?

Chuck Brumley, KB2E

The Collins ART-13 Transmitter Revisited-- Restoration For Amateur Service

by Bill Feldmann, N6PY
(n6py@qnet.com)

Introduction

In the spring of 2003 I purchased an ATC transmitter and was given two ART-13's. This presentation will describe my experience in making all three operational and some simple modifications that I made on one of them. The ATC and the cleaner of my two ART-13's were left completely unmodified. I modified the second ART-13 to operate on 160 meters, flatter audio response and more gain, and for cleaner CW keying.

The ART-13's History and Design

The ART-13 aircraft transmitter was originally designed by the Collins Radio Company in response to a Navy requirement issued in 1940. The transmitter needed the ability to rapidly change frequency, 100 watts of output, much better audio quality and reliability than existing aircraft transmitters, could operate CW and MCW, and could be programmed for remote operation. It was to be powered by standard aircraft voltages of 24 to 28 volts DC. It was first designated as the model ATC and Collins Radio was given its development contract. Roy Olson was in charge of the project for Collins. There was also a contract issued for a competing design, the ATD, by another contractor. After development and testing the design was adopted for long range Navy aircraft in early 1942 and was in service by 1943. The ART-13 is considered to be the best HF aircraft transmitter of WW2. However, due to its complexity for a transmitter of that time, our Navy came close to rejecting it during the final design review until a British naval officer said he really liked it and the British would take every one Collins could make, then our Navy decided to issue the production contract.

There are four military versions of the ART-13: The initial Navy ATC, the ART-13, the ART-13A, and the ART-13B. Circuit wise, except for the MF VFO, the first three are identical except for an added safety interlock on the top cover of the ART-13A. Some of the relays in the ATC were physically different than ART-13 relays, but the circuits were identical. The ART-13B had some minor circuit changes, which are described in the field maintenance manual. Collins made all ATC's and non-A radios while other contractors built most B and A radios after WW2.

For excellent frequency stability and repeatability it had the first application of the famous Collins PTO that was designed and developed by Ted Hunter at Collins. This main PTO operated in two bands between 1mc and 1.6 mc. A two-stage multiplier provided for continuous frequency coverage between 2 and 18.1 mcs. It also could be equipped with an optional medium frequency (MF) oscillator, which allowed coverage between 200 and 1500 kc when used with an external final tank circuit on the early Navy ATC. The ART-13 or ART-13A used a 200 to 500kc oscillator, and the ART-13B used a fixed crystal oscillator. The transmitters incorporated a CFI crystal calibrator module that provided tone markers for accurate frequency calibration.

For rapid frequency change the mechanical autotune system, developed by Pete Morrison at Collins, selected up to 10 preprogrammed frequencies. The five autotune modules selected the

VFO frequency, multiplier frequency band, and final amplifier network tuning and antenna impedance matching. The radio operator would select a channel, tune the radio using the five autotune controls and then lock these controls so the radio would always return to these settings when ever that channel was selected. There was an 11th channel for selecting the optional MF oscillator and a 12th channel for manual HF tuning.

The audio module was designed for input by carbon or low impedance dynamic mics. It used a low to high impedance input transformer followed by two stages of audio amplification using a 12SJ7 followed by a 6V6 modulator driver tube. This module fed the two chassis mounted 811 modulator tubes which provided both screen and plate modulation of the final using a very efficient modulation transformer with a separate screen winding. This makes the ART-13 an extremely desirable Ham AM rig that can only be matched by broadcast rigs for audio quality if the right mic and audio system are used. This design is capable of extremely low audio distortion for a military radio, less than 5%. The weak link for distortion was the carbon mics usually used with this radio.

For excellent reliability it used an 813 final amplifier delivering a conservative 100 watts of RF output and two 811 modulator tubes. It used an 837 oscillator tube and two 1625 multiplier/driver tubes. The final fed an L network designed to feed capacitive low impedance wire antennas below about 9 mc and a PI network for higher frequencies. When using the MF oscillator, relay switching was provided to feed the external final antenna-matching network.

Obtaining Your ART-13

This is usually the most difficult, and is often a matter of luck and good fortune. I looked for over a year with no luck. Then, one Saturday evening when I checked into the West Coast Military Collector's net and mentioned I was looking for one, a net member said he had an ATC with the optional MF oscillator. Within a few weeks while I was cleaning up the ATC, an ART-13 turned up and was given to me by a friend who had obtained it with a broadcast AM transmitter. The third came from a fellow board member of our local Ham club. He had obtained an ART-13 from a disbanded MARS station and gave it to me. This one was very clean and most likely never had been used, having all fresh tubes and absolutely no wear on any relays or controls. After dust removal and lubing the autotune system, it fired up like it had just come from Collins.

They sometimes show up at Hamfests or flea markets. Try to find one that is unmodified. If it has been modified, look for documentation showing only minor reversible modifications. Unfortunately, many are highly modified or are parts rigs because they were so cheap and plentiful after WW2. Most of the best ones were purchased surplus and just put away and forgotten. They seem to show up out of someone's garage.

ART-13 Manuals

Don't even attempt to work on or use an ART-13 until you have obtained a copy of the manual and understand its theory of operation and how to use it. The little operating manual that came with the rig is usually missing and is hard to find. You will need the missing information to work on one. The field maintenance manual is more useful and has all the information, so it's all you'll need.

Good original manuals are very hard to find, and if you have one you may not want to use it because of its collector value. I obtained an excellent Air Force copy (T.O. 12R2-2ART13-2) from W7FG at 800-907-6146 that covered all models and was last revised in May of 1972. This manual copy has everything you need to know about the ATC or ART-13 except for the early MF VFO.

Dennis DuVall (W7QHO) provided me with a circuit schematic for my MF VFO from his ATC manual.

Power Supply

To operate your ART-13 you will need the following voltages: 24 to 28 VDC at 10 amps, 1100 to 1400VDC at 250ma, and 400 to 430VDC at 250ma. If you plan to use your ART-13 on CW the 400V supply must be regulated to reduce chirp and should have less than 5% ripple to reduce hum on phone.

In aircraft use these voltages were supplied by using a dynamotor running off of 28 VDC. The dynamotor will require 30 amps on phone and a starting surge current of close to 90 amps. Good dynamotors are getting hard to find, they are noisy, and they require lots of starting current. If you plan to use one, a good idea is to use a 28V supply good for at least 30 amps, and parallel it with a couple of 12 VDC automobile batteries in series to handle the starting surge current.

Most of us prefer to build a supply for our use in the shack. A very nice design by John Svoboda (W6MIT) is shown in Figure 1, the schematic on page 28. This supply also has the relays needed for transmitter control. Finding transformers is the greatest problem when building a supply. John's supply is unique; it uses one transformer for both the 400 and 1200-volt supplies. John's 400V supply is well regulated. I highly recommend regulation and good filtering of the 400V supply since any hum will get into the audio module and regulation reduces chirp on CW. For the 400V supply, try to stay between 400 and 430 VDC, which will maintain good performance and won't stress the radio. You will need a supply that will produce at least 1100 VDC for full power output. However, I don't recommend going over 1400V due to the age of these radios and because it might cause modulator distortion.

For the 28V supply, good regulated commercial 10 amp supplies are readily available, making it hardly worth the trouble of building one. 28V regulation and low ripple is only needed if you plan to leave your ART-13 stock and use a carbon mic. This supply is used for the autotune motor, relays, tube filaments, and carbon mic current. 24 volts will work, but the autotune will be slower. Below 24 volts, relay drop out problems could occur.

You will also need the U7 power connector plug to interface your supply with the radio. The best place to get one is from Robert Downs at WA5CAB@cs.com. Robert also has some dynamotors along with the dynamotor connectors.

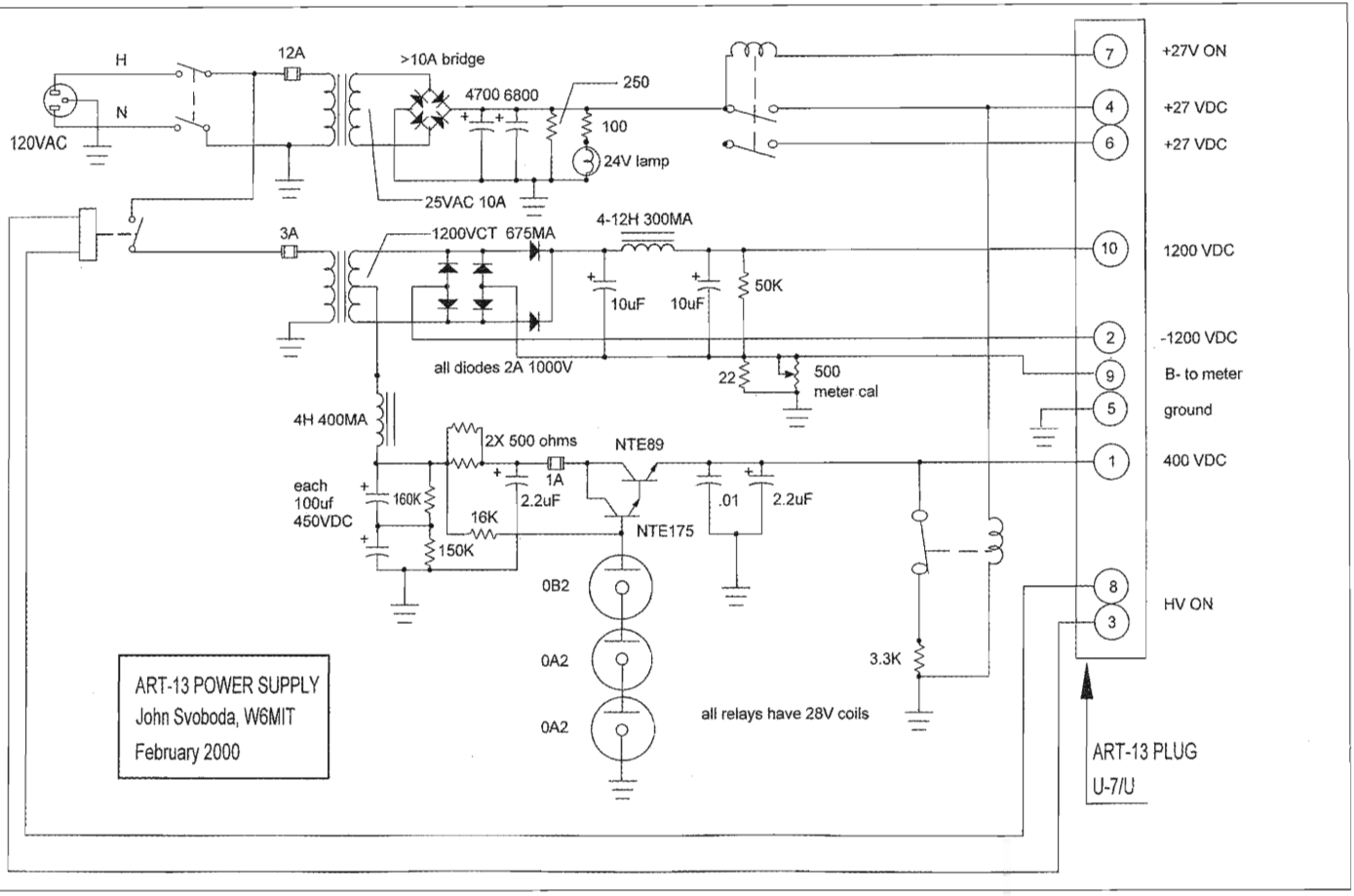
Figure 8-41A in my Air Force manual copy shows the wiring for the U7 connector. In your supply you will have to provide a return current meter shunt resistor for the 1200V supply. I used 20 ohms so that my plate current meter reads 200 ma full scale. This figure also shows the relay circuit logic necessary to control the voltages for your supply.

Initial Inspection and Cleanup

I start by removing the top, bottom, and lower front covers from the ART13 and looking for obvious damage or modifications. This is also a good time to pull and check all the tubes. Using my Heath transconductance checker, I was able to check all the tubes except the 813 final.

Push on the chain sprocket wheel on the motor and check to see that it turns the autotune shaft and also that nothing is jammed or damaged. After sitting for many years it may take a little pressure to break the shaft loose. If your ART13 has seen lots of service the drive chain may be a little loose, but this is not a problem.

Next determine if you need to clean your ART13. Two of mine were just dusty, and cleaned up with a little compressed air and my Shop Vac to remove some dead insects and spider webs. My third one was very dirty and full of mouse droppings. On this one I removed the panel meters, sprayed its


H
N
120VAC
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100
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3A
1200VCT 675MA
4-12H 300MA
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10uF
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all diodes 2A 1000V
22
500
meter cal
4H 400MA
2X 500 ohms
NTE89
1A
2.2uF
each
100uf
450VDC
160K
16K
150K
NTE175
.01
2.2uF
0B2
0A2
0A2
3.3K
all relays have 28V coils
7
+27V ON
4
+27 VDC
6
+27 VDC
10
1200 VDC
2
-1200 VDC
9
B- to meter
5
ground
1
400 VDC
8
HV ON
3
ART-13 PLUG
U-7/U
ART-13 POWER SUPPLY
John Svoboda, W6MIT
February 2000

interior with a 50% solution of Simple Green in water, used a soft brush on really dirty spots, then rinsed it in the driveway with a hose sprayer. I blew off the water with compressed air and let it dry for a week. I use this method with most of the radios I've restored. Keep the water and Simple Green out of the meters, go easy on transformers, completely rinse it off with water, and let the chassis completely dry before applying any power.

Lubrication of the Autotune Units

After cleaning, the next very important step is to lubricate the autotune mechanism. Using figure 4-14 in my manual, I oil all the A and C labeled parts with General Motors approved ATF, which will leave minimal deposits when it dries. Others have used synthetic motor oil with good results. Remember to oil all the bearings on the autotune shaft. Some of these are a little hard to get to.

Next, I grease all the parts labeled B in the manual with Radio Shack Archer Lube Gel, which is a silicone based grease containing Teflon particles. Be sure use it on the autotune shaft worm gears. If you have the felt oilers in your radio, remove them or bend them away from the gears so you won't contaminate the new grease. Some gears are hard to reach with the grease, but I found the first time you cycle the autotune the grease gets well spread over the gears. Also, be sure to grease the threaded shaft for the limit switch mechanism.

Try to get a little oil on the bearings for the large E variable capacitor, and the bearings for its switch. Additionally, lube any switch cams with the Lube Gel grease. I finish off by spraying a coating of silicone spray lube over the complete autotune mechanism, especially the plastic cams. Be very careful not to get any silicone spray on the autotune relay contacts.

Relay and Switch Contact Cleaning

Lastly, I apply a small amount of "Deoxit 5" to all accessible relay and switch contacts to remove any coating that would interfere with a good electrical contact. However, don't just spray it all over. I usually apply it with a Q-tip or the pen applicator supplied by Deoxit.

Some contacts, like for the C control's coil tap contacts, are a little hard to get to. I had to use a Q-tip on the end of a set of hemostats to clean them.

Initial Checkout and Typical Problems

The moment of truth comes when you give your ART-13 the smoke test. It's best to do this with the covers still off the radio and with it tipped up on its backside so you can easily see any sparks or smoke.

Connect the power supply or dynamotor to the radio with the ART-13's emission switch in the OFF position. Place a jumper wire between the antenna and ground terminals on the LH side of the radio to prevent any arcing in the final network during testing. Place the local or remote switch in local, the channel selector switch on channel 1, and make sure all five autotune locking bars are locked. Turn on the power supply or connect the dynamotor to a 28 VDC source. Turn the mode switch to CW while looking at the limit switches on the RH lower side of the radio. The autotune motor should start and the limit switch threaded shaft should start turning. Be sure the motor reverses when the limit switch reaches the end of its travel. If it doesn't, or the autotune motor doesn't turn, shut off the power immediately and start troubleshooting. Don't worry about a lot of mechanical noise from the autotune cams and gears, that's normal. When the switch reaches its other end of travel, the motor should stop and the red light on the radios front panel light. This indicates the autotune has successfully cycled. Try to gently turn each of the five autotune knobs to assure they have locked for channel 1. They should rotate a little before meeting any resistance. Repeat this proce-

dure for the remaining 9 channels to assure the autotune units are working properly for all channels.

Next, check for normal grid drive by placing the power switch in the tune position, the emission switch in CW, and the meter switch in the grid position. Place the channel switch in manual, the A band control on 1, and the B VFO multi-turn control at 500. Be sure your power supply is turned on. Close the test switch and observe that the meter needle is within the gray grid current range. Repeat this procedure for the remaining eleven A bands. On the lower bands it should be near half scale or higher. On the higher bands, 7 and up, it may be around 1/3 scale. It should always be in the gray grid drive range.

If you have no grid drive on all bands, or the drive is low, and you know you have good PTO and multiplier tubes, check that all the filaments are on, and that the CW relay operates when the emission switch is placed in CW. On my ATC, the VFO tube filament wasn't lit because I had a damaged tube socket contact pin, which was a real pain to fix. Also try coupling a receiver to the VFO tube and checking for a signal between 1000 and 1300kc to assure the VFO is working. If you have low drive on a few bands, it's most likely an alignment problem in the multiplier's tuned circuits. Follow the procedure in the manual to correct this. I modify the procedure by doing the alignment with the VFO tuned inside the Ham bands where I will be using my radio.

Be careful not to damage the ceramic multiplier trimmer caps. The rotors are easy to break especially after becoming stuck for sitting many years. I use a heat gun or hair drier to heat them and then gently push on the rotating tabs to break them loose. Also use an insulated tool to adjust them; they have 400 volts on them. I had a bad trimmer on my ATC that would not adjust, and had to disconnect the bad section and install a small trimmer next to the bad cap because the originals are very difficult to repair.

Since I don't have an easy way of checking 813 tubes directly, I checked mine by placing the band switch in one of the lower positions where I had at least half scale or more of grid drive, placed the power switch in the operate position, the emission switch in CW, and the meter switch in the plate position. I then momentarily closed the test switch and looked for at least 180 ma of plate current.

Now I check for RF output. The ART-13 was not designed to operate into a 50-ohm load, making it necessary to add capacitance to the antenna on the lower bands. To test the output on 75 meters, place about 400pf capacitance between the cap terminal and ground. Remove the jumper wire between ground and the antenna terminal and connect a 50-ohm dummy load between the antenna terminal and ground. Place the radio in the CW and tune modes. Place the channel switch in manual, the band switch A in the 4th position and the VFO B at 611. Place C on 5, D near 50 and E near 170. Close the test switch and rotate the E control for a dip in plate current. Set the dip around 80ma by changing loading using the D control and re-dipping the plate current with the E control. With the test switch closed, don't move the E control between 100 and 200 to prevent damage to the internal fixed capacitor switch. Lastly, switch from the tune to the operate mode and readjust for around a 130ma dip, which is near 100 watts of output with a 1200 volt supply.

To check VFO calibration, listen on a calibrated receiver while closing the test switch to assure your signal is near 3870kc. You can correct the VFO setting by using the VFO corrector knob, or if out of its range you can loosen the VFO knob set screws and bring it into calibration. If you find the VFO to be greatly out of calibration on other bands, you will have to follow the procedure in the manual for aligning the

VFO.

Next I check for AM voice operation. The ART-13 doesn't normally have a mic gain control, but some have one behind the hinged chart holder. The addition of this control was a field modification. Attach a carbon or low impedance dynamic mic and lift the chart holder to set the switch behind the holder for the kind of mic you are using. I use a scope like a Heath HW10 in the cable to the dummy load to observe voice modulation. Place the emission switch in phone and assuming the radio is still tuned for 3870kc, close the test switch or push to talk switch on the mic. If you tuned for 130ma in CW the meter will now read around 150ma. This is because the meter reads the sum of plate and modulator current in the phone position. Now talk into the mic and you should see modulation on the carrier showing on your scope. If you're using the DY17 carbon mic you will only be able to modulate around 70% unless you really shout into the mic. I use a studio condenser mic with a Symetrics 528 processor, which has an output gain control. I set my gain for 90% normal modulation on peaks using this control. With my ART-13's tuned for 150ma of current in voice, 100% modulation peaks will kick my current meter up to just full scale, 200ma.

On one of my ART-13's I had no audio output, but normal modulator idle current. I was lucky to have an octal tube extender so I could check tube voltages in the audio module. I found no screen voltage on the first audio tube. I pulled the audio module and found a bad cap in the tube's screen circuit.

Next, check the output on all the other bands you plan to use. Be sure to use the right antenna capacitor value, which is shown in table 1 and discussed in the next section.

Antenna Loading and Operating Considerations

As I mentioned earlier, the ART13 was designed for operation into capacitive impedance wire antennas using its L or PI final network. These antennas were usually just a little shorter than ¼ or ¾ wave in length for the frequency of operation. However, most of us are using 50-ohm nearly resistive antenna feed systems. To get this radio to work with our 50-ohm systems it's necessary to add some capacitance to its output, especially on the lower bands. This converts its L network to a PI network on the lower bands, for good harmonic suppression, and proper impedance matching. I was fortunate to have a variable 500pf capacitor to use with mine. The ART-13 also has a terminal for an extra capacitor that isolates the capacitor from the receiver when not transmitting.

Below in Table 1 are some of the typical settings of the capacitor and five autotune controls for my favorite frequencies. The C, D, and E settings are repeatable within 10% for all three of my ART13's. However, your CAP, C, D, and E settings may vary somewhat because of feed line impedance differences. The settings for 1925kc are for the ART13 I modified for 160-meter use, which is discussed under modifications.

I use a BC348Q receiver, which I find is an excellent AM receiver, with my ART13's in a configuration similar to the Air Force ARC-8 system. I connect this receiver to the receiver antenna terminal on the LH side of my ART-13 and the receiver's mute terminals to pins 23 and 24 of the large U8 connector. Since the U8 plug is expensive and hard to find, I connect to the pins using some individual sockets wired to a length of wire and a connector on the other end that fits the BC348Q's mute line.

To set frequency I usually don't use the ART-13's CFI unit. I place the ART-13 in calibrate, and use my receiver BFO to zero beat the ART-13's frequency. On the BC348Q I had to provide a shorting switch for the mute line

since in calibrate the ART-13 opens its receiver mute contacts.

When adjusting the C coil tap control, always use the lowest possible number setting to reduce the chance of tuning to a harmonic of your desired frequency. On some lower bands, 160 and 75 meters, there have been reports of VFO emission from ART-13's. To reduce this, I recommend using an antenna tuner or an antenna that resonates on your operating frequency.

If you plan to use your ART-13 on 80 through 20 meters and primarily on AM phone, it really doesn't need any modification. Its audio is far better than most Ham AM rigs. If you want outstanding broadcast quality audio you only need to hook a good mic and audio processor system to its audio input. An amplified D104 mic also will do a good job and allow you to adjust audio gain. However, I highly recommend the Symetrics 528 or ART Tube Channel processors with a good condenser mic. If you are running your ART13 at close to its design voltages your audio quality will rival that of most broadcast transmitters. The stock ART13 was specified in the original ATC contract for audio distortion of less than 5% and will more than beat that figure when in good condition. It's interesting that our military used it with a carbon mic, but the British used dynamic mics with theirs for better audio.

TABLE 1
TYPICAL AUTOTUNE CONTROL AND EXTERNAL CAPACITOR SETTINGS FOR 75, 40, 20, AND 160 METER FREQUENCIES

FREQ.(kc)	A	B	C	D	E	CAP. (pf)
3870	4	612	5	55	186	400
7292	8	154	10	48	90	250
14285	11	1510	12	80	95	0
1925*	1	635	1	15	140	1000

(* Only for my ART13 modified for 160 meter use.)

Modifications

The following modifications are for those of you that like to experiment a little and have ART-13's that may not be real collectable and also might provide a little food for thought. However, the first modification I do is recommended for all ART-13's that will see lots of Ham band use.

If you plan to use your ART-13 a lot, there are two modifications worth doing. Since it was designed for short communications and not long rag chews, it's a good idea to add a small muffin fan to pull air away from the area of the final and modulator tubes.

The motor field current should be removed when the motor is not operating to keep the motor cool. The military used this field current to act as a brake under conditions of shock and vibration, which is not necessary for our use. An excellent modification designed by Dennis (W7QHO) is to disconnect the field wire from terminal F2 on the motor and connect the cathodes of two 5-amp 100-volt diodes to the F2 terminal on the motor. Then connect one diode anode to the A1 terminal and the second diode to the A2 terminal. This will then only provide field current when the motor is operating. Also, as a safety measure, a 5-amp fuse should be placed in the wires going to the A1 terminal for protection of the motor field in case of a diode short.

If you plan to use your ART-13 on 160 meters, the next modification I used

works very well. I obtained two small Radio Shack 12 VDC, SPDT relays, P/N 275-248A. One was placed in the VFO compartment and the second in the multiplier coil compartment using double-sided tape. I wired the relay coils in series and connected 28 VDC from the VFO tube socket to the relay coil in the VFO compartment. I then hooked a small switch between ground and the coil of the second relay to activate the relays when I want to operate on 160 meters. I connected the common relay terminal of both relays to good nearby RF grounds. To lower the VFO frequency, I hooked a 100pf dipped silver mica capacitor between the normally open (NO) contact of the relay in the VFO compartment and the RF end of L101, the VFO coil. I then installed a small 75pf variable trimmer cap in the multiplier compartment with a 75pf dipped silver mica cap across the variable cap. I wired the variable cap terminals between the NO terminal of the multiplier relay and the RF end of the first multiplier coil, L105. To align the multiplier for 160 meters I closed the relay switch, placed the A control in position 1 and powered up the ART13 in the tune mode. I placed the mode switch in calibrate and listened for a signal in the 160 meter band using a receiver with a wire near the ART-13's first multiplier tube. Then, adjust the VFO B control for zero beat in the receiver at 1925kc. Next, I set the ART-13 in the CW tune mode, close the test switch and peak the grid drive for maximum by adjusting the variable cap added in the multiplier compartment. My grid drive adjusted to a little over mid scale and tracks at this value over the whole 160-meter band. The most difficult part of this modification was getting all the small screws loose from the VFO compartment cover on the RH side of the ART-13 to install the relay.

An easy modification to get more gain from the carbon mic is to decrease the attenuation and raise the mic's current by disconnecting R204 in the audio module from ground. This really helped the carbon mic's gain and doesn't affect the gain for a dynamic mic. It also doesn't greatly affect the impedance across the audio input transformer and won't hurt its frequency response.

Another modification that will increase the audio gain and possibly further reduce distortion, although I haven't tested it for this, is to increase the screen voltage on the 12SJ7 first audio tube. In the voice mode it's only 40 volts and after this modification it's increased to 78 volts, which increased the current through the tube from 500 microamps to a little over a 1ma. This increased its gain by about 6db and should reduce distortion. I decreased R208, the screen resistor, to 470K from one meg and decreased R209, the plate resistor, to 100K from 220K to maintain just over 100 volts on the 12SJ7 plate. However this does increase the carrier modulation in the MCW mode, so if you use MCW, readjust the level using R2201, the pot on the back of the MCW/CFI module. Also you will need to turn down your sidetone gain using the pot behind the tuning chart holder.

A stock ART-13 has excellent communication audio, but to flatten its response for broadcast quality, I did the following things: In the audio module I reduced C205 from 1000pf to 270pf, reduced C209 and C210 from .01uf to .005uf, and increased C204 from .006uf to .15uf. This flattened the audio response within 1db between 150 and 4000 cycles as compared to the 500 and 2500 cycle range before modification.

If your 28V supply has some ripple (like mine), you will have hum on your phone signal when using a carbon mic. I eliminated the hum by adding a small sized 500uf, 50-volt cap across the 20uf cap in the audio module, C201.

If you plan to operate CW with your ART-13, you must regulate the 400V supply as I mentioned above to reduce chirp. I also have experimented with grid block keying of the first multiplier

to save wear on the keying relay and reduce the clicks of a stock ART-13. This is a rather extensive mod and if yours is real clean and collectable and you don't plan to work much CW you may not want to do it. Since R130 is almost impossible to get to with the multiplier module in the radio, I disconnected it at S114 and added a 1K, 5W resistor on the chassis. I wired the resistor to the disconnected R130 end of S114 and to a phone jack I installed on the ART-13's back panel near L107, the final amplifier grid choke. I connect my bug at the phone jack. I added a 1uf, 480V capacitor at the junction of S114 and the 1K resistor to soften the keying. To keep the final cut off with no grid excitation, I added a small RCA jack to the back of the ART-13 next to the added key jack with a 500V, 1/2A, diode whose cathode is wired to the RCA jack and anode to the junction of L107 and R110 the grid bias resistor. This supplies –60V of bias from a small low current bias supply I have in my power supply. The diode isolates the final grid from the –60V supply when the grid is driven during excitation. For the multiplier to work in the voice mode, you need to short your key or add a shorted plug into the key jack when on AM. I got around this by adding a relay, the same one as for the 160-meter modification, with its NC contact to the key jack and its common to ground. The contacts are opened when the mode switch is in CW by taking 28V from the battery contact on S105 to the relay coil, and by grounding the other end of the coil through a 390-ohm, 1W resistor to the CW contact of S110, the mode switch. Since my bug doesn't have a sidetone, I wanted to still use the ART-13 sidetone oscillator. I made the sidetone work by disconnecting R2217 (the tone oscillator cathode resistor in the MCW module) from ground and adding a 500V, 1/2A diode with the anode to the disconnected end of R2217. I wired its cathode through a chassis mounted pin connector to the key jack. This allowed me to key the tone oscillator and sidetone with the multiplier keying modification. The pin jack connector allowed easy removal of the MCW module for service. This modification allowed nearly chirp and click-free keying of my ART-13 on 20 meters. The only down side is having around +100V on the contacts of my bug, but with very little current there is no sparking.

Conclusion

I hope this presentation has been of some help to those of you who want to get an ART-13 on the air along with encouragement to those of you who are looking for a high quality transmitter for use on the Ham bands. Of all the available AM gear, the ART-13 will beat most for AM audio quality. Its only disadvantage is that it was not designed to operate on ten and fifteen meters.

References:

Walt Hutchens, KJ4KV, Electric Radio #7, Nov. 1989: ELECTRIC RADIO IN UNIFORM, THE AN/ART-13

Bill Kleronomos, KDØHG, Electric Radio #62, June 1994: ON THE AIR WITH THE ART-13/ARC

Bill Kleronomos, KDØHG, Electric Radio #28, Aug. 1991, IMPROVED CW WITH THE ART-13

Bill Kleronomos, KDØHG, Electric Radio #29, Sept. 1991, and #30, Oct. 1991: IMPROVE AND MAINTAIN THAT ART-13

Mike Murphy, WB2UID, Electric Radio #32, December 1991: ELECTRIC RADIO IN UNIFORM, ADDING 160 METER COVERAGE TO THE ART-13

Dennis DuVall, W7QHO, Electric Radio #109, May 1998, ELECTRIC RADIO IN UNIFORM, ADVENTURES WITH THE ART-13 AND BC-375

Ben Stearns, Published 2002 by Ben Stearns, ARTHUR COLLINS RADIO WIZARD

Ken Braband, Published by Rockwell International, THE FIRST 50 YEARS

ER

Restoring the Collins ART-13 Autotune System

by Ray Osterwald, NØDMS
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When Bill (N6PY) sent his ART-13 article in to be published, he asked if I would include some information about restoring the autotune system. I've never had the luxury of a new-condition ART-13, and as a result I've learned more that I ever wanted to about the ingenious Collins autotune system.

It is best if you can avoid removing any of the autotune units because normal use will not cause them to become unsynchronized, and due to the design of the system, wear does not affect the accuracy of the system. In other words, if it works, don't mess with it! If you find an ART-13 that has been used very little, normal cleaning and lubrication is all that should be needed. In other cases it might be necessary to remove an autotune unit in order to remove something else, like the PTO or multiplier module, or to access wiring or possibly some other buried component. Once an autotune is loosened from the main casting, resynchronization is necessary.

Common Problems

The original grease and oils used on the ART-13 were petroleum based. After 40 to 60 years, these old lubricants break down and become hard and loose their lubricating properties. Some were mixed with paraffin-based substances, and after the oil is gone, all that is left is the hard material. Actually, that has helped to prevent rust and corrosion on the steel alloys used in the autotune units all of these years, but all the old material has to be removed in order for the autotune to cycle properly. One typical problem I've seen happens when an autotune channel has been set up by the book, but in operation one or more autotune units fail to lock up on the channel, or will lock up at a different setting every time the autotune cycles. This in not normal! The Collins autotune should return the transmitter to a setup channel with an accuracy of less than 50 cycles. If your rig is having channel selection problems, do not disassemble an autotune unit. They were originally assembled at the factory on precision jigs, and while there are a few among us who can successfully take them apart to make repairs, I would not recommend it. What usually happens to make the autotune operation erratic is that dried-out lubricant and dirt makes the autotune stop ring disks stick together. The best cleaner I've found is drug store lighter fluid. It removes all the old lube and dirt, but won't over clean the Oilite bearing material. If an Oilite bearing is over cleaned, it is possible to ruin a steel journal. If the stop ring drum is soaked in the fluid and blown out with compressed air, nearly all the crud can be easily flushed out. Use some rags underneath the autotune to keep the lighter fluid from running all over everything, and be sure to remove any source of heat or sparks, as it is *extremely flammable*. You can tell when they are clean by poking at the stop ring disks with a toothpick. They should be slightly free to move. When I re-lube the autotune unit, I try to keep the disks dry because the autotune seems to be more accurate from one cycle to another. The manual has specific points to be lubricated, and it recommends these points to be sparingly greased.

The counter drum they mention is only found on the VFO "B" autotune unit, and the "anvil" mentioned is the long "L" shaped piece of spring steel mounted over it. The limit switch bearings are also found only on the "B" unit. Note that the book calls out the use of a camel's hair brush to apply oil and grease, and that "Only very small amounts of oil or grease are required at most points. Be sure to remove any excess oil or grease after lubricating the autotune system." Modern synthetic lubricants will last a very long time, and you can select viscosities so that they stay put under the hot conditions inside the ART-13.

Autotune Hints

If it is necessary to remove an autotune unit, resynchronization of the system will be will be necessary. Remove the autotune cover and examine the right-hand end of the line shaft. There is a slot milled in the end of the steel shaft, and in the center is a hole that is tapped for a 4-40 screw. Originally, the tool kit supplied with every ART-13 had an autotune crank that fit the slot, and a screw to tighten the crank to the line shaft. These are very hard to find now. It is tempting to use a screwdriver blade in the slot in place of the crank, but don't do it. The slot won't hold up to the abuse, and you won't even finish the alignment before the slot is ruined. Figures 1 and 2 are photos of an alignment crank I made up from pieces of scrap brass found at a metals dealer. I didn't make a tab that would fit the slot in the line shaft because I don't have a milling machine. What I did to make it work was to find a #10 internal-tooth lock washer that fit around the outside of the slot, and was high enough to clear it. A 4-40 steel screw is visible in the photos, and with lock washers at each end, my homemade crank is plenty secure. The diameter of the round piece is 1 inch, and it is ¾ inch deep. There was a hole already through the center. The length of the flat bar is 2 ½ inches, and it is 3/16 thick. The bar is soldered to the round part and also has a 4-40 machine screw

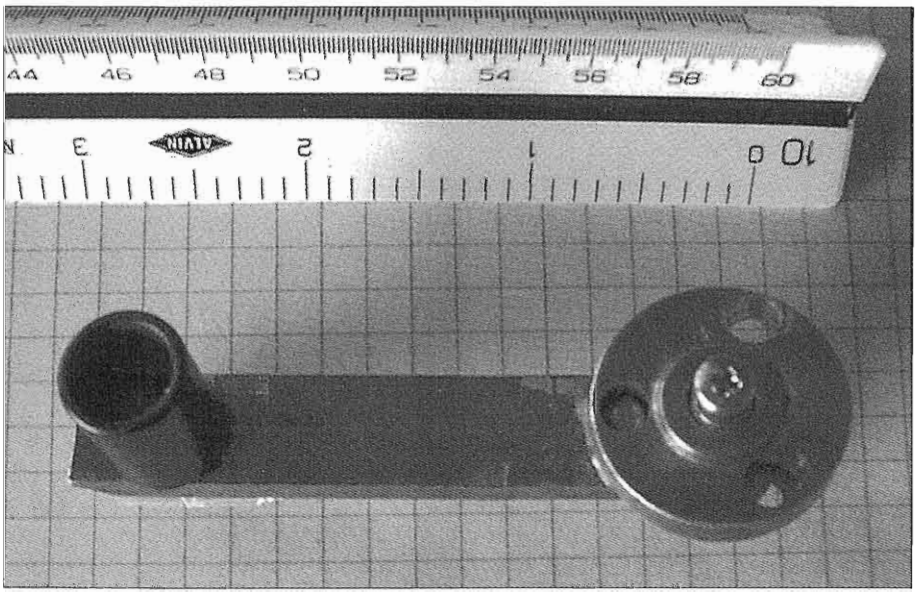


Figure 1: A top view of the homemade autotune crank that is made from scrap pieces of brass.

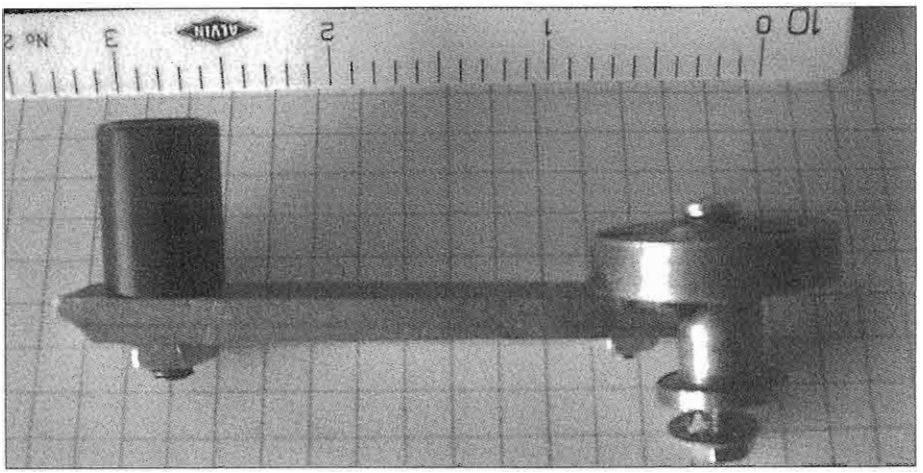


Figure 2: A side view of the autotune crank.

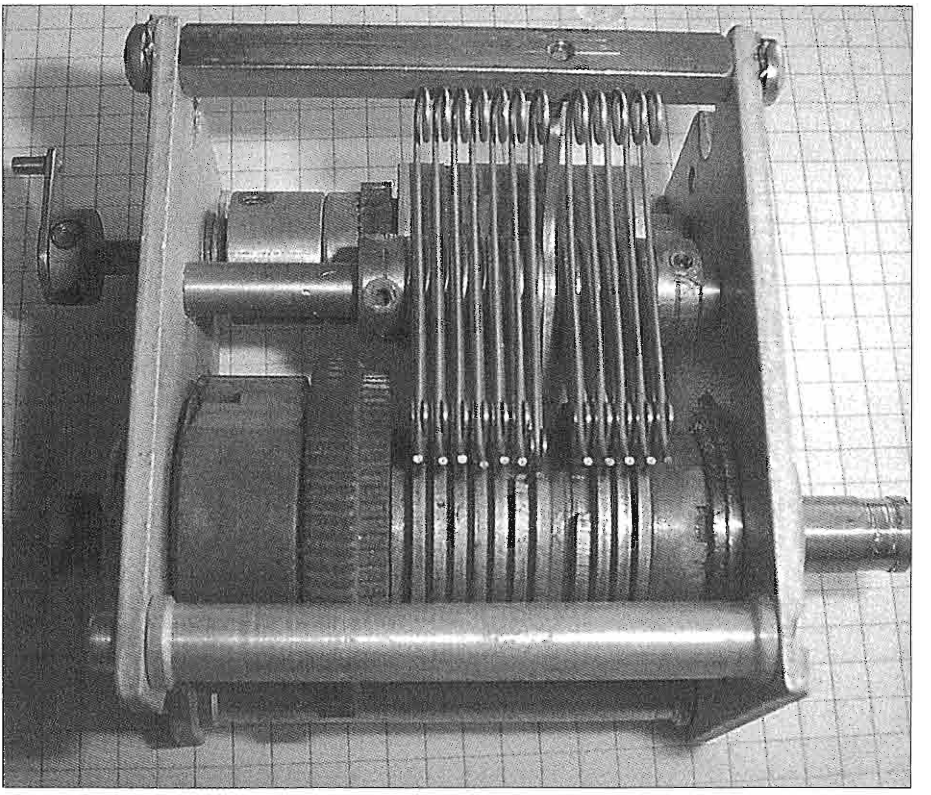
and nut for good measure. The knob came from a broken spinner knob in my junk box. There is nothing critical in the dimensions, use what you can find and make it so that the crank handle clears the autotune casting while you turn the line shaft.

Not many of us have an airworthy B-29, so it's safe to skip the section "Trouble Shooting in the Aircraft!" The synchronizing procedure in the manuals is accurate, and it isn't too hard to do, but it is tedious and can take quite some time to finish. You will probably have to expect to do it at least twice. Unless you've done the procedure before, I would recommend starting with the "preliminary synchronization check" so you can become familiar with the sequence of events, and find the parts that are discussed in the procedure. The thing to keep in mind is that there is no adjustment on the VFO's autotune, the "B" unit. B is a multi-turn unit, and all the others are single-turn units. The object of synchronization is to find out which units are out of synchronization with the VFO "B" unit and fix it so that everything synchronizes with the VFO.

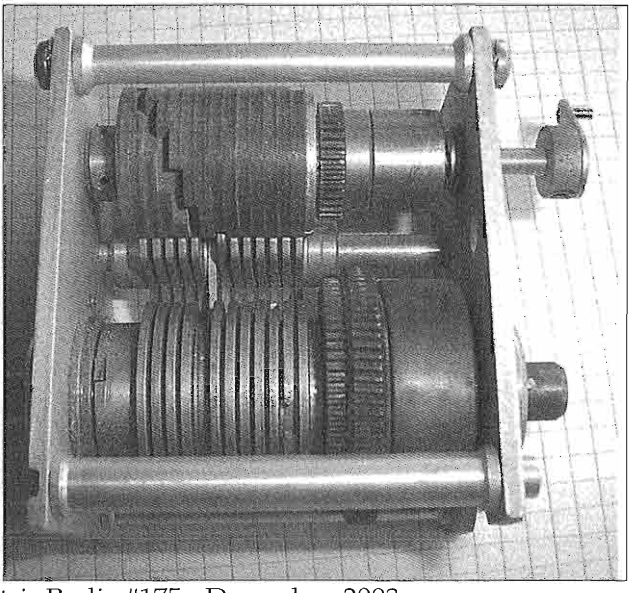
Figures 3 and 4 are side views of a single-turn autotune unit. I've included these photos to make the synchronization chore go more quickly. There is only one line drawing in the manual which has the parts labeled, and it is a partial drawing. The photos don't have the parts named either.

All 4 multi-turn units are the pretty much the same. In Figure 3, the right side of the photo is at the front of the unit, and the shaft sticking out holds the knob. The large geared assembly on the bottom is the cam drum, and the rings that stick together due to dried lubricant are just to the right of the big spur gear. I've set this unit so that the #5 pawl has just dropped into its cam slot, and this is described in the book as an important first step in the procedure. The manual pawl is the first one from the front, so the #5 pawl is actually the 6th from the front—it is easy to miscount and make synchronization worse if you are not careful. The pawl springs are the long vertical wires between the two side plates.

Figure 4 is the opposite side of the same single-turn unit. At the bottom, the cam drum and its spur gear are shown. Just above it are the pawl heels, and at the top is the stop ring drum.



Single-turn autotune units are pictured in Figure 3 above, and Figure 4 below. See the text for part identification and orientation in the transmitter.



The stop ring drum is made out of some kind of phenolic material, and I would advise keeping cleaning fluids away from it unless there is no other choice.

When you are done, it is very satisfying to hear all five of the #5 pawls click into position at exactly the same moment. When you hear that sound, it's safe to put to autotune cover back on and set up your ART-13 channels. Just be sure to "notify pilot before unlocking auto-

ER

A CD Vernier Dial Drive

by Earl Russell, WR1Y
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Groton, MA 01450
pegruss@RCN.com

Do you have a pile of old CD's? Have you found a use for them? A friend of mine makes clock faces and installs battery-operated fit-ups. I have been using them bolted to upright angle irons to mark my yard for the benefit of snowplow drivers. They make very good reflectors. I have a new use, if you are handy with simple tools and have a need for a neat vernier drive. I have labeled it the "CD Vernier".

I enjoy making things in my shop and appreciate the satisfaction of building old regenerative radios and simple transmitters. While designing a new vernier drive I searched for a good round plate to use as the driven section, ala National Radio Type B. I could have made the part out of any number of pieces of scrap metal I inventory in my shop, but preferred a ready made part. That's when the CD approach popped into my head. A compact disk is a very accurate circular part. It must be to work with the standard magnetic or video pickup.

The drawing in Figure 1, page 40, shows the simple hub used to connect the CD to the shaft of the variable capacitor. The second part is a standard quarter inch shaft cut down to the size of small faucet washers and threaded to hold them in place. I have a South Bend 9-inch lathe, but I'm sure it could be done with a drill and a sharp file.

In an earlier issue of Electric Radio a program named "Graph Paper Printer" was described and recommended. [ER #160--Ed.] I made the faceplate with that program and everything that was said about the usefulness of this program is correct. The faceplate was glued to the CD with "DURO" all-purpose spray adhesive. Using regular Elmer's glue wrinkled the paper when it dried. To duplicate an old fashion dial design I cut a classic shaped hole in the front panel. I backed the panel with a scribed piece of yellow plastic to produce an index line. This piece of plastic was simply glued to the back of the panel with clear "sticks to almost anything" glue. The dial can be easily set to 1 degree, as the value of the smallest gradation is 1.8 degrees. With the size faucet washers that I used the ratio of vernier comes to 10: 1. It has a nice smooth feel.

In order to get the adjustment correct for the feel and operation of the drive, all mounting holes were slotted to allow fine adjustment. It is important to find a bushing for the knob shaft that is tight. I used one that is over one half inch long to keep the knob shaft from rocking when it was turned. An ideal condition would be to have both ends of the shaft supported. It's another part, but probably worth the effort.

I had considered having the driving shaft terminate in a rubber cabinet foot, spring loaded in the out position that could be pushed in to enable the vernier. The plastic CDs are just too flimsy for that to work. A simple rubber bushing on the driving shaft would work well if some provision is made to hold alignment. As was said in my physics classes, "that is left to the reader as an exercise".

The photograph in Figure 2 shows the coupling to a standard broadcast

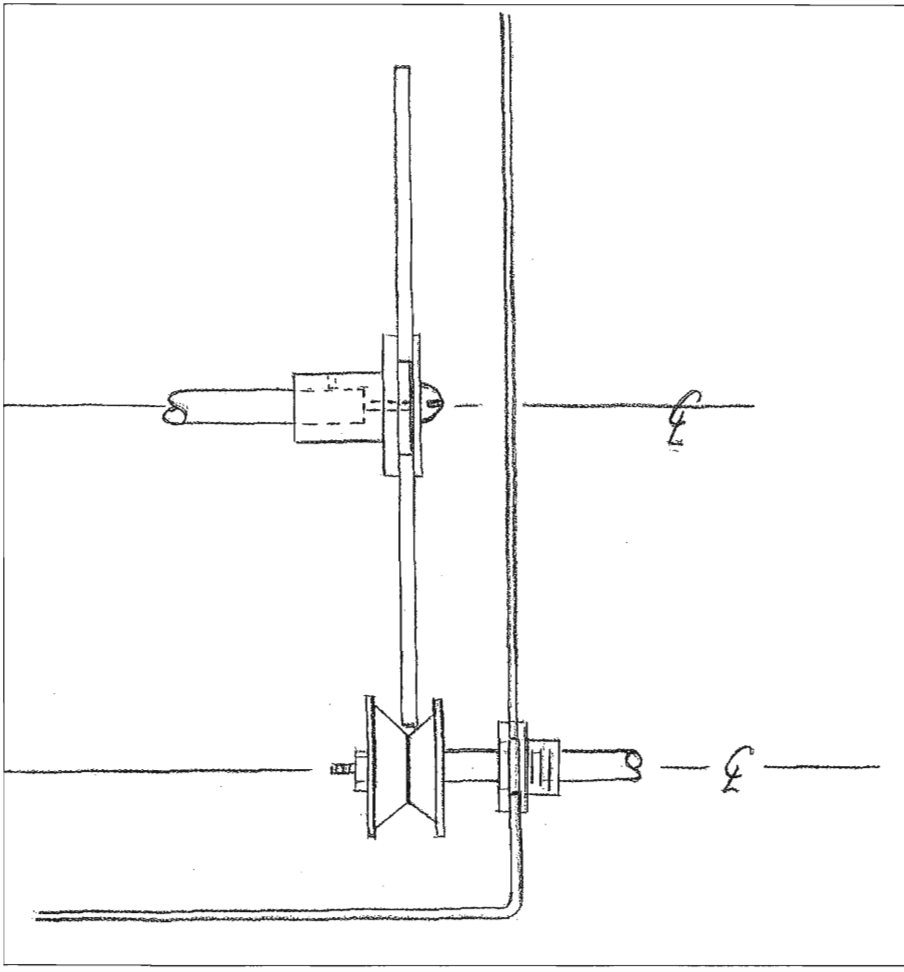

Figure 1 above: A side view drawing of the dial construction as mentioned in the text.
Figure 2, page 41 upper, is a photograph of the dial mounted on my chassis.
Figure 3, page 41 lower, is a nearly full size layout of the CD dial.

capacitor with plates removed to make a dual 100 Pfd variable capacitor for a regenerative receiver I'm currently working on, using 3 Raytheon CK series miniature tubes scavenged from old cordwood construction Sonarbuoys. I'd like to hear from anyone else who tries the CD Vernier and what modifications they came up with to improve the design. There certainly is no shortage of raw material with almost daily mail deliveries of new parts. Just about any ratio can be had, either by reducing the size of the CD or using a different drive diameter.

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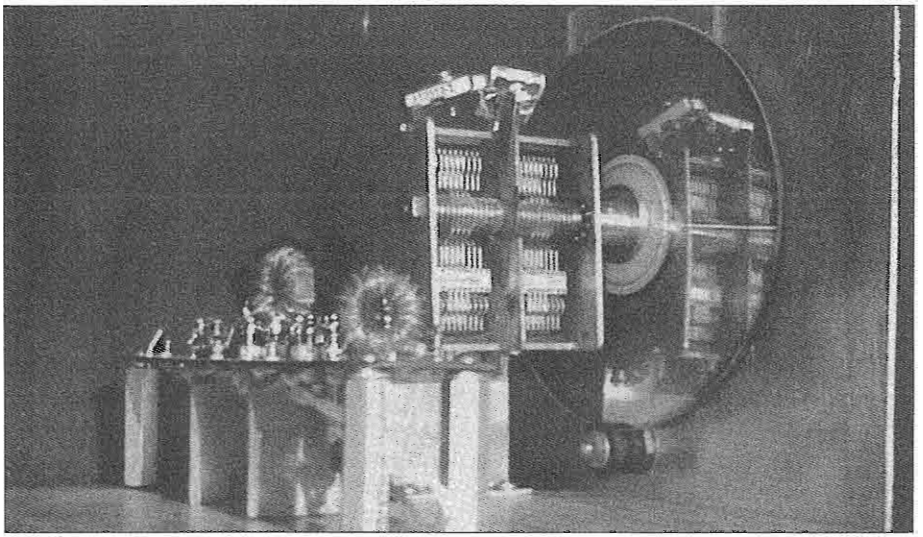

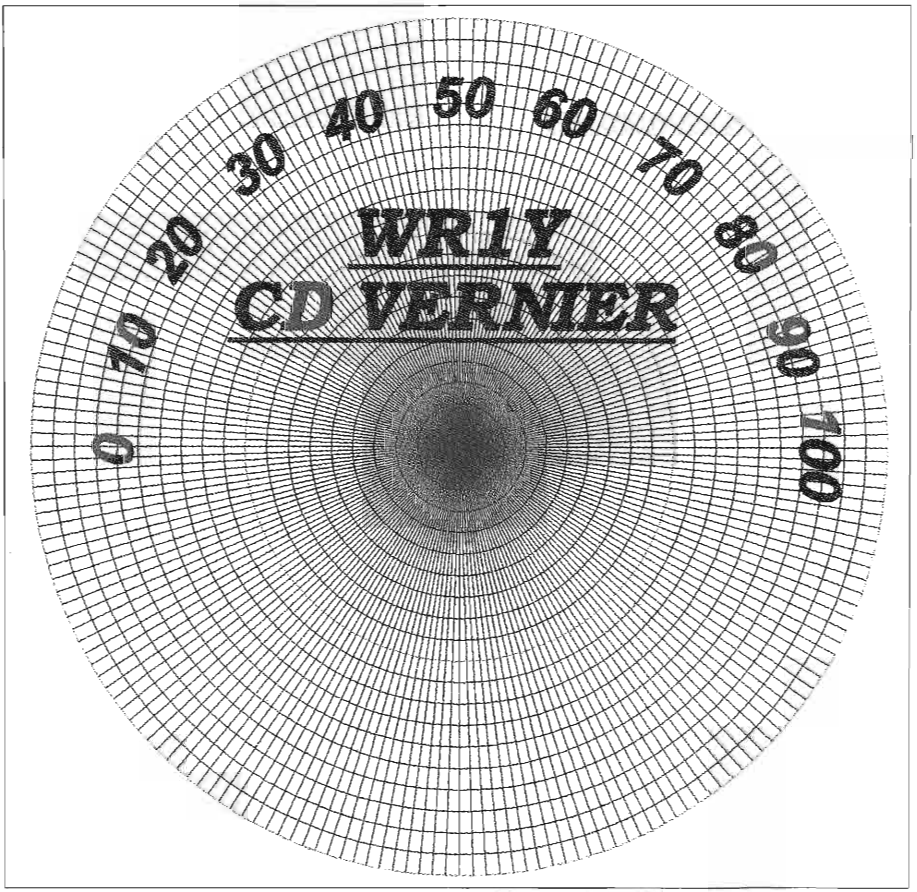
0
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60
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80
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100
WR1Y
CD VERNIER

The Seven Dollar Wonder

by Hal Guretzky, K6DPZ
Land Air Communications
95-15 108th St.
Richmond Hill, NY 11419

Many times when you restore vintage equipment you find out that the audio output transformer is open or shorted and can't be used. You need to get the equipment going, but you probably don't want to go broke doing it. Also, correct audio output transformers for vintage equipment are getting very hard to find. The is where your local Radio Shack store comes in handy.

Many receivers such as Collins, Hammarlund, National, etc. use common output tubes with corresponding plate load impedances that are listed below:

6BF5	2500 ohms
6AQ5	5000 ohms
6EB8	8000 ohms

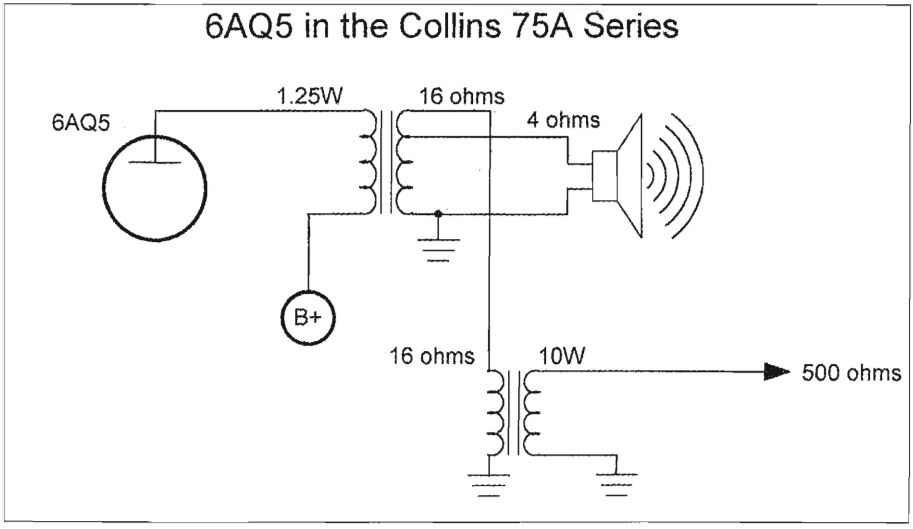
These load impedances can be matched using an inexpensive Radio Shack transformer, part number 32-1031B. The matching ratios are:

C and .62W	7000 to 4 ohms
C and 1.25W	4000 to 4 ohms
C and 2.5W	2000 to 4 ohms
C and 5W	1000 to 4 ohms
C and 10W	500 to 4 ohms

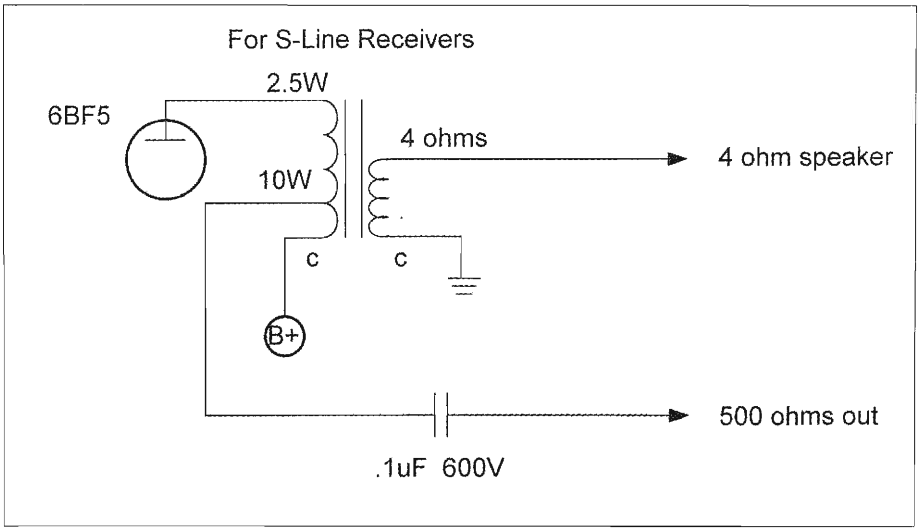
"C" is the common terminal on the primary winding.

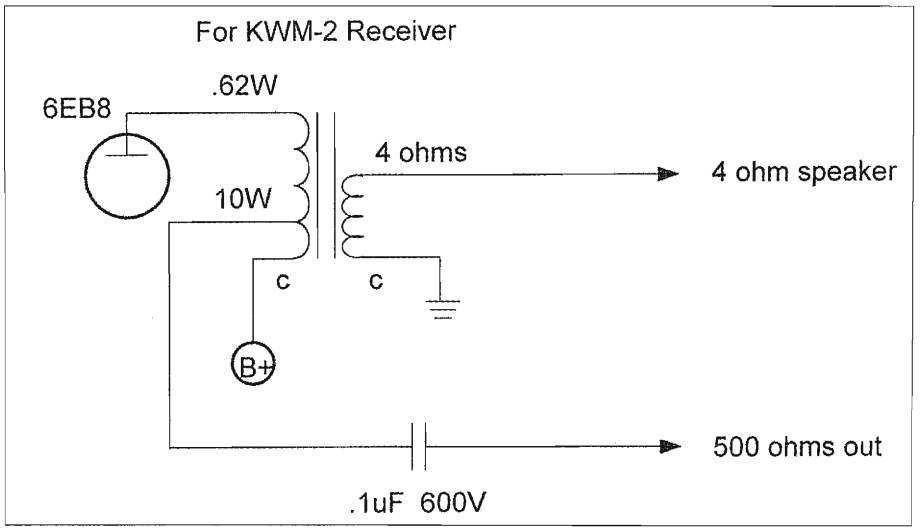
Hammond also makes similar line matching transformers in their 117 series.

The schematics that follow show examples of how the transformers may be used. These are concept diagrams, and exact wiring is up to the person doing the restoration work.

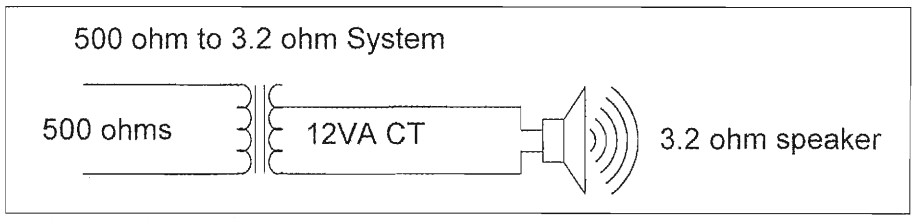


In this application we are using two transformers to provide 4 and 500 ohm outputs, and the total cost was about $14.00 for both transformers.

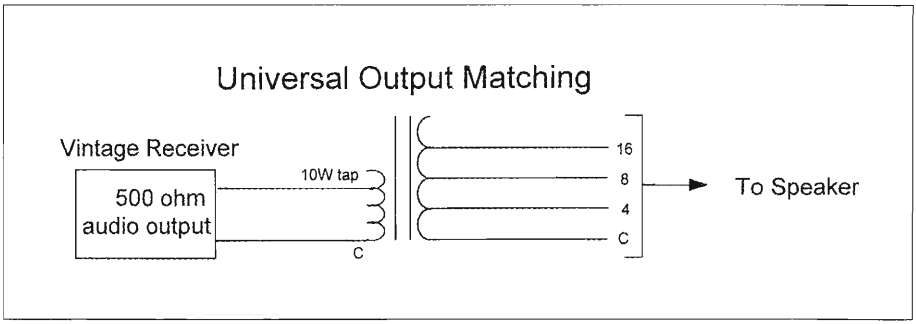




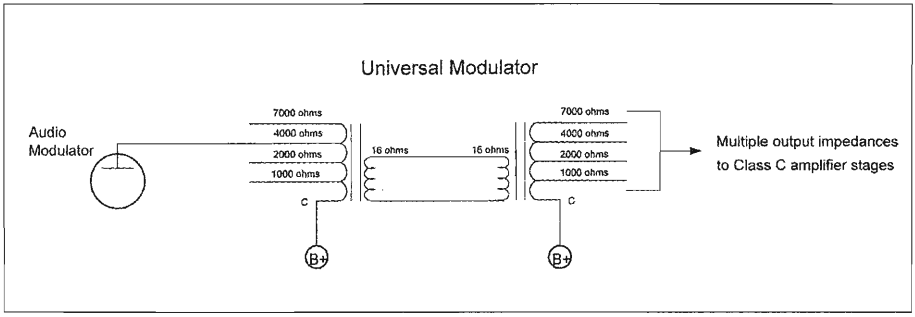
The two diagrams above show how to use the line matching transformers with Collins S-line receivers and with the receiver in the KWM-2 to provide 4 and 500 ohm outputs.



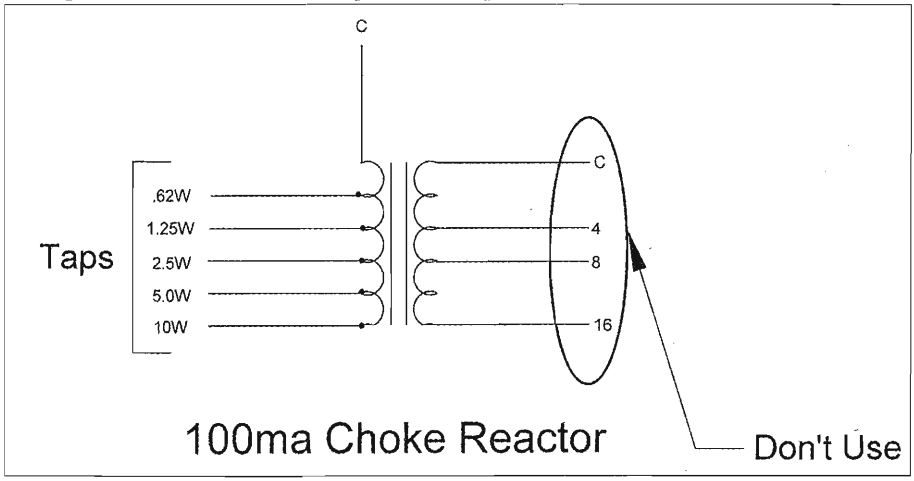
Radio Shack transformer #273-1365 is sold as a power transformer, but has enough iron for good response as an audio output transformer.



These transfromers may be used to match the high impedance audioi output of many vintage receivers to more commonly available low impedance speakers.

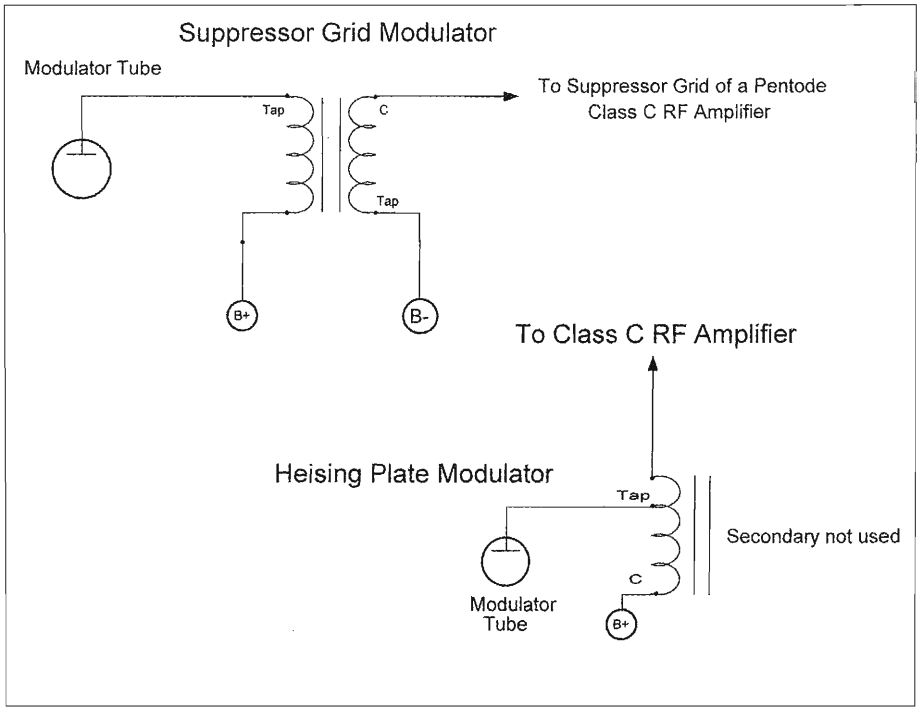


Two line matching transformers may be used as a universal AM modulator with a 20 watt rating. This can be useful if you are building a low power Class C stage to use with an existing linear amplifier to run the legal limit for AM.



To make a 100 ma choke reactor for transmitter design connect the common terminal "C" to the power taps as follows:
C to .62W = 5 Henry
C to 1.25W = 3 Henry

C to 2.5W = 1.5 Henry
C to 5W = .5 Henry
C to 10W = .5 Henry



Suppressor grid modulation is an old form of generating AM, and is of the so-called variable efficiency method. In a variable efficiency system the average input to the modulated stage remains constant during periods of modulation and no modulation. Amplitude modulation of the stage is accomplished by varying the efficiency of the stage at the audio rate. They are easy to build and relatively inexpensive, but have the disadvantage of always operating at less than 45 percent efficiency.

Heising modulation was the first method of producing plate-modulated AM. It uses a Class A audio amplifier coupled to an RF amplifier through a modulation choke coil, and this function is provided by the Radio Shack transformer above. If a Heising modulator is properly adjusted, 100% modulation may be obtained. If a pentode modulator tube is used, a higher percentage of distortion may be tolerated in a low power transmitter. Complete design information may be found in many classic handbooks, such as any of the "Radio Handbooks" before approximately 1970.

ER

VINTAGE NETS

Arizona AM Nets: Sat & Sun: 160M 1885 kc at sunrise. 75M 3885 kc at 6 AM MST. 40M 7293 kc 10 AM MST. 6M 50.4 mc Sat 8PM MST. Tuesday: 2M 144.45 7:30 PM MST.

Boatanchors CW Group: QNI "CQ BA or CQ GB" 3546.5, 7050, 7147, 10120, 14050 kc. Check 80M winter nights, 40 summer nights, 20 and 30 meters day. Informal nightly net about 0200-0400Z.

California Early Bird Net: Saturday mornings at 8 AM PST on 3870 kc.

California Vintage SSB Net: Sunday mornings at 8AM PST on 3860 +/-

Colorado Morning Net: An informal group of AM'ers get together on 3875 kc Monday, Wednesday, Friday, Saturday, and Sunday at 7 AM MT.

Canadian Boatanchor Net: Meets daily on 3725 kc (+/-) at 8:00 PM ET. Hosts are AL (VE3AJM) and Ken (VE3MAW)

Collins Collectors Association Nets: Technical/swap sessions meet every Sunday on 14.263 mc at 2000Z. Informal ragchew nets meet Tuesday evening on 3805 kc at 2100 Eastern time, and Thursday on 3875 kc. West Coast 75M net is on 3895 kc 2000 Pacific time. **10M AM net starts 1800Z on 29.05 mc Sundays, QSX 1700Z.**

Collins Collector Association Monthly AM Night: Meets the first Wednesday of each month on 3880 kc starting at 2000 CST, or 0200 UTC. All AM stations are welcome.

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

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

Drake Users Net: This group gets together on 3865 kc, Tuesday nights at 8 PM Eastern Time. Net controls are Gary (KG4D), Don (W8NS), and Dan (WA4SDE)

DX-60 Net: This net meets on 3880 Kc at 0800 AM, Eastern Time on Sundays. Net control is Mike (N8ECR), with alternates. The net is all about classic entry-level AM rigs like the Heath DX-60.

Eastern AM Swap Net: Thursday evenings on 3885 kc at 7:30 PM Eastern Time. Net is for exchange of AM related equipment only.

Eastcoast Military Net: Check Saturday mornings on 3885 kc +/- QRM. Net control station is W3PWW, Ted. It isn't necessary to check in with military gear, but that is what this net is all about.

Fort Wayne Area 6-Meter AM net: Meets nightly at 7 PM Eastern Time on 50.58 mc. This is another long-time net, meeting since the late '50s. Most members use vintage or homebrew gear.

Gray Hair Net: The oldest (or at least one of the oldest at 44+ years) 160 meter AM nets. Net time is Tuesday evening on 1945 kc at 8:00 PM EST and 8:30 EDT. Also check www.hamelectronics.com/ghn

Hallicrafters Collectors Association Net: Sunday on 14.293 mc, 1730-1845 UTC. Control op varies. Midwest net Sat. 7280 kc 1700Z. Control op Jim (WB8DML). Pacific Northwest net Sunday 7220 kc at 2200Z. Control op Dennis (VE7DH).

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

K1JCL 6-meter AM repeater: Operates 50.4 mc in, 50.4 mc out. Repeater QTH is Connecticut.

K6HQI Memorial Twenty Meter Net: This flagship 20 meter net on 14.286 mc has been in continuous operation for at least 20 years. It starts at 5:00 PM Pacific Time and goes for about 2 hours.

Midwest Classic Radio Net: Meeting Saturday morning on 3885 kc at 7:30 AM, Central Time. Only AM checkins are allowed. Swap and sale, hamfest info, and technical help are frequent topics. Control op is Rob (WA9ZTY).

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

Northwest AM Net: AM activity is daily 3 PM to 5 PM on 3875 kc. The same group meets on 6 meters at 50.4 mc. Times are Sundays and Wednesdays at 8:00 PM. 2 Meters Tues. and Thurs. at 8:00 PM on 144.4 mc. The formal AM net and swap session is on 3875 kc, Sundays at 3 PM.

Nostalgia/Hi-Fi Net: Started in 1978, this net meets Friday at 7 PM Pacific Time on 1930 kc.

Old Buzzards Net: Daily at 10 AM local time on 3945 kc in the New England area. Listen for net hosts George (W1GAC) and Paul (W1ECO).

Southeast Swap Net: Tuesday at 7:30 PM Eastern Time on 3885 kc. Net controls are Andy (WA4KCY) and Sam (KF4TXQ). Group also meets Sunday on 3885 kc at 2 PM Eastern Time.

Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM on 50.4 mc. Net control op is Will (AA6DD).

Swan Nets: User's Group meets Sunday at 4 PM Central Time on 14.250 mc. Net control op is usually Dean (WA9AZK). Technical Net is Sat, 7235 kc, 1900Z. Net control is Stu (K4BOV)

Vintage SSB Net: Sunday 1900Z-2030Z 14.293 & 0300Z Wednesday. Net control Lynn (K5LYN) and Andy (WBØSNF)

West Coast AMI Net: 3870 kc, Wed. 8PM Pacific Time (winter). Net control rotates between Skip (K6YKZ), DJ (K6RCL), Don (W6BCN), Bill (N6PY) & Vic (KF6RIP)

Westcoast Military Radio Collectors Net: Meets Saturday at 2130 Pacific Time on 3980 kc +/- QRM. Net control op is Dennis (W7QHO).

Wireless Set No. 19 Net: Meets the second Sunday of every month on 7270 kc (+/- 25 Kc) at 1800Z. Alternate frequency is 3760 kc, +/- 25 kc. Net control op is Dave (VA3ORP).

CLASSIFIEDS

Advertising Information

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

Non-subscribers: $3.00 minimum for each ad up to 20 words. Each additional word is 25 cents. Email ads are fine.

Please call or write for display rates.

VINTAGE EQUIPMENT ONLY!

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FAX (call first): 303-838-3665
email: ER@OfficeOnWeb.Net

Deadline for the January 2004 Issue: Wed., Dec. 30

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

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

FOR SALE: Hallicrafters HA-1 "TO Keyer". $75 + shipping. Richard Cohen, 813-962-2460

FOR SALE: Galena crystal radios and or parts; also radio tubes, used but test good. Len Gardner, 458 Two Mile Creed Rd., Tonawanda, NY, 14150. email: radiolen@aol.com

FOR SALE: BC-224E with LW & HF, B.O. S-53 xclent, $75. S-85 xclent $115. SX-24 w/PM-23 spkr $185. All + shipping. Ron, MI, 517-374-1107.

FOR SALE: Bandmaster Deluxe. Unmodified w/tubes. Controls operational. No p/s. Front has rust but no knicks. Pix available. N4GL, pendragon@netsignia.net

FOR SALE: Collins 75A-1. Collins grading: Good-Very good. No mods. $375 + shipping. Bill Cabeen, 310-829-7678 (day) 310-459-2192 (evening) PDT. cabeen@ucla.edu

FOR SALE: Collins KWM-1, pwr supply attached, manual, $600 + shipping OBO. George Portell, W8QBG, 480-986-5797.

FOR SALE: National NC-57 internally modified per my recent ER articles. Excellent performance. $125. Brian, K6STI. 760-599-8662. bb@n2.net.

FOR SALE: DX-35, DX-40 reproduction crystal doors. $11.50 shipped. Texans add 8.25% sales tax. Glen Zook, 410 Lawndale Dr., Richardson, TX 75080

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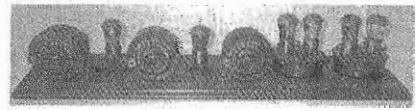
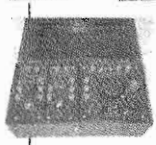
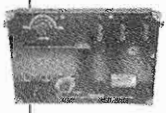
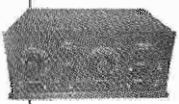
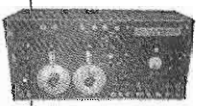
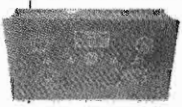


Future Radio Auction

January 17, 2004 • 10:00 am
at the "Expo Auction Center"
8157 Garman Rd., Burbank, Ohio
(Exit 204 off Interstate 71)

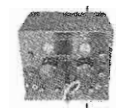
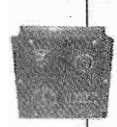
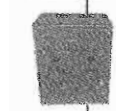
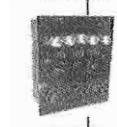
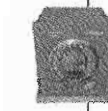
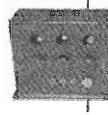
Notice of an upcoming auction to be held in January, 2004. This sale has many early items and is out of the Auburn, Indiana area. Listed are some of the items to be offered in the auction:

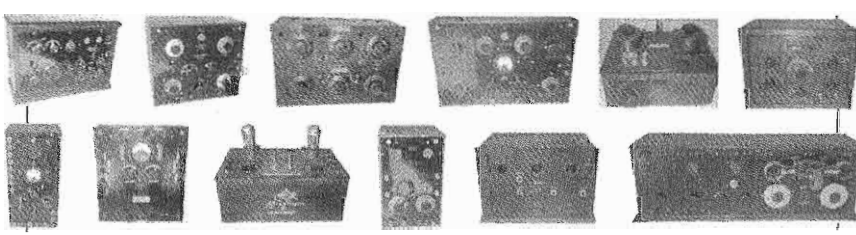
Marconi 294 Receiver, 1906 Marconi Tuning Condenser, Marconi Spark Coil, Wireless Specialty IP-501A, Wireless Specialty Loading Unit, Wireless Specialty Silicon Detector IP-200, Norden Hauck Super 10, Scott World Record Super 10, Chicago Radio Lab Z-nith (1921), Paragon RA-10, DA2Amp, 10 Receiver, Clapp-Eastham HR-Receiver, H2 Amp, RCA 44A Ribbon Microphone, Mecograph Telegraph Key Grebe CR9, Clarifier, CR-8, CR-3, CR-12, MU-1, Rork, Rord, Mignon Wireless RLC 25-6 Receiver, Federal 61, 59, 110, 200 Drop In Phono Panel, Western Electric 4C Receiver, 2A Tuner, Audion Control Box T-se107, 4D Receiver, 34B Amp, 25B Amp, 7A Amp and Power Supply, CW-926 Switch Board Items, CW926B, Deforest Interpanel (ca. 1921), Deforest D-10, D-12, EP4, Radiola I, II, III, IV, V, VII, VIII, RT, 24, 26, 25, Sodion Type DR6 Receiver, Kennedy 220, 525 Amp, Type 281, Type 15, Type 3, 521 Amp, 110, Bristol Amp, Model 9 Bread Board, Model 10.

A huge selection of Early Tubes, Books, Magazines.

*This sale will be a great way to start the new year -- adding some of these hard to find items to your collection! More information coming soon -- **stay tuned!** There are several nice Scott Pieces in this collection also.*

Terms: Cash/Check/Visa/MasterCard; 5% Gallery Fee



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FOR SALE: First issue "Ham Radio Horizons" excellent condx. $25 ppd. Roger, 816-356-0396

FOR SALE: Collins ant tuner 5 KW automatic used with Collins 204H1 5 KW xmtr. Exc $800. Set new 30S-1 transformers 8 pcs big power to audio small power. Photo and numbers available, $500. All FOB Los Angeles. W6ATC@AOL.COM, 310-276-5934.

FOR SALE: NOS 35TG and HK54 tubes, $25 each plus shipping. Martin Piepenburg, W9OLD, 5536E 500N, Monterey IN, 46960, 574-542-2591.

FOR SALE: Hallicrafters SX-96 $150, S-76 $130, SX-130 $125. National NC-125 $125. Heath DX-60B, HG-10 VFO $140. All with manuals, plus shipping. All in good condition, not DOA. Burt, KC8FBR, 2424 F-30, Mikado, MI 48745, 989-736-8020, kc8fbr1@netzero.net

FOR SALE: FRR-24 equipment, BC-640, 639 complete. Lots other. F. Bridges, 104 Maple St. Brevard, NC 28712, fbridges@citcom.net

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

FOR SALE: QST, 1944, 1945, 1949, 1953, 1954, 1956, 1957 $10 each year + shipping. Alan Lurie, W9KCB, 309-682-1674, 606 E. Armstron Ave., Peoria IL 61603

FOR SALE: Layayette HE30, all functions OK, has pwr. @10 $95. Zenith T/O model H500 A/O N/D $100 @10 Plays. Hickok V/O meter, model 470A with cables. $40. Please check past adds, still have leftovers. Bernie Samek, 113 Old Palmer Rd, Brimfield MA 01010, 413-245-7174 FAX 0441. NOTICE: If I don't return your call, please call again because message was garbled on my machine or I copied wrong.

FOR SALE: Full years QST 38 hardcover $25, '36 $24 shipped USA. 1936 ARRL handbook good to ex condx. $30. Tom Berry, W5 LTR, 1617 West Highland, Chicago, IL 60660, 1-773-262-5360 or 1-773-262-0016

FOR SALE: SX-62A - $150; SX-62B $150; SP-400 $200; HQ-129X $125; Gates 250GY $150; KLM 10-30-7LPA Log Periodic, never put together $500 OBO. All PU only near Cortez, Colo. JPEGS available. Barry, N6CSW, 970-564-9187, brw@frontier.net.

FOR SALE: Homemade exciter, Collins 51J-4, 180S-1, Shure CX-21, Turner 33D, Astatic. Bill Coolahan, 1450 Miami Dr. N.E. Cedar Rapids IA 52402-2933. 1-319-393-8075

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

FOR SALE: Galena crystal radios, homemade, also parts, with pix available. Radio tubes, most used, free lists. Len Gardener, 458 Two Mile Crek Rd., Tonawanda, NY, 14150. email: radiolen@att.net

FOR SALE: Naval Receivers RAK, RAL, RAO, RBA, RBB, RBC, RBL, RBM. Some checked, pwr splys available. $75-$450 depending on condx. Many other types. Carl Bloom, 714-639-1679. carl.bloom@prodigy.net

FOR SALE: For Sale: NCX-3 and PS- $115, Large, nostalgic Mercury "Drug Store" type tube tester with charts-$ 75, works great. **WANTED:** Hickok 752A manual.,Carter WD4AYS, 434 979 7383, CElliott14@aol.com

FOR SALE: Hallicrafters NOS SR-2000 Hurricane cabinet and front panel $125. Stuart T. Carter, II. W4NHC, 680 Fernwood Drive, Melbourne FL 32904-1995, 321-727-3015

FOR SALE:GR 1192 frequency counter, manual copy, $45. GR 1666 Kelvin bridge, manual copy, $225. Bach-Simpson wave/ modulation meter, $35. Sencore filament tester, $15. 7&9 tube pin straightener $3. Ross Wollrab, 229 N. Oakcrest Ave, Decatur, IL 62522-1810. rewollrab@aol.com

FOR SALE OR TRADE: QST, full years, excellent condition. 1950 thru 1960, plus 1944 missing September. $10 per year plus shipping from 10021. Or trade for CQ 1950 thru 1969. Ken, W2EWL, 212-288-1310, ken44@nyc.rr.com

SALE/TRADE: BC-1335/Delco, RT-66/ GRC, TA-12C. NOS: 304TL, 4-125A, 872/ stacks. NCX-3, S-108. **WANTED:** RCA

Radiomarine T-408/URT-12, info. Sam KF4TXQ PO Box 161 Dadeville, AL 36853-0161 stimber@lakemartin.net 256-825-7305

FOR SALE: Onan pre-wired generator instrument panel assy, 14 x 19 ¾, bottom hinged, new, $325. Many high quality, hard to find transformers for builders: filament, plate, etc. Pick up what you want or take it all. Must sell, no shipping. Joe, W6CAS, 916-731-8261, Sacramento, CA

FOR SALE: HP334A Automatic Distortion Analyzer, $100. HP190A Q-Meter $85.Both tested, nice condition. Kirk Ellis, KI4RK, 203 Edgebrook Drive,Pikeville NC 27863. 919-242-6000, e.kirkellis@netzero.com

FOR SALE/TRADE: Original manuals: National, Drake, Johnson, Hallicrafters, Hammarlund, Gonset, Swan, WRL, B&W, Knight, Lafayette, others. Ni4q@juno.com 407-351-5536

FOR SALE: QST magazines. Thirties through 2000. Request list and inexpensive contents pages, phone or write 914-666-4523 Charles Graham, K2GVE, 4 Fieldwood Drive, Bedford Hills, NY. 10507.

FOR SALE: Heath Sale—QF-1 Q mult; AM-2 SWR; CPO code; HD-15 patch; IT-12 audio. $15 each + Shpg. H. Mohr, W3NCX, 1005 W. Wyoming, Allentown, PA 18103-3131

FOR SALE: Collins KWM-2 & "S" Line repair, Fast service. All work guaranteed 281-351-4953 WB7DYW@EV1.NET http://users2.ev1.net/~wb7dyw/index.htm

FOR SALE: KWM-2A plug-in relays K2 & K4 manufactured by Allied Signal, P/N T163-6C-115D and T163-4C-115D. $35.00 for a set + $3.85 priority mail. Mike Hutnick, 450 Riverview Ave., Bloomsburg PA, 17815, hutnick@epix.net

FOR SALE: Vacuum fixed and variable capacitors. Details at: http://www.isquare.com/personal pages/forsale-vacvar.htm Bob, WØYVA, Great Falls, VA. 703-450-7049.

FOR SALE: Military whip antennas, 1938 Webber signal generator, make offer. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777, 989-595-6483

FOR SALE: Tested good globe 201A $14, 226 $15, 227 $10 and others. Slightly weak tubes guaranteed to work in early radios ½ price shown. Write or e-mail: tubes@qwest.net for a new price list or see www.fathauer.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281, 480-968-7686. Toll Free 877-307-1414

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

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

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

FOR SALE: Tube collectors: 1944 Jennings uranium glass capacitor. Mint in original carton. $20 ppd. Bob Ryan, 1000 S. Gilbert St., Apt 132, Hemet CA 92543-7065

FOR SALE: Collins Radio stock certificates, 33 avail, 10-share (green) or 100-share (blue), issued to various companies. $20.00 each, limit one per customer. Check or MO. No choice on color. William O. Dean, KC7ICH, PO Box 3105, Tonopah, NV, 89049

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

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

FOR SALE: New Ranger 1, Valiant 1, & Navigator plastic dials, freq numbers in green, with all the holes just like orig. - $17.50 ppd. Bruce Kryder, W4LWW, 277 Mallory Station Dr., Ste. 109, Franklin, TN 37067. bak@provisiontools.com

FOR SALE: KWM2/S-line metal logo pins. Meatball or winged. Excellent replica of the original. Put one on your hat, badge, or replace a missing logo on your panel. $6.25 shipped. W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029. 760-747-8710, w6zz@cox.net

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

FOR SALE: R.L. Drake repair and reconditioning, most models including TR-7's, 35 years experience. Jeff Covelli, WA8SAJ, 440-951-6406 **AFTER 4 PM**, wa8saj@ncweb.com

NOTICE: Visit Radioing.com, dedicated to traditional ham radio & vintage radio resources. Let's Radio! Charlie, W5AM. http: / /www.radioing.com.

FOR SALE: Heath Nostalgia, 124 PG book contains history, pictures, many stories by longtime Heath employees. (See BOOKS, on page 62) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028

FOR SALE: TX'ers, rcvrs, parts, manuals, etc. Send a large SASE. More at http://come.to/AF4K/ Brian Carling, 117 Sterling Pine Street, Sanford, FL 32773 Brian Carling, AF4K, 117 Sterling Pine St., Sanford, FL 32773.

FOR SALE/TRADE: Transmitting/Receiving tubes, new & used. $0.55 & LSASE for list. I collect old & unique tubes of any type. **WANTED:** Taylor and Heintz-Kaufman types and large tubes from the old Eimac line; 152T through 2000T for display. John H. Walker Jr., 13406 W. 128th Terr. Overland Park, KS 66213. PH: 913-782-6455, Email: jhwalker@prodigy.net

FOR SALE: Treasurers from the closet! Go to www.cjpworld.com/micromart to find some unique items many hams would lust for! Gus, WA, 360-699-0038 gus@wa-net.com

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

NOTICE: T-368 Registry. For info w2zr@ao1.com Subscribe to the T-368 & BC-610 reflector at http:/ / groups.yahoo.com/group/T-368_BC-610

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

FOR SALE: Strong steatite antenna insulators. Lengths from two to fifteen inches. SASE for list. John Etter, W2ER, 16 Fairline Dr., East Quogue, NY 11942. 631-653-5350

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

FOR SALE: Spun Aluminum Knob Inlays for most Boatanchors. Collins Dial Drum Overlays. Dakaware Knobs. Charlie Talbott, 13192 Pinnacle Lane, Leesburg VA 20176-6146. 540-822-5643, k3ich@arrl.net

FOR SALE: Build your own "Midget" bug replication by KØYQX, ca 1918, featured by K4TWJ in CQ Magazine, May '98. 10 detailed blueprints. FAX: 507-345-8626

or e-mail bugs@mnic.net

FOR SALE: Parts, tubes, books, ECT. Send two stamp SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761 wb0cte@arrl.net

FOR SALE: Collins restoration. Everything inside & out to make it as Art Collins built it. 50 yrs experience. W9OJI / N4FZ, IL, 815-734-4255 or N4PZ@aol.com

FOR SALE: Convert any wattmeter to read PEP! Perfect for AM/SSB-$24.95 ppd for complete kit! HI-RES, 8232 Woodview, Clarkston MI 48348, 248-391-6660, info@hi-rescom.com

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

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

feltondesign@yahoo.com

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

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

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

FOR SALE: PANEL AND CABINET REFINISHING; Johnson, Hammarlund 180(a), R390(A), & others total restoration & sales; My updated web site: http://w4pnt.8k.com Patty & Dee's Marina; Dee Almquist, 534W. Main St., Waynesboro, VA 22980. 540-249-3161 Cell: 540-480-7179, FAX 540-249-5064

FOR SALE: RIT for Collins KWM-2/2A; No modifications needed. $79.95 SASE for details. John Webb, W1ETC, Box 747, Amherst NH 03031 bigspndr@bit-net.com

FOR SALE: Aluminum heat dissipating plate and grid connectors for all 3, 4 and T series Eimac tubes including 3-500Z, 4-1000, 304T's and others. Alan Price fixr7526@cs.com

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

FOR SALE: I built hot-rod receivers; R390A, SP-600, R-388/51J. NC-183D...and transmitters: Valiant, DX-100, T-4X-A-B, HT-32. 51J-4 filter replacements, R390A Hi-fi AM $245.00 ea. Chuck Felton, KDØZS, Wyoming, 307-322-5858, feltondesign@yahoo.com

FOR SALE: Collins reproduction items available through the CRA on www.collinsra.com. Join the CRA and subscribe to the Collins Journal. Dave, W3ST

FOR TRADE: Two good RCA 833A's for one Taylor 833A. Also looking for Taylor 204A, 813, TR40M. John H. Walker Jr., 13406W. 128th Terr., Overland Park, KS 66213. PH: 913-782-6455, Email: jhwalker@prodigy.net

FOR SALE: YAESU's FT-902DM HF Transceiver Excellent $450.00, FT-221 2mtr all mode Transceiver Excellent $175.00. John, W8DKI jalw8dki@hotmail.com, 1-936-872-3755.

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

WANTED: Manual for Layayette KT-173, 20-in-1 electronic kit, information on Signal Corps I-166 VOM. Louis L. D'Antuono, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612

WANTED: BC-456 or MD-7 modulator. Tim, N6CC, 925-830-9474. timsamm@attglobal.net

WANTED: One good-to-excellent working condition Heathkit DX-60. Prefer the original model but will settle for an A or B in good shape. Luke, K4JEJ, 561-262-5668. k4jej@adelphia.net

WANTED: "The Care and Feeding of Power Grid Tubes" by Robert Sutherland, W6UOV. Keith Kunde, K8KK 216-524-7698 k8kk@arrl.net

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

WANTED: Hallicrafters S-20R, in good working order. Dave Casler. KE0OG@arrl.net. (970)-626-5565.

WANTED: Hallicrafters HA-1 keyer in good condition, please email Mike at: mmhardie@telus.net

WANTED: Operating instructions or diagram for a Hickok VTVM model **209B**. W.J. Klewchuk, POB 927, Wadena Sask., Canada SØA 4JØ.

WANTED: Meter or meter lens for Gonset Communicator IV. KEØQM. 913.782.9092 ke0qm@planetkc.com

WANTED: Anything by DAVID GRIMES: radios, Especially Model 3XP, advertising, ephemera, literature; please contact: Mike Grimes, K5MLG; 3805 Appomattox Cir; Plano, Texas, 75023, (972) 867-6373. Email: rimesm@flash.net

WANTED: Sonar FR-104 30-50 MHz receiver, also Dynaco Mark II or Mark III audio amp. Bill Smitherman, KD4AF, 336-699-8699

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

WANTED: Two Thordarson T20C53 (or equivalent)chokes. 12 Henry 90 ma 1500V insulation. Brian Roberts K9VKY, 130 Tara Drive, Fombell, PA 16123 724-758-2688 k9vky@arrl.net

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

WANTED: Diversity panel to hook up two Hammarlund SP-600-JX's in diversity mode. K8CCV, Box 210, Leetonia, OH 44431-0231, 330-427-2303.

WANTED: Manual/Technical Info For Navy LS-518A/SIC Intercommunication Station. Jim Cavan, 603-487-5284, Jcavan56@Aol.Com

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

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

WANTED: WW2 Navy MBF transceiver, hopefully unmodified. John Svoboda, W6MIT 530-672-0903 or svoboda@directcon.net

WANTED: Collins 310B-3, basket case OK, 70E-8A PTO per 1948. Chicago CMS-2, pair of Taylor T-21. Jerry, W8GED, CO, 303-979-2323.

WANTED: HQ-129X cabinet. Condition not important since I can strip and repaint if necessary. Joe Fell, W3GMS, e-mail joseph.fell@Unisys.com or phone 610-648-4425.

WANTED: James Millen coils 42080, 42040, 42015, 43015. Navy SE2511/SE2512 receiver, SE2513 coil set. Gary Carter, WA4IAM, 1405 Sherwood Drive, Reidsville, NC 27320. Phone: 336-349-1991. Email: gcarter01@triad.rr.com.

WANTED: R-1051/URR top condition top price. IZ1FID federico.baldi@virgilio.it fax +390384672219

WANTED: Correspondence with others (am incarcerated) on Military (especially R-390's & backpacks) and tube rigs. Also looking for copies of old surplus catalogs postwar thru 90's. W.K. Smith, 44684-083, FCI Cumberland Unit A-1, POB 1000, Cumberland, MD 21501.

WANTED: #33A and #35 Universal SW-3 coils for cash or other coils. Hank Bredehorst 2440 Adrian St Newbury Park, CA 91320. 805 498-8907 quailhill@earthlink.net

WANTED: 23 channel tube-type CB radios for 10-meter conversions. Also tube-type 10-meter linear amplifiers. Ed, WA7DAX, 1649 East Stratford Ave., Salt Lake City, UT., 84106. 801-484-5853

WANTED: Looking for the emblem of National "NC". Katsu JO1GEG/ ex.N8EYH, khirai@ieee.org

WANTED: National HRO-500-TS and LF-10 preselector. Information on improving SSB distortion in the HRO-500. Bob, WØYVA. bobs@isquare.com; 703-450-7049.

WANTED: Audio transformers, with good windings, for Westinghouse RADA and Aeriola SR. amplifier. Paying $40.00 each plus shipping. Roland V. Matson, POB 956, Lake Panasoffkee FL

WANTED: WW-2 Japanese Military Radio of any kind. Yokohama WW-2 Japanese Military Radio Museum, Takashi Doi, 1-21-4,Minamidai, Seyaku, Yokohama, 246 Japan takadoi@carrot.ocn.ne.jp http://www.yokohamaradiomuseum.com/

WANTED: Collins R-389 LF receivers, parts, documentation, anecdotes, antidotes. W5OR Don Reaves, PO Box 241455, Little Rock AR, 72223 501-868-1287, w5or@militaryradio.com, www.r-389.com

WANTED: Any TMC Equipment or Manuals, what have you? Will buy or trade. Brent Bailey, 109 Belcourt Dr.,Greenwood, S.C. 29649 864-227-6292 brentw@emeraldis.com

WANTED: Older rigs & accessories. Brian Carling, AF4K, 117 Sterling Pine St., Sanford, FL 32773. http:/ /come.to/AF4K/

WANTED: National NTE CW xmtr in working Condx. I love National. Sylvia Thompson, 33 Lawton Foster Rd., Hopkinton, RI 02833. 401-377-4912. n1vj@arrl.net

WANTED: National Co. emblems, escutcheons, and logos from equipment,

also National AN/WRR2 in working order. Don Barsema, 1458 Byron SE, Grand Rapids, MI 46606. 616-451-9874. dbarsema@prodigy.net

WANTED: ARC-5 rcvrs, racks, dynamotors. Jim Hebert, 1572 Newman Ave. Lakewood, 0H 44107.

WANTED: Top prices paid for globe shape radio tubes, new or used. Send for buy list or send your list for offers. Write or email: tubes@qwest.net See WWW.Fathauer.Com or send for catalog of tubes for sale. George H. Fathauer & Assoc., 688 West. First St., Ste 4, Tempe, AZ 85281. 480-968-7686, Call toll free 877-307-1414

WANTED: Old military radar displays, scopes, antennae, receivers, manuals, etc. Even half ton items! William Donzelli, 15 MacArthur Dr., Carmel, NY 10512. 847-225-2547, aw288@osfn.org

WANTED: Seeking unbuilt Heathkits, Knight kits. Gene Peroni, POB 7164, St. Davids, PA 19087. 610-293-2421

WANTED: Western Electric horns, speakers, amps, and mics. Barry Nadel, POB 29303, San Francisco, CA 94129. museumofsound@earthlink.net

WANTED: Manuals, manuals, and manuals for radio-related equipment to buy or swap. Catalog available. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. 732-238-8964

WANTED: Postcards of old wireless stations; QSL cards showing pre-WWII ham shacks/equip. George, W2KRM, NY, 631-360-9011, w2krm@optonline.net

WANTED: R-390A rcvrs, parts rigs or restorable, will restore yours at reasonable prices. Walter Wilson, KK4DF, 706-733-8323 wewilson@knology.net, www.knology.net/~wewilson

WANTED: Info on xmtrs made by Clough-Brengle Co. Used by the CCC, in the mid to late 30's. Any help would be greatly appreciated. Ron Lawrence, KC4YOY, POB 3015, Matthews, NC 28106. (704) 289-1166 hm, kc4yoy@trellis.net

WANTED: WW II Japanese xmtrs & rcvrs (parts, plug-in coils) for restoration & ER articles. Ken Lakin, KD6B, 63140 Britta St., Ste. C106, Bend, OR 97701. 541-923-1013. klakin@aol.com

WANTED: Searching for RME CT-100 or 3R9 xmtrs and info about them. David Edsall, W1TDD, 156 Sunset Ave., Amherst, MA 01002. 413-549-0349, dedsall@crocker.com

WANTED: Orig Heath manuals for ham & test equip. Please state condx & price. Warren, K1BOX, NC, 828-688-1922, k1box@arrl.net

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

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

WANTED: I wish to correspond with owners of National FB7/FBXA/AGS coil sets. Jim, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511 j.c.clifford@Juno.com

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 820, Hot Springs, AR 71902. 501-318-1844, Fax 623-8783, www.boatanchor.com

WANTED: Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. 661-259-2011. FAX: 661-259-3830

WANTED: Any books featuring panel meters, gauges, or flight instruments. Chris Cross, POB 94, McConnell, IL 61050.

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

The Collins Video Library

The Collins KWM-2 Video (4 hours, $89.95) Highly detailed video on operation, rebuilding, alignment, troubleshooting, and neutralization of this classic! A must for anyone who owns and operates a KWM-2 or 2A. Printed documentation included.

The Collins 75S-3 and 32S-3 Video (3.5 hours, $74.95) An excellent in-depth examination of the most popular version of the S-Line equipment. Operation, modification, alignment, neutralization are covered and more! Much of this information applies to all versions of the S-Line!

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The Collins KWS-1 Video (2 hours, $39.95) This video is the perfect companion to the 75A-4 video for owners of the "Gold Dust Twins"! Butch Schartau (K0BS) shows you how to operate, maintain and repair your KWS-1. Watch as Butch goes theough the entire alignment and neutralization process, as well as showing you how to properly operate this famous transmitter.

The Collins 75A-4 Video (4 hours, $89.95) This video is four hours of great information on how to repair, maintain and restore this classic receiver. Butch Schartau (K0BS) guides you through all aspects of keeping your 75A-4 running like a top.

R-390A Video (7 hours, $109.95) At last it's available! Long awaited by serious "boatanchor" enthusiasts this is a great video all about the ultimate receiver. Now you will have the ultimate video to go along with it. R-390A expert Chuck Rippel (WA4HHG) covers an absolutely incredible array of information in this "heavy duty" video. This video looks at operation, the receiver modules, complete circuit description, front and rear panel details, complete mechanical and electrical alignment, PTO details, and performance evaluation, modifications, troubleshooting, and restoration. There is nothing like this video available today, at any price!

R390A Addendum Video ($49.95) Another 3 hours and 40 miutes of R-390A information from Chuck Rippel (WA4HHG).

SP-600JX Video (4 hours, $89.95) In this video, Chuck Rippel takes us through all aspects of SP-600-JX servicing including repairs, restoration and modifications. This video is a must for any new owner needing to work on the SP-600.

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

Produced by Floyd Soo, W8RO (ex-KF8AT)

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FOR SALE: Heath HA-14 "Compact Kilowatt" linear amplifier, collector grade, w/AC power supply, $425. Richard Prester, 131 Ridge Road, West Milford, NJ 07480. 973/728-2454. rprester@warwick.net.

FOR SALE: SCR522 control unit BC1303, Phantom Antenna A29 and Manual IE36, $35.00 shipped . Rich Wurtzinger K9RLF, 1140 S Taylor, Oak Park, IL 60304 708 383 4579 richwurtz@juno.com

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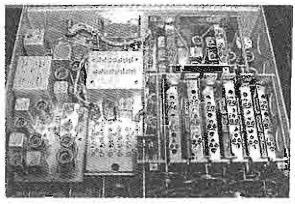

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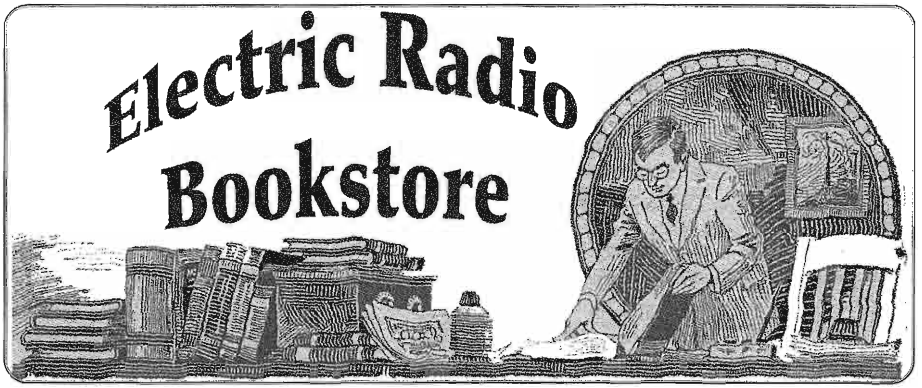

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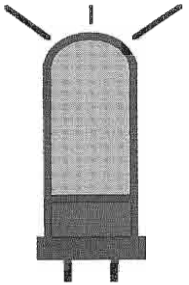

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