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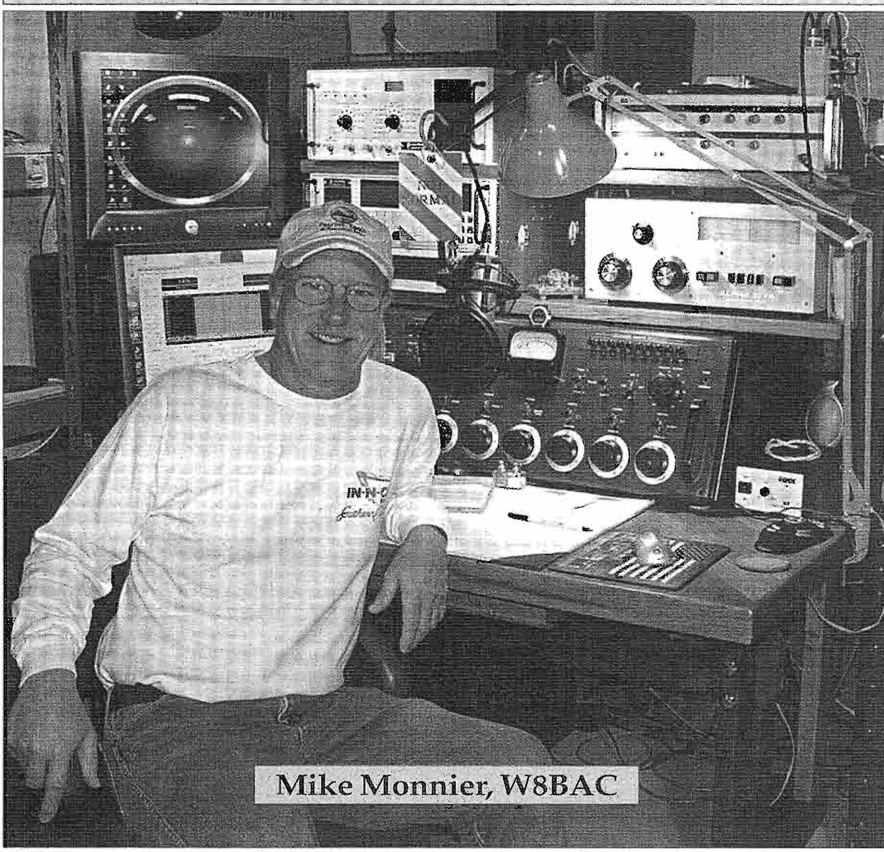
ELECTRIC RADIO

celebrating a bygone era

Number 217 June 2007



Mike Monnier, W8BAC

ELECTRIC RADIO

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

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:
Chuck Teeters (W4MEW), Jim Hanlon (W8KGI), Tom Marcellino (W3BYM), Gary Halverson (K6GLH), David Kuraner (K2DK), Bruce Vaughan (NR5Q), Bob Grinder (K7AK), Larry Will (W3LW), Dave Gordon-Smith (G3UUR), Dale Gagnon (KW1I)

Editor's Comments

Honor Your Elmer

As we all know, "Elmering" has been a tradition for many decades that's used to encourage newcomers and assist with entry into amateur radio. With a start in amateur radio, many of us have gone on to pursue a technical career or a career in public service that benefits many outside of amateur radio. It is easy for such voluntary service to be taken for granted.

In a suggestion that Gary Halverson (K6GLH) came up with, I think it's time to "Honor Your Elmer" with a new contest at Electric Radio. The full details of this contest are not finalized as this issue goes to press and I'll have more next month. The contest will provide a way for amateurs to honor their Elmer by writing a description of the Elmer and how you were inspired to get into amateur radio. Readers will vote on the best story, and the writer of the best story will win a prize and the story will be published in Electric Radio. In order to save valuable page space in ER for articles, I will be posting the submitted articles on the ER web site where all may read them and vote on the best one. I'd like this to be a fun contest, and please send me relevant comments and suggestions.

Amateur Radio Licensing

Too frequently, we tend to take the privilege of obtaining an amateur radio license for granted, sort of like the voluntary service provided by our Elmers. If it had not been for a fortunate turn of events, radio spectrum might have been locked up as the exclusive domain of government and commercial services. In this month's Part Two of Bob Grinder's article on the 1912 radio act that began licensing, a door is opened that gives a glimpse into an important historical aspect of amateur radio, especially considering important recent changes in radio law. Of course, the equation is different today because of the economic impact of selling commercially-made equipment that couldn't have been foreseen in 1912.

73, and Keep Those Filaments Lit!

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The Hallicrafters S-19R Sky Buddy

By Chuck Teeters, W4MEW
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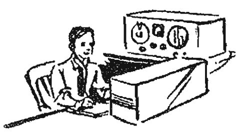
My first receiver was almost a 1939 Sky Buddy, but W8HHU and W8UKT talked me out of buying one. I had saved up the $30 to buy a new one at Genesee Radio in Buffalo, New York. Herb and Paul said a used S-14 Sky Chief that Genesee had for sale at the same price was a better receiver. The S-14 had an RF amplifier, a 6D6, so it had better image rejection.

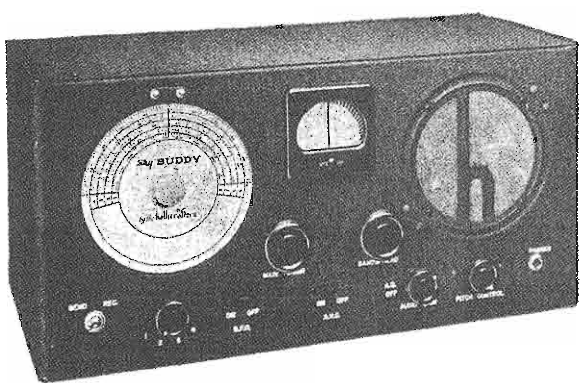
The S-14 had separate RF and audio gain controls, so it was easier to use on CW, and the S-14 had a magic eye tube tuning indicator, a poor man's S-meter. The S-19R Sky Buddy didn't have any of these features. Even though the S-14 was 3 years older, they thought it was a better receiver. So, I bought the S-14 Sky Chief. I used it on 160 meters until the WWII shutdown on December 8, 1941. After the war, the first HF band the FCC opened up, in 1946, was 10 meters. My S-14 only tuned to 18 MHz, so I had to build a converter for 10 meters. My friend, who had an S-19R, was on 10 before me because the S-19R tuned 10 meters.

About 8 years ago, I talked Marty (AA4RM) out of his S-14 Sky Chief, so

HALLICRAFTERS COMMUNICATIONS EQUIPMENT

WORLD'S LARGEST BUILDERS OF AMATEUR COMMUNICATIONS EQUIPMENT





The SKY BUDDY

The new SKY BUDDY is an amateur receiver in every respect, covering everything on the air from 44 mc. to 550 kc., including the 10, 20, 40, 80 and 160 meter amateur bands. It now employs the same electrical bandspread system used in higher priced Hallicrafter models. The more important features are: Electrical bandspread, broadcast Band, BFO, AVC switch, phone jack, pitch control, built-in speaker. For operation on 110 volts 50-60 cycles AC. For operation in 110 volt AC from 6 volt DC use No. 302 Electronic Converter. Dimensions 17½" x 8½" x 8½" high.

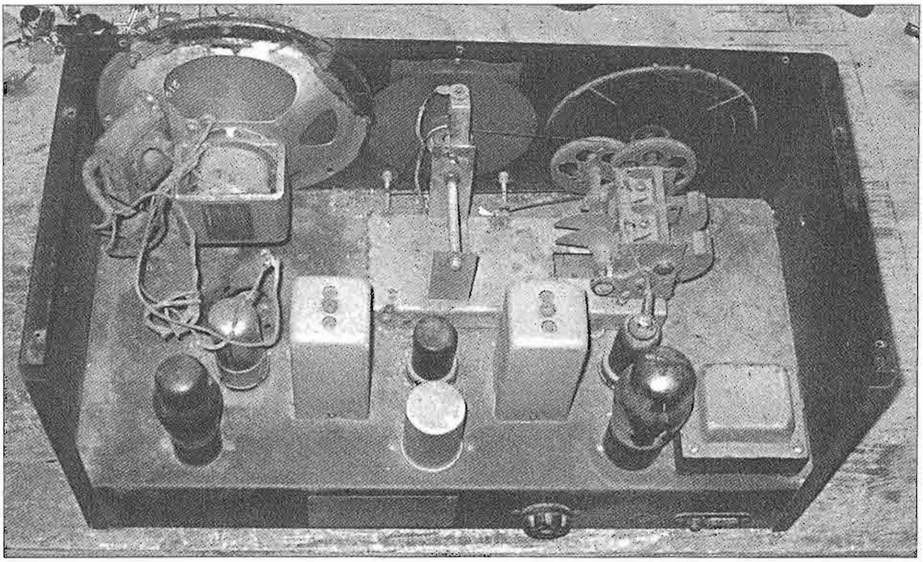
FEATURES

Six tubes. Tunes 10 meter band. Electrical bandspread. Coverage and bandspread from 550 kc. to 44 mc. DC operation socket—battery or vibrapack.

The SKY BUDDY (Model S19R)—Including tubes and speaker. Shipping weight 21 lbs.......... (SKYBU) $32.50

Extra for Univ. 110-250 volts, 25-60 cycles $5.00

Hallicrafters was a frequent advertiser in many publications. The one reproduced above is from the 1942 edition of Radio's Master Encyclopedia.

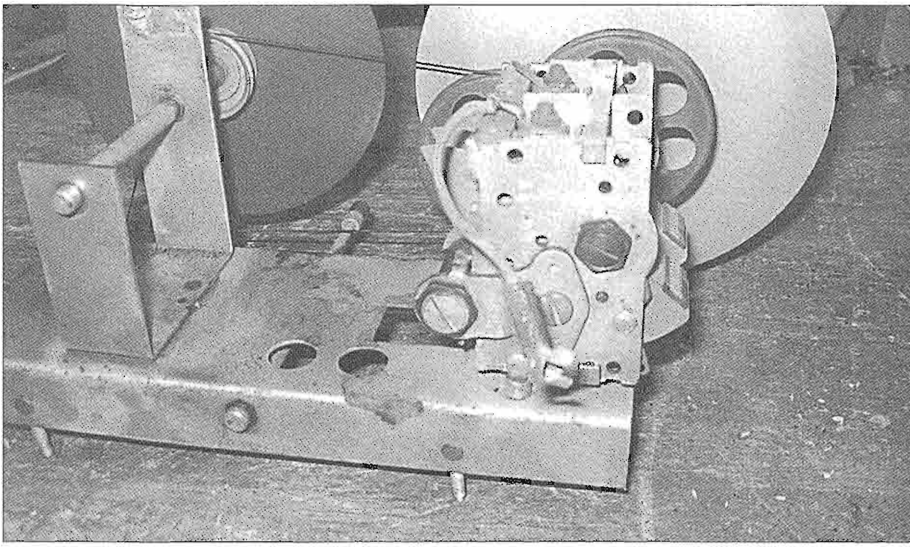


Here is a rear view of the S-19R with the top removed, but no other work had been done at this point. This photo shows the 8-inch speaker sticking over the top of the front panel. Whoever did the speaker replacement job carefully painted the speaker rim black so it wouldn't be too noticeable with the top screwed back on. Their time might have been better spent dressing the wires instead of painting practice! The socket for the missing type 76 tube is visible below the speaker frame.

for the last few years I've been able to use it. It's a good receiver, not quite as good as I remembered it, but certainly a usable receiver. The Sky Chief is as good as anything around on 160 and 75 AM phone and 40-meter CW, providing there isn't too much QRM. I built up a copy of Byron Goodman's 6SN7 10-meter converter from the February 1946, QST, that I had used, and it too is a usable combination. I use my S-14 Sky Chief for Old Timer's Night, Straight Key Night, and the Classic Exchange, and had forgotten about the S-19R Sky Buddy.

A couple of months ago, however, I was at the Rock Hill, South Carolina hamfest and spotted a decrepit-looking S-19R Sky Buddy. It had flaking paint and a rusty bottom, missing controls, a scratched up dial, nonfunctional tuning knobs. Also missing was its line cord, a tube and socket, and most obvious, it had an oversized speaker sticking through a hole that had been cut in the top of the cabinet. I wandered around the bone yard and passed the Sky Buddy several times before finally stopping and asking about it. I found it came from a barn, and had been there for over 50 years. The asking price was $15. I offered $10, and I now owned the S-19R.

A few days later the S-19R hit the bench, where I stripped it down. About half of the wiring under the chassis was minus the insulation, due to rodents. The BFO tube, a 76, and its socket were gone, along with the BFO coil and all BFO components. I removed the 8-inch electrodynamic speaker that replaced the original 5-inch part and I found a VRP part number on it. That identified the repair job on the Sky Buddy as having been made during WWII, or shortly thereafter. Victory Radio Parts, or VRPs,



This photo shows the removable subchassis that holds the tuning condenser and the dial cord mechanism.

were a limited number of repair parts that were available for civilian radio repairs between 1942 and 1946. VRPs were all a repairman could get without a priority certificate, and obviously they did not include 5-inch speakers.

To get the 8-inch speaker in where the 5 inch had been required removal of the BFO and cutting a 4 by 1-inch slot in the top of the cabinet. It appeared that all of the other parts, with the exception of the rectifier tube, were original. The rectifier was supposed to be an 80, but was changed to an 83, which has the same 4-pin base but is a mercury-vapor rectifier with higher current ratings.

A cleanup of the chassis, and a continuity check of the power transformer, IF cans, output transformer, and the RF coils showed everything was OK. The rodents only liked the point-to-point, push-back wire insulation. I replaced the chewed-up wire, the line cord, a phone jack, a send-receive switch, a leaky dual 8-µF filter cap, and installed a 5-inch permanent-magnet speaker. This also required the installation of a small filter choke to replace the speaker field coil. With a new 80 rectifier tube installed, I put the power to it and I had B+, AVC, and signals on the BC band. All the voltages checked OK except in the 41 audio output. The 6SQ7 detector/first audio grids were a few volts positive, so I replaced the audio coupling caps. The Sky Buddy sounded pretty good after that.

It was now time to start on the mechanical end of the restoration. The first thing to do was to string new dial cords. On the S-19R, this job is a bit harder than on most receivers. You can not remove the chassis as it is welded in. Only the top, bottom, and back of the cabinet are removable. As far as I know, only the Sky Buddy and the HT-6 transmitter were built in this fashion. The S-19R used a subchassis to hold the tuning cap and dial drive mechanism. You remove the dial and knobs, unsolder the connections to the tuning cap, and remove 4 nuts from the subchassis mounting studs and pull the subchassis out. It is much easier to remove if you also remove the first IF can to get some working room. You can then restring the dial drive cords and reinstall the sub chassis. I had a new German-silver dial for the Sky Buddy, so I installed it and a new 0-to-100 bandspread dial. With over 22,000 Sky Buddies built, it is not too hard to find parts. I also made a new celluloid dial cover for the bandspread dial. My S-19R is now the only old Hallicrafters I own that doesn't have a faded, dark-yellow dial.

I made a new top cover for the cabinet out of 3/16-inch aluminum. A flat-black paint job and control labeling finished up the mechanical work. A touch-up alignment was done, and it was ready for a new BFO. The front-panel switch was still there, but that was all. Installation of a 5-pin socket and a type 76 took care of the BFO tube. Hallicrafters used a front panel-mounted BFO coil that was similar to an IF transformer, with one trimmer cap having a ¼-inch shaft for pitch control. I have never been able to find original parts, so I have used R-390A BFOs in the past in other silver-dial Hallicrafters, but there was no room in the Sky Buddy for the part. So, I mounted a 15-pfd variable on the panel and tried a BC-band oscillator coil for the BFO. These universal replacements will tune down to 800 or 900 kHz with 350 pfd across the winding. The one I had contained a slug, so with it in all the way I got it tuned down to 455 kHz with a 680-pfd cap. While installing the new BFO, I got a chance to increase the BFO injection voltage for better CW and SSB reception. The S-5 signal AVC voltage in the S-19R was 4 volts. I increased the value of the coupling cap until the BFO produced about the same voltage. It has worked out to be just about right for CW.

With the Sky Buddy in the shack and connected to an outside doublet antenna, it is a remarkably good receiver. Calibration of the main dial is never off by more than the width of the dial marking lines, which is 10 kHz on 75 meters, 20 kHz on 40, 50 kHz on 20, and 100 kHz on 10 meters. It hears any thing my Icom can hear, plus lots more, all at once, as the selectivity is poor. The drift during warm up is not bad, about 4 kHz on 40 meters. It has less drift on 75 and a bit more on 20 and 10 and about half of the S-14 Sky Chief drift. I guess it's a 6K8 versus a 6A7. CW reception is not rock solid, but if you don't bang the desk or cabinet it is good for a 30-minute, hands-off QSO. SSB is a different story, however, as the BFO has some hum modulation which garbles the voice. My S-14 Sky Chief, with the original Hallicrafters BFO, has the same problem so it's not in my homemade BFO. Side-by-side bench checks with the S-14 Sky Chief showed the S-19R was a shade narrower, 9 kHz, compared to 11 kHz at 6 dB down for the Chief. The S-14 had the edge on image rejection on 40 and 20-meters, but only by a few db. The S-19R bandspread, 0-to-100 dial, is easy to tune because 80 meters covers the whole 100 divisions, while 20 is tuned in 25 divisions. This is about twice the number of dial divisions that the mechanical bandspread on the S-14 Sky Chief provides.

Overall, I think I would select the S-19R Sky Buddy over the S-14 Sky Chief if I had it to do over. The better bandspread, bit better selectivity, and 10-meter coverage, I think, outweighs the tuning eye, RF gain control and a bit better image rejection of the S-14. Also, having spent several hours recently replacing the drive belt of the S-14 mechanical bandspread tuning makes me lean in favor of the Sky Buddy and its dial cords. Of course, I can't go back and change my 1939 selection, and since I now have both receivers, who cares anyway, other than QST author extraordinaire Larson E. Rapp, W1OU, the receiver guru.

ER

Verifying Antenna Ground Connections

By Brian Davis, W9HLQ
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How to Verify Your Ground Connections are Good

For a number of years I have been active on 160 meters. As I improved my station, I came to learn that a good ground system is imperative to success on that band. I use a vertical and "feed it against ground." This means a good ground system is 50% of my "antenna system": the better my ground the better my antenna.

Most often, the weakest link in a grounding system is the bonding from one conductor to the next. This would be from the ground wire/cable to the bonding clamp, and the connection from the clamp to the ground rod (sometimes called an electrode). In RF environments, multiple antenna systems, ground rods, and ground radials may be involved so naturally they all must make proper connection. These bonding points can degrade with time due to vibration, climatic changes, weather, moisture causing galvanic corrosion, and other reasons. Your ground connections should be checked periodically.

There are several ways of checking the integrity of bonding conductors in a grounding system.

First, visually inspect the entire site, looking for loose connections, broken connection points and corroded connections: repair any of these.

Secondly, do a mechanical inspection, physically stressing each connection looking for less obvious loose or broken tie points.

Lastly, do an electrical bond-resistance test. Here, the most appropriate instrument to employ is a micro-ohmmeter. The micro-ohmmeter is far more effective in checking the quality of a resistive bond than a multimeter or other resistance-measuring device. The micro-ohmmeter conducts the test with a higher current. In this way, the quality of the bond is electrically stressed, eliminating the appearance of good resistance from weak connection points, such as a connection point where a single strand of wire is the bonding point. In this case, the multimeter, using low current, would potentially show this single-strand bond as a good connection. The micro-ohmmeter will quickly identify it as a poor bond by actually causing the single strand connection to open.

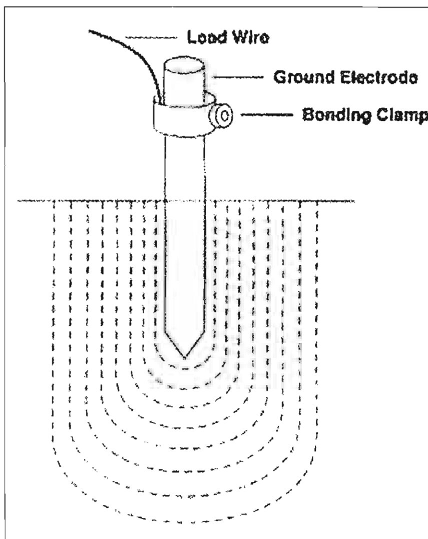

Figure 1: Grounding Electrode and Major Bonding Locations

Before reviewing the actual testing process, let's first examine the components of a grounding electrode. Notice how **Figure 1** shows a typical grounding electrode with three major bonding points: the ground electrode, the bonding clamp, and the lead wire. All three points should be checked with respect to each other.

The 10-amp micro-ohmmeter is an effective tool for testing any grounding bonding system. It employs a low voltage, typically 8-10 volts DC, and a high current, typically adjustable from 1 to 10 amps. A commercial micro-ohmmeter, such as the model from AEMC Instrument (http://www.aemc.com), consists of a test instrument and a set of heavy test leads (I am not affiliated with AEMC in any way.). Once the leads are attached to the connection, a button is pushed and the connection resistance is read directly. (See below for an inexpensive way the ham operator can test his bonding connection.)

A good resistive connection will be in the micro-ohm region and at worse case, in the milli-ohm region. This test procedure should occur for every bond along the grounding system from the tower and all equipment right down to each and every grounding rod and radial. This testing of the bonding system should be conducted quarterly, or at very least annually, to ensure a good quality grounding system.

How to Make Your Own Micro-Ohmmeter

The micro-ohm meter is not a test instrument that a typical ham will have, of course. But, you can easily approximate the function by following the steps described below, which I have done.

Locate a fairly inexpensive automobile battery charger in the 6-to-10 amp charging range. I used both a very old K-Mart charger, rated at 6 amperes, and also a newer "Starline" by Starline Products, Minneapolis, Minnesota. It also was rated at 6 amps, but the meter reads to 8 amps. I used an automotive charger since it has high enough high internal resistance and will endure momentary shorts repeatedly. You could use a bench DC power supply that has current limiting. Set it for 10-to-20 amps current limit and measure all day long! The automotive charger can be found at garage sales and flea markets for just a few dollars and makes a great piece of test gear.

Locate or borrow a high current ammeter and—with caution—determine the maximum current the charger will deliver in a short-circuit condition. I found that the Starline automobile battery changer would deliver 35 amps when I shorted the clip leads together. Of course this is for a slit second, since a prolonged short will open the internal circuit breaker.

Next, place one charger lead on your ground rod, and then momentarily touch the other lead to the bonding clamp first, and then to the lead wire. Of course, small sparks will fly as the 35 amps flow through the connection. This exercise will prove that the connection is electrically sound: if it can pass 35 amps DC, it can pass your RF with little attenuation. Should the need arise, the connection can safely pass lightning surges to ground.

To estimate the resistance of the connection, place a DC voltmeter across the connection under test. For example, place one of the voltmeter leads on the ground lead wire, and the other connection on the ground rod. Verify the meter connections are secure and then momentarily place the battery charger leads at the same location. Watch the voltmeter move up slightly as you pass about 35 amps thru the connection. If the connection is poor less current will flow, resulting in a poorer "short" to the battery charger. This will allow the measured voltage to rise, indicating higher resistance and more voltage drop at this connection.

I suggest that you set the voltmeter to a high-voltage range at first. This will avoid possible meter damage should the connection be open and the full 12, or more, volts be applied directly to the meter. Once you verify the connection is

Example	Measured volts	Calculated resistance
a	0.1	0.00285 ohm
b	0.17	0.0048 ohm
c	0.28	0.008 ohm
d	0.13	0.0037 ohm

Table 1: Measured Bonding Resistance

good, you can set your voltmeter to the lowest scale.

When doing my tower and ground system, I found very good repeatability in my readings and measurable variances in the different connections. I found all my connections, which have been in place for over 4 years, would handily pass 35 amps. In fact, I found I could quickly verify all connections simply by tapping one lead to each ground connection of my radial fan-out. By listening to the battery charger meter ping across the scale with the high current flow, I was assured that this connection was intact. Using this system, a 40-radial ground system can be checked in a matter of minutes.

For experimentation purposes, I measured the voltage across selected connections to see what resulted. Assume 35 ampere current flow (admittedly this value will be inaccurate, but I have no way to determine high currents at various loads). Given the measured voltage and assumed current, I used ohm's law to estimate the bond's resistance. **Table 1** shows sample readings.

This simple process will verify the connections are good. You can also identify good connections and better ones. I found several that looked robust and well made, yet they measured poorly. This summer, after my other projects are done, I will come back to that connection and see if I can improve it.

Figure 2 shows how I made the above measurements. I tested the resistance from the tower section to one of the radials. This tested the connections between the tower, a stainless steel anti-galvanizing sheet, the ground wire distribution block, and the wire itself. I show a digital VOM, but an analog meter might give better readings due to the short duration the charger will endure the short.

Figure 2: Making Bonding Measurements

Thanks to the help of many in the Chiburban Mobileers (especially Howie, W9NHM, SK), who operate exclusively on 160 meters, I became an advocate of a good ground radial system.

ER

The Story of my RME-99 Receiver

By Ken Seymour, KA7OSM
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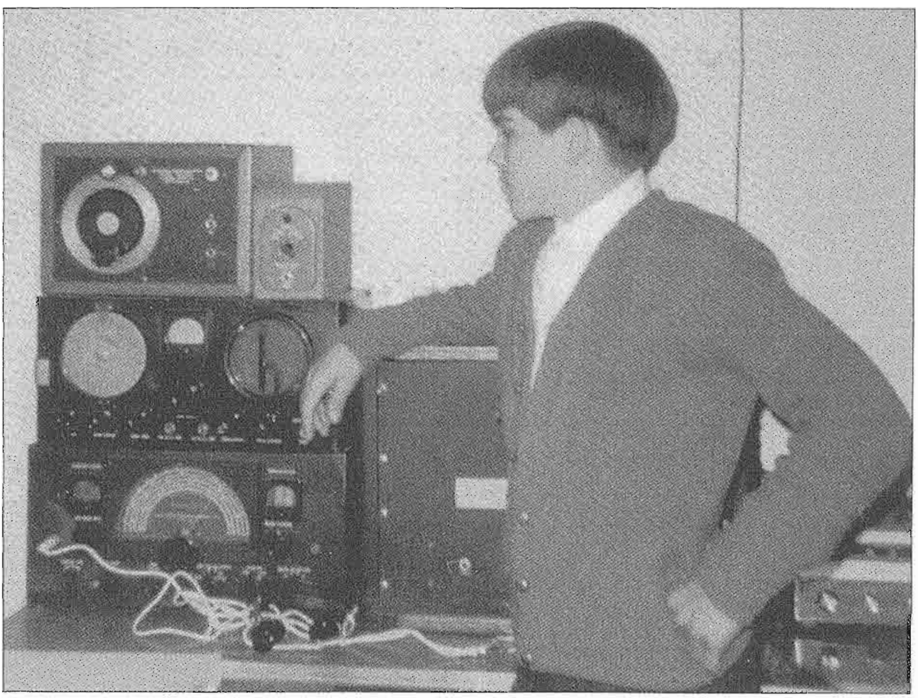
It was the summer of 1964 and I was almost eleven years old. My parents threw my brother and me into the back of their 1959 sky blue Plymouth wagon and we headed down I-5 from Portland to Chula Vista California to visit my grandparents. With Dean Martin and the Beach Boys playing on the radio, the three day trip was certainly memorable to me. At that time I was a budding radio enthusiast who just completed assembling a Graymark AM/SW radio kit that my father bought for me. I had radio in my blood and I was dangerous.

It was late afternoon on that hot summer day when we pulled into my grandparent's driveway. After completing the customary hugs and kisses I proceeded through the garage towards the house. At that point I was awe struck as I gazed upon my grandfather's workbench and saw the coolest radio that I had ever seen. I didn't know what it was at the time, but, there it was, a big black RME-99 with dials and knobs everywhere.

Back in 1964, I had no idea that this receiver originally belonged to my great-grandfather, Horatio Seymour (W6VZ) of Santa Monica, California. With the help of the ARRL, I was informed that his call first appeared on record in 1922 and was last entered into the call book in 1953. That is when my grandfather Horatio Jr. became the receiver's care-



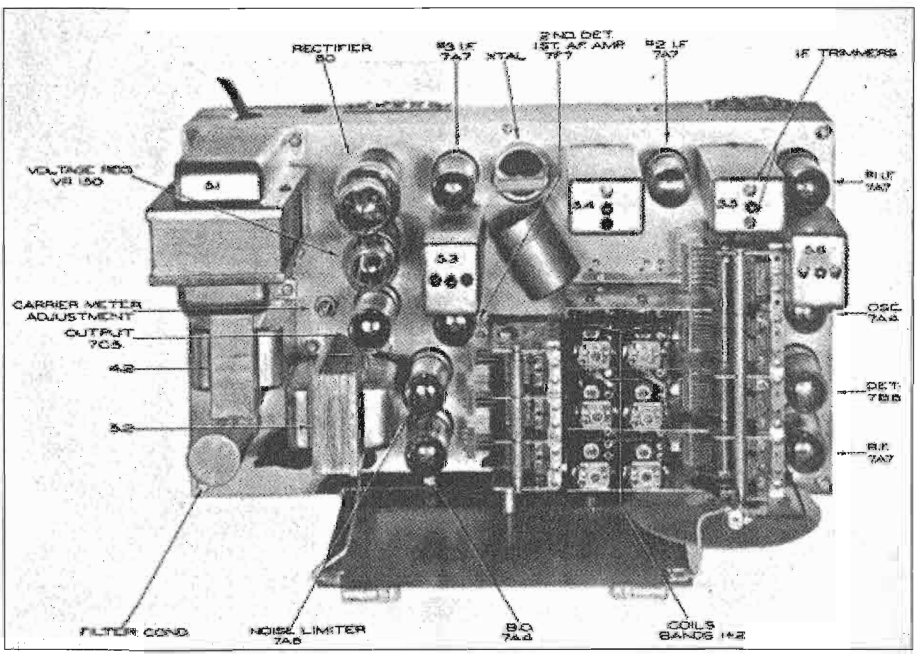
Ken Seymour is visiting his grandfather in 1966, and is looking at the RME-99 that would become his receiver years later.

taker. Strangely enough, I have no record of my grandfather being a ham. Yet, he was as much of a radio and ham buff as anyone. He retired as a Lt. Commander in the US Navy where he was a radioman and communications officer through WWII, and after. When he retired in 1966, my grandparents moved to Portland to be closer to us. This was the beginning of many years of grandpa being my Elmer where he helped shape me into the engineer and radio buff that I am today.

It's now forty-two years later and I have been the proud caretaker of this heirloom for twenty years and have been using it on the ham bands since 1993. The receiver ran flawlessly until recently a few months ago when I flipped the power switch on and was disappointed to see nothing happening. The set was dead. Suspecting the usual filter capacitor problems or a bad tube, I lugged the receiver into my workshop and meticulously removed the knobs and chassis from the cabinet. To my astonishment, I discovered that all of the components were still original. None of the filter or bypass capacitors had been replaced. My grandfather was known for always restoring and keeping his gear in immaculate shape. So, I wrongly assumed that this 1940 receiver would have at least gone through one set of filter capacitors in its history.

I opened up the original manual and began to read through all of technical material and studied the schematic intently. The schematic was small and hard to read. The tube pin numbers were not listed, nor were the component values. Components were referred to in the schematic with reference designators. This was OK, it just meant that I would have look up the components in the parts list and check a tube manual for tube pin outs.

The RME-99 was a well designed radio that was manufactured for a brief period from 1940 to 1941. The price was around $140, which competed head-on with the Hallicrafters SX-25 in the same price



This is a scan from Ryders service pages for the RME-99 showing part locations.

range. The 99 was actually the first RME model that incorporated the large calibrated bandspread dial for the amateur 80, 40, 20, and 10 meter bands. It preceded models 41, 43, and 45 which were more prevalent as they were manufactured from 1941 through 1948.

The 99 is finished slightly different in a black powder coat, using 12 tubes including a VR-150 for voltage regulation to the RF and IF amplifier's screen grids, and the set has the small main tuning dial located to the right of the large band spread dial. Whereas, the RME-45 is finished in gray, uses 9 tubes (no voltage regulation), and the main tuning dial is located underneath the band spread dial arch. RME added the voltage regulation tube back into the late production 45 and 45B's in 1947. From a design standpoint, these RME models were slightly different. They all used the "new" loktal tubes which most hams today now cringe about. The RME-41 was basically a model 43 without the crystal filter, having 9 tubes. Only the RME-99 had 3 stages of IF amplification in addition to the standard BFO and crystal filter circuitry.

As I began my systematic troubleshooting, I first did a visual inspection for burnt components. Seeing none, I then checked the tubes. They all tested fine. Next, I replaced the 3-in-one power supply electrolytic with individual 22 µF, 22 µF, and 10-µF @ 500 VDC capacitors. Follow up testing confirmed that one stage of this capacitor was shorted. I then replaced the 7C5 audio output cathode bypass capacitor with a 22 µF @ 50 VDC electrolytic. Finally, I went through the set and replaced all of the bypass and coupling capacitors. This was pretty straight forward with the exception of a few hard-to-get-to buried ones hiding under the high-frequency RF coil deck. After replacing the AC cord I powered the radio up on the Variac, watched the tube filaments glow, and I soon heard a broadcast station coming through the speaker. The set was back in working condition! I wrapped things up by checking the DC voltages, which were all within specification and proceed to check the alignment. After allowing the RME-99 to warm up for 30 minutes, I spent the next two hours meticulously going through alignment of the IF and RF stages noting that the set did not require much adjustment.

I reassembled the radio and one evening lugged it back to the shack and hooked it back up to the antenna and TR relay. I turned the lights off in the shack and as the band spread dial light lit the room up softly, I sat quietly for the next two hours listening to the RME-99 reminiscing of my days as a boy going to grandpa's house listening to the same radio in his basement 40 years earlier.

73 W6VZ and grandpa, DE KA7OSM CUL

Postscript:

After I wrote this article last year, my ham shack was broken into and the RME receiver and some of my other vintage AM equipment was stolen. Law enforcement was successful in recovering some equipment as it was being sold on eBay through a pawn shop. However, much of my equipment was probably dispersed all over and has yet to be recovered. Law enforcement has suspects (usual Meth ones) but the case is still open. In either case, I encourage all of you to put in security systems, take pictures, and record serial numbers (which I have) of all your equipment. Better yet, clamp the gear to your desk top to make it more difficult to remove if you feel it could be vulnerable. You never know what fate lies ahead. I have yet to recover my cherished RME-99. So, if anyone should come across one, my grandfather etched his SS# on the front and I added 2 red banana jacks on the back chassis to switch on/off the B+.

[Editor's note: I'd like the vintage radio community help Ken to recover his RME-99. Please examine all of them seen for sale *very* carefully.]

ER

The Restoration Corner

Please send in your short restoration topics so this column can run regularly!

Collins 75A-4 PTO End-Point Adjustment Tools

By Mike Hardie, VE7MMH
mike46@shaw.ca

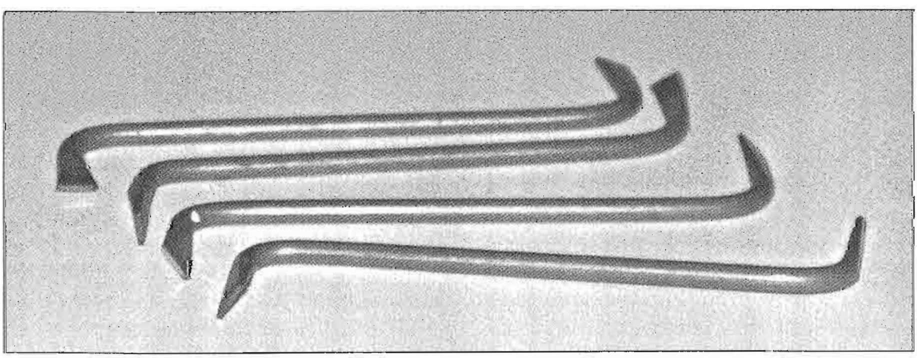
The PTO in my 75A-4 needed a large end-point adjustment and the manual described using a stiff piece of wire as a tool. An attempt with a straightened-out paper clip didn't work at all, something much stronger was required. The second attempt was done with a tool made from 1/8" welding rod, flattened on the end and bent through 90 degrees. This was successful but the available "throw," due to the space between the 6BA6 and the hexagonal shaped brace beside the adjustment, was only about 30 degrees. Several revolutions of the adjustment would likely be required. The next step was to make a set of these tools with the blade angle advancing about 30 degrees with each tool for a total of 180 degrees of rotation. With these tools and a frequency counter the adjustment was a snap.

Here's how to make the tools. Get a 1/8-inch mild steel oxyacetylene welding rod and cut 4 pieces, 4 inches long using a hacksaw with a fine blade. One at a time, put the ends about 5/8" into a vise and bend through 90 degrees, bending each end in the opposite direction. The pieces will now look like an "S" or "Z" shape. Next, flatten and taper the ends by hammering them into sort of a screwdriver shape, flatten each successive end about 30 degrees more in relation to the "shaft" so that the tools are a set that will complete a 180 degrees rotation in steps of about 30 degrees. The last step is to use a hand file to make the flattened ends more like real screwdriver ends.

Be very careful if you "cheat" and use a grinder for the last step. Depending on the angle to the grinding wheel, the bend in the shaft of the tool will cause the grinding wheel to "grab" the tool. This is scary, even with protective gear such as goggles and gloves. The hand file is safer and you'll get a better result.

Viola, you're in business.

If I were making another set I'd make three improvements. First, give the 90-



Custom-Made Wrenches for Adjusting the 75A-4 End-Point Leadscrew

degree bend a ½" radius so that the tool would work around the 6BA6 tube more easily. Second, add one more tool and make the successive blades in steps of approximately 22-1/2 degrees. Last, after filing, I would put heat-shrink tubing on the shaft of the tool. A couple times, I dropped a tool into the radio and waited for the sparks to fly. Thankfully they didn't.

Keep in mind the goal of the end point adjustment is to make the "electrical length" of the PTO equal to the "mechanical length" of the dial graduations. In other words, 1 Kc of PTO change should equal 1 Kc of dial change. After completing this, it is very likely the dial won't read correctly, so a corrective adjustment to the actual PTO range to bring the radio back on frequency will be required.

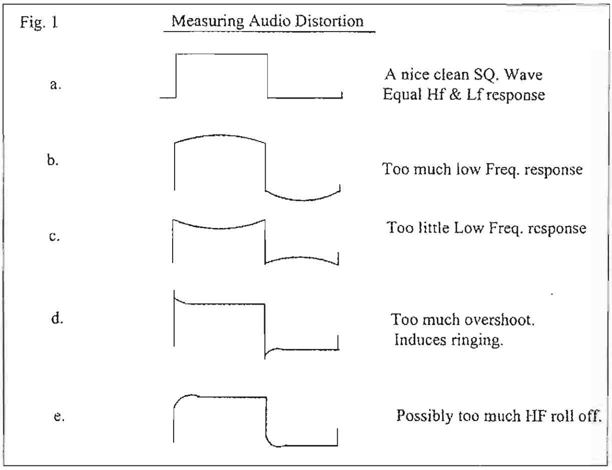
73, Mike, VE7MMH

Measuring Audio Distortion, Revisited

By Bob MacDonald, N2NIR

A good way of discovering and repairing distortion or verifying the effectiveness of a new design in an audio chain is to use a square wave. A reasonably low-frequency square-wave signal, say 800 to 1000 cycles, is capable of showing almost immediately where problems exist. The square wave contains the base frequency and many of its harmonics.

See **Figure 1**, above. The fast rise and fall of the leading and trailing edges show the ability of the audio chain to respond to high frequencies. The flatness of the center portion shows whether the lows are too enhanced or suppressed. High frequency overshoot can be easily seen, as can too much HF rolloff.



If your audio generator cannot generate square waves, your scope sometimes can. The calibrator produces a good square wave, usually 1.0 volt p-p. Simply set the horizontal sweep frequency to the frequency you want. For example, 800 Hz = .00125t, 1000 Hz = .001t. You can adjust this to provide a convent display. Some scopes have only a fixed frequency calibrator.

Here is a word of caution: The 1.0-volt p-p signal will probably be too large, and you can risk damaging the modulation transformer. A typical audio chain input has too much gain for such a large signal. Make sure the pot in the audio chain is at a minimum setting when you start. If necessary, put a variable resistor across the calibrator output and adjust for as low an input to the audio chain as needed to see a response. If you are testing a modulator, turn off the power, making *sure the power supply filter capacitors are completely discharged*, and disconnect the plate caps to isolate the modulation transformer from the test. If no plate caps are present, disconnect the modulation transformer output and put a load resistor equal to the RF plate load across the output winding. Again, use the lowest audio drive possible to complete the test.

Good Luck, Bob, N2NIR

Transformer Rebuilding Service

–Information courtesy of OJ Jenkins, KØOJ:

Gary Brown (WZ1M) offers hard-to-find transformer rewinding services that include power transformers for vintage equipment and power supply chokes.

Here is Gary's contact information:
TRS (Transformer Rewinding Service)
ATTN: Gary Brown
478 Forest Ave.
Orono, Maine 04473
Tel: 207-942-5745
email: xfrmrs@roadrunner.com
web site: http://members.tripod.com/tubes_tubes_tubes/transformerrewindingservice/

ART-13 Audio Modification

By Ben Booth, W4CT

Here is yet another article that I think will be of interest to ART-13 operators. This modification is non-intrusive and easily reversible – involving only the lifting of one wire from C205.

I have a couple of extra ART-13 speech amplifier chassis and so decided to do a little experimenting with them regarding their audio fidelity.

I was fortunate to have the proper female 12-pin socket in order to mate with the male 12-pin plug under the chassis, to which, and from which, everything flows, such as filament; B+; audio; drive to the 811s, and so forth.

I used an accurate sine-wave source of audio and applied it across the input of T201 (pins 9 and 10). Pin 9, 8 and 11 are tied together and go to the chassis. Pin 10 goes through R201 (220 ohms) to T201 primary input to the 12SJ7 first audio. All of my tests were done with the microphone toggle switch in the up position (dynamic microphone). There were no tests done with the toggle switch in the carbon mic position. The audio input was varied from 200 Hz to 7,000 Hz, and actually a little higher, and the waveform monitored on a Tektronix 7704 scope and listened to as well on a speaker load across the 811 output transformer, T202. The 12SJ7 is relatively easy to overdrive and this was carefully controlled and monitored.

Most apparent was the rather sharp reduction in amplitude with increase in frequency of the output measured across the output of T202 with a constant amplitude input.

I found that removing C205 (.001 µfd) eliminated this reduction in amplitude and did not introduce any distortion. C205 is connected from the first audio amplifier (12SJ7) plate to ground thus effectively bypassing higher audio frequencies.

While doing these tests I also disconnected C209 and C210, which are .01 µfd caps that serve as bypass caps from each 811 grid to ground. I expected to see a change in audio response, particularly at lower frequencies, but found they made no difference at all, so elected to remove the old black ones and replace them with .01 µfd Orange Drops.

Also, I thought that increasing the value of C204, the .006-µfd coupling capacitor between the 12SJ7 and 6V6 driver would help audio response, but it made no difference, so it was checked and left alone.

If a schematic is not available (or can't be found!) C205 can be found as follows: Turn the speech amplifier upside down with the mic toggle switch opening facing **away** from you. Find the three stacked, large-mica capacitors, underneath and to the right, and bolted to the side of the chassis nearest you. C205 is the capacitor on the top of the stack. Simply unsolder the ground wire on the left side of C205 and curl it up out of the way.

In operation of the ART-13 I use an amplified D104 and a scope to monitor the modulation waveform. This is highly recommended, as is a frequency counter to measure final output frequency of the transmitter. On the air reports have been most complimentary.

Enjoy! 73, Ben, W4CT

Using Modern HC-49 Crystals in FT-243 Holders

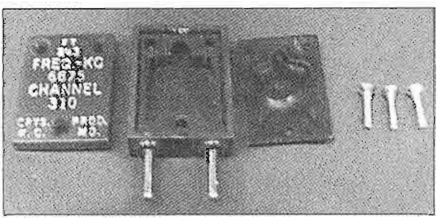
By Darron Sanchez, WA5TCZ

I was looking for a way to use HC-49 crystals in my boatanchor radios. A search on the Internet suggested putting the HC-49 crystals into empty FT-243 cases.

Picture #1 shows a FT-243 crystal.

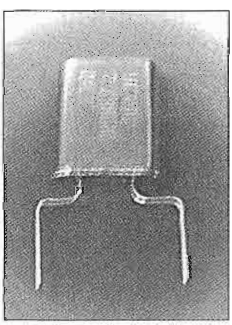
Picture #2 shows what parts to keep, all the other parts can be thrown away. The two square brass plates must be unsoldered from the two pins of the crystal holder; this is not shown in the picture.

Picture 1



Picture 2

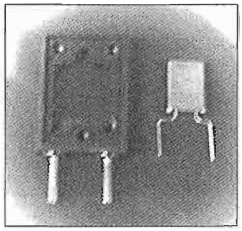
Picture #3 shows a HC-49 crystal and how to form the leads to fit inside of the FT-243 crystal case.



Picture 3

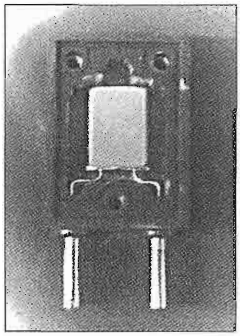
You might have to remove some of the inside of the case with a knife or Dremel tool to make the HC-49 crystal fit inside of the case.

Picture #4 shows what the FT-243 case and HC-49 crystal looks like at this point.



Picture 4

Picture #5 shows the HC-49 crystal mounted inside of the FT-243 case.



Picture 5

You must now solder the crystal wires to the pins on the FT-243 case.

Put the rubber piece and the crystal cover back on with the three screws and you are all done.

I have used these crystals in a Drake 2NT and a Heathkit DX-40 and had no problems.

A good source of these crystals at a reasonable price is:

Expanded Spectrum Systems
6807 Oakdale Dr.
Tampa, FL. 33610
813-620-0062
www.expandedspectrumsystems.com
ess@expandedspectrumsystems.com

This was a fun project and a good way to make up crystals that fit the old boat-anchor radios.

73, Darron, WA5TCZ

Stuck SX-28 Tuning Slugs

By Joel Ekstrom, W1UGX

Some models of the Hallicrafters SX-28 receiver use slotted and threaded powdered iron slugs to adjust the RF coil inductances. With time, these slugs often become stuck inside the coil form, and even a mild increase in screwdriver torque will cause the slug to partially crumble, putting one into "deep kimchee!"

I found that acetone, applied with a medicine dropper, would loosen the slugs enough to be easily turned for alignment purposes. Of course, the set has to be upside down to do this, but that was not too inconvenient. After the acetone evaporates, the slugs may be stuck again, but who cares-at least they won't move around!

More About Testing With Square Waves

By Ray Osterwald, NØDMS

As mentioned by Bob MacDonald earlier, an oscilloscope's square wave calibrator signal can provide a wealth of information about circuit distortion. If used with a properly-adjusted attenuator scope probe, additional expensive equipment is not needed for circuit testing.

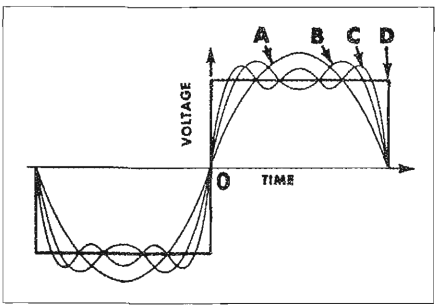


Figure 1

A square wave is made from a fundamental signal and many harmonic components. In **Figure 1**, "A" is a sine-wave fundamental signal, and is typically a 1-kHz signal on most oscilloscopes. "B" through "D" represent the odd-order harmonic frequencies. "B" is the sum of the fundamental and the 3rd harmonic, C is the sum of the fundamental plus the 3rd and 5th harmonic, etc. In theory, the number of harmonic components is infinite. The amplitude of the harmonics varies in inverse proportion to the harmonic frequencies, 1/3, 1/5, etc. The composite square wave seen on the scope screen is the sum of many harmonic frequencies, and all these frequencies can be applied simultaneously to a circuit under test.

When a square wave passes through a circuit, unless the circuit is perfect, some distortion will occur. Circuit reactances and component defects affect specific frequencies differently. That causes a departure from a true square wave.

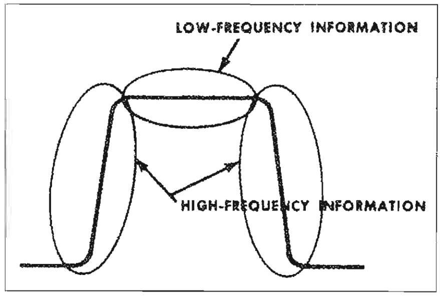


Figure 2

Figure 2 is a summary of where frequency-specific information is contained in a square-wave display. In square-wave testing, the *nature* of a circuit defect becomes obvious after you learn where to look. Other types of distortion testing (frequently expensive) merely show the *presence* of distortion.

If the low-frequency components (the fundamental and the first few harmonics) are not present in the proper amplitudes and phase relationships, the top part of the square wave will be distorted, forming the shape of a slope or a curve.

In **Figure 3**, the upper curve sags and falls in the top part, indicating that low-frequency components have leading phase angles and are attenuated. In the bottom curve, the upward bowing and rising in the top part is showing that low-frequency components have lagging phase angles and their amplitudes have increased.

High-frequency distortion shows up in the shape of the leading edge of the square wave. While the leading edge can

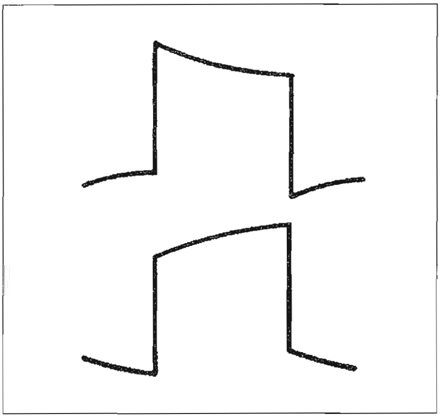


Figure 3

never be truly vertical, it can get darn close in good equipment. Its departure from vertical and what happens to the top corner can reveal much information about the nature of the high-frequency response.

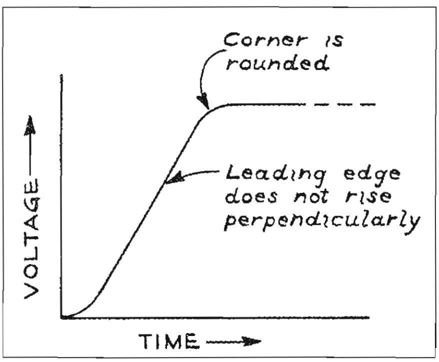


Figure 4

In **Figure 4**, circuit under test does not have good high-frequency response because the leading edge slopes away from a vertical line and the top corner is rounded. The rounding occurs because the high-frequency harmonics are not present in the output signal. Actually, some rounding is normal in average-grade consumer circuitry. If rounding is excessive, there is a problem with the circuit's high-frequency response.

In **Figure 5**, the circuit under test is producing spikes in the leading edge of the square wave. The diagrams show what is called "overshoot." The lower curve has a brief spike, while the upper spike lasts longer. Overshoot on the leading edge means that the amplitudes of the high-frequency components have been enhanced for some reason. Frequently, spikes occurring in early stages become greatly amplified and cause problems in output stages.

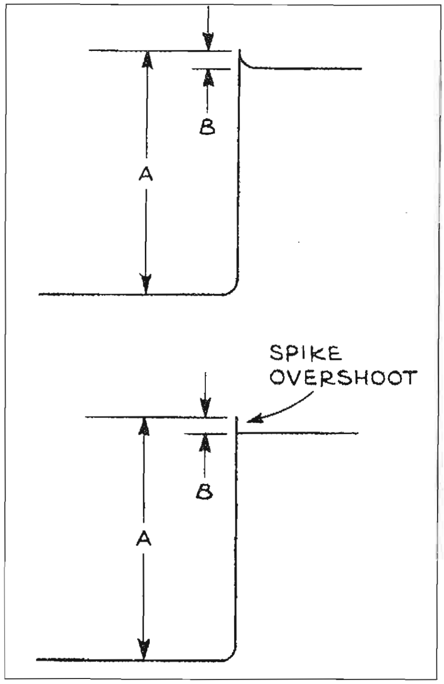


Figure 5

The physical causes of high-and-low frequency distortion can come from many sources, and a full discussion is beyond the scope of this brief discussion. Much audio distortion can be traced directly to disk-ceramic coupling capacitors. In my equipment, I always replace them with good quality, 600-volt Mylar capacitors.

(Illustrations from Chapter 2, "Square Wave Testing," Typical Oscilloscope Circuitry, Tektronix Inc., Beaverton, OR, 1961.

ER

Broadcast and Amateur Transmitter Audio Revisited, Part 3, Conclusion

By David Kuraner, K2DK
2526 Little River Rd.
Haymarket, Virginia 20169

Last month, we discussed phase inverters, audio driver requirements and impedances. We conclude the series with a discussion of cathode bypass capacitor issues and feedback.

Sometimes, positive feedback can be used in conjunction with negative feedback to achieve even greater benefits. We start this article with the complex issue of bypass capacitors.

To Bypass Or Not To Bypass? That Is The Question!

Often, in researching technical literature, one comes upon apparent inconsistencies which must be reconciled. The issue of cathode bias or feedback resistor bypassing is one such issue. Several authoritative and classic texts seem to be in conflict. Also, practice conflicts and seems to go both ways.

If you have a Class-AB stage, the ARRL handbooks claim that the cathode does need to be bypassed. Their rule of thumb is to have the product of the resistor in ohms and the capacitor in microfarads exceed 25,000. Many suggested audio modifications over the years include increasing the values of cathode bypass capacitors to really excessive values. On first glance, this appears to be either totally unnecessary or outright ridiculous.

A similar rule seems to apply for resistance-coupled, interstage circuitry. Often, we talk about "fattening up" the coupling capacitor for better low-frequency response. A typical plate load resistor in a 12AX7 speech amplifier is 470-k ohms. If the associated capacitor is .05 µF, the mathematical product is now close to that magic number.

The 6SJ7 pentode is often used as a push-pull driver in broadcast transmitters. The circuit uses a small amount of unbypassed cathode-resistance feedback in the driver (in what appears to be directly contradicting the ARRL Handbooks), and then system feedback from the modulator plate to the driver input. The Radio Handbook (William Orr, W6SAI), Gernsback Publications and the Audio Encyclopedia all present reasons and counter reasons.

After much research (and aspirin), the issue seems to boil down to: is the push-pull stage a voltage amplifier like the 6SJ7 pentode stage in the typical broadcast rig or is it like a power stage using beam-power tubes? For a voltage stage, the stage is using the cathode resistor for voltage feedback and need not, or should not, be bypassed. The voltage in the cathode appears as feedback to the stage's grid. A power stage, however, will loose power to the unbypassed resistor and therefore should be bypassed. This negates the audio feedback voltage from appearing between the cathode and ground.

In many instances, the power stage is push-pull and the bypass is absolutely essential. It is almost impossible to maintain perfect balance between the two tubes. According to the classic texts, if the tubes are perfectly balanced, the odd harmonics cancel and only the even harmonics remain. (The exact opposite of what we think we have been taught.) The phase relationships are such that the even harmonics create a negative feedback which tends to cancel in the output. (This is now more in keeping with the dogma we all learned about push-pull stages.) If the tubes are not matched, the odd harmonics are generated with positive feedback. The non-bypassed cathode resistor would apply unbalanced feedback, creating distortion. Again, I must emphasis we are discussing Class-AB1 amplifiers. Class AB2 or B draws grid current. If a cathode resistor existed, there would be a change in the grid bias voltage, and thus the operating point, over part of the wave cycle, creating distortion. If the grids draw current, a well-regulated bias supply is required.

The typical bypass capacitor in the cathode circuit is a low-voltage electrolytic. Normally, the value is somewhere between 20 µf and 100 µf. It seems that as the value increases, the power output of the push-pull stage can be increased with the intermodulation distortion remaining the same. (This is distortion from the mixing of two signals.) Often, values of 500 to 1000 µf are used. This does appear to be excessive, but the audio purist will insist on achieving absolute perfection.

One can accept that perhaps this large value is justified in a high-fidelity audio amplifier. But is it justified in a ham transmitter modulator considering that this is not found in broadcast transmitters? Another question is, should a voltage-driver or voltage-speech amplifier stage be bypassed and what is the appropriate value for that cathode bypass capacitor? This issue is like beauty. It's in the eye of the beholder. Or, in this case, the ear of the listener. If a cathode resistor provides degenerative feedback, why bypass it? And, why suggest ridiculously high values as a modification in a single-stage voltage amplifier? This is what I refer to as the diminishing-returns zone.

Feedback

It is well known that negative feedback can improve both frequency response and distortion produced in an amplifier. Little known is that sometimes positive feedback can also make an improvement when combined with negative feedback. Before discussing feedback circuits used in amateur and broadcast transmitters, lets discuss some theory.

Referring to **Figure 1**, we have a simple triode amplifier circuit with a cathode resistor. This cathode resistor is part of the tube's load, and as we saw with the single-tube phase splitter, a part of the tube's output will appear between the cathode and ground. For the moment, lets assume we are dealing with DC voltages only. The current which flows in the plate is the same in the cathode. The cathode resistor is also in the grid circuit, so any current within the cathode resistor produces a voltage which appears on the grid.

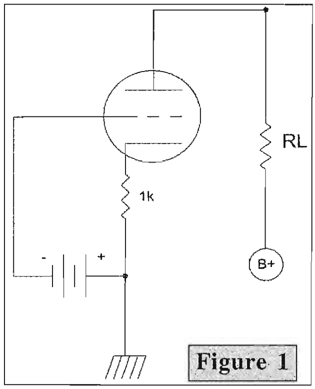


Figure 1

Assume that the value of this cathode resistor is 1000 ohms. Again, lets also assume for illustration that a positive 1-volt change at the grid causes an additional 1 volt to be developed across the cathode resistor. And, that volt appears at the grid as negative voltage with respect to the cathode. Such an amplifier would be of no practical use because the input voltage would be immediately cancelled and nothing would happen.

Now, if the circuit is such that only a portion of the input is cancelled, we have negative feedback which regulates the gain of the stage. The greater the output, the more the stage's gain is reduced. The principle is similar to AGC in a receiver, which is also a feedback control. Should the response of our amplifier change due to tube or component aging, the change is not as drastic as it would be otherwise because of the regulation from the feedback. An AGC circuit tends to reduce signal level variations, but is not intended to make them all one constant, consistent amplitude.

The above examples are with DC voltages, but lets extend this to AC and audio frequencies. If the circuit components favor one part of the audio spectrum over others, with greater gain by the amplifier, the feedback will have a leveling effect. Thus, the frequency response will be more, even than without the negative feedback. The same effect is true with distortion products generated by the circuit. They will tend to be cancelled as they are generated.

Please note that we are discussing a non-bypassed circuit. The bypassed cathode resistor would then be only used for DC grid bias if the AC component is not part of the voltage drop. And a reminder–cathode resistors are only used for Class A1 or AB1-stages. The moment the stage draws grid current by going positive, the bias will change on the grids because of the changing cathode current. The final audio stage of almost any vintage receiver, which drives a speaker, uses a cathode resistor bypassed by an electrolytic capacitor. And again, remember that the 6V6, 50C5, 6L6, etc. in audio service is operating Class A1.

Feedback can have a very significant effect on the amplifier's impedances. The mathematical equations are a bit beyond the scope of this article. **Figure 2** is another example of how to implement negative feedback within one stage. It's almost intuitive that there will be an effect on both the input and output of this stage with a feedback resistor (Rf) from the output plate to the plate of the preceding stage, which feeds the grid.

In the illustration of the broadcast transmitter audio section in ER #199, December 2005, the 5-Meg resistors from the modulator plates are being fed back to the input of the lower stages so its effect is minimized. This feedback can be eliminated, if necessary, should there be problems as previously suggested in one of the articles in the broadcast transmitter series.

Sometimes, in the design of amplifiers and feedback circuits, phase shifts have to be considered. Should the phase of the feedback, at some part of the audio spectrum, shift sufficiently to trigger positive

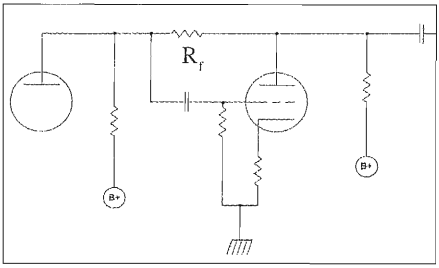


Figure 2: The feedback resistor (Rf) is connected between the two plate circuits. The impedances of these stages are lowered while the second stage is the one with the feedback loop.

feedback or distortion, special correction circuits are incorporated to prevent this. This often manifests as a low-frequency oscillation of several cycles per second, or oscillation way above the audible range. If the overall amplified feedback at any frequency approaches unity or greater, the circuit will not be stable and break into oscillation. Normally, this is not an issue with the audio circuits we deal with. However, the Johnson Ranger issue discussed in Part 1, ER #215, was included to draw attention to the fact that these low-value capacitors could be suppressing high-frequency instability in some circuits.

Positive Feedback

Positive feedback in an audio amplifier seems like an invitation for disaster. However, if controlled properly it does have some significant benefits. As more **negative** feedback used, the greater is the reduction in distortion and leveling of the audio spectrum. Let's say that we really want to force the issue and use 20 dB of **negative** feedback. This is quite a lot, and will reduce the gain of the amplifier significantly.

If one stage were to be designed with 6 dB of **positive** feedback, the overall reduction would be 14 dB, which is a bit more tolerable in terms of gain-reduction loss for the sake of distortion and spectrum response.

Think of a regenerative detector. The feedback can be varied up to and beyond

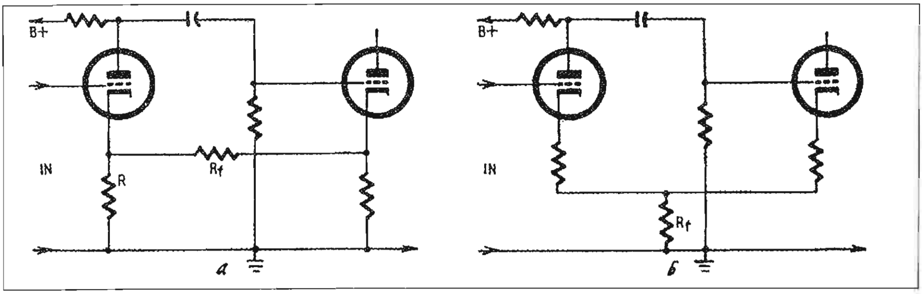
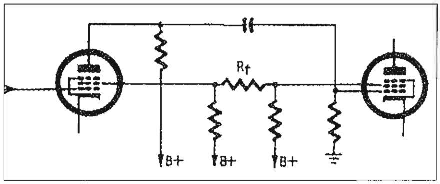


Figure 3: Above: Two simple circuits for applying positive feedback to an amplifier. Right: Another practical application of positive feedback can be utilized in pentode-tube circuits. Feedback from screen to screen will eliminate the need for the decoupling capacitor. Extremely high-gain input to the second stage should be avoided.[1]



the point of oscillation. We adjust it to the "sweet spot" at the point around oscillation. While we normally don't think in terms of dB of feedback in this instance, it is surely quite a large value. The 6 dB of positive feedback is nowhere near the sweet spot, but it does provide much greater amplification. Thus, both the signal and the distortion feedback are four times greater. When this higher distortion is fed back to the input, much more initial distortion is neutralized right at the start. So, an even-greater reduction of distortion is obtained over the rather aggressive 20 dB of feedback. The overall amplifier is only losing 14 dB. Systems using these techniques can be made to have only 0.5% distortion products, when normally, they would have about 0.8 to 1%. See **Figure 3**.[1] Do keep in mind that a typical AM broadcast transmitter often has around 2% distortion. This technique is the audiophile's ultimate pursuit of perfection.

In the illustrative schematics shown in this series, feedback circuits are used. Some will clearly show the feedback path from end to the beginning of the audio stages or some point close to the beginning. Others are not as obvious, since they are employing non-bypassed cathode resistors.

Conclusion

The considerations in designing low-distortion audio circuitry can be quite involved. The manner and extent to which one wishes to pursue the ultimate performance is entirely up to just how far you need, or wish, to go. When trying to bring vintage ham equipment audio performance up to broadcast standards, remember one thing. If you start out with an ugly duckling, unless it really is a swan, no amount of plastic surgery is going to make it one. And, beware of the diminishing-returns zone.

The typical vintage ham modulation transformer will not permit the rig to truly sound like you have the mod iron made by Electro Engineering (often found in many late-model BC transmitters). But, you can "fool" listeners with a job well done. Vast improvements can be achieved. And often, the perceived difference between a BC transmitter's audio and some of the modified amateur equipment is really hard to distinguish.

Reference:

1. Norman Crowhurst and George Cooper, Chapter 4, "Distortion," Hi Fidelity Circuit Design, Gernsback Library, Inc., 1956, 2nd printing 1957, pgs 48, 70, figures 402, 405.

ER

Speaking of Microphones

By D. S. "Jeep" Platt, K3HVG
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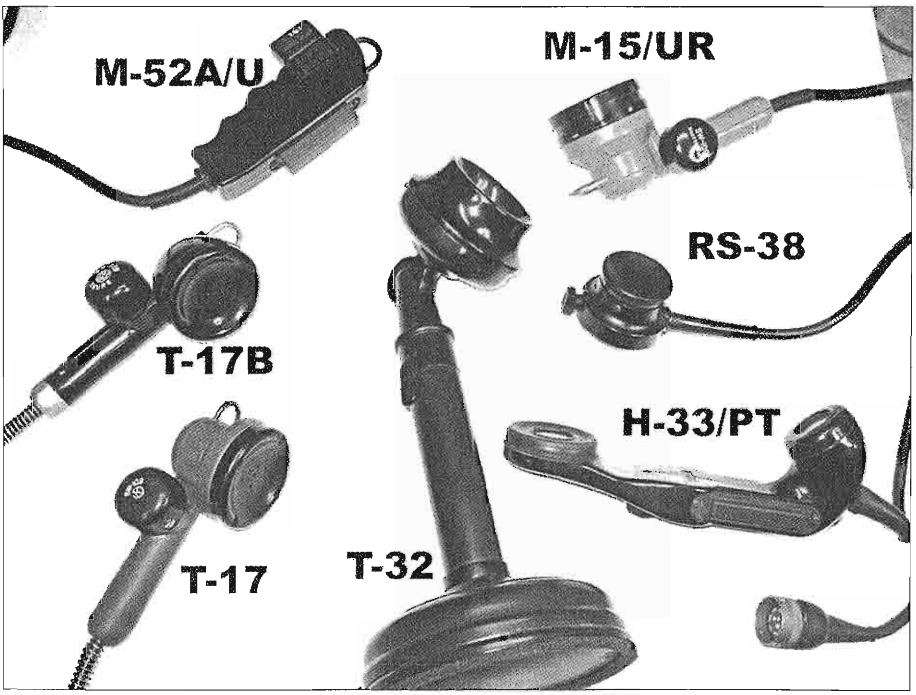
Probably, all of us use one sort of military issue carbon microphone or another with vintage military equipment. I'd like to present some information on the various types available and perhaps some insights in keeping these devices in operational condition. This article will address what I believe are some of the most popular carbon mics currently used on our military ground-based equipment and include some information I've been able to accumulate on them, to include a bit of contemporary information, too.

One of the earliest mics that appear to be commonly used is the T-32 candlestick mic. The T-32 uses a conventional low-impedance[1], single-button element similar to the common telephone F1 unit, although a much earlier design. The T-32 is actually a modification of a '20s or '30s desk telephone, sans receiver. What they did was chop off the movable hang-up fork—leaving a small thumb-lever—and use the existing off-hook linkage and switch contacts mounted in the base for the PTT. This mic can have outstanding output and sound quite good, assuming the element is still active. A more modern telephone element can be substituted if replacement is required.

Next on the list, and perhaps the most prolific of the era, is the venerable T-17. The T-17 is also a low-impedance, single-button carbon mic. Variations of the T-17 are lettered units up to and including the T-17D. The T-17 microphone, with its characteristic SW-109 PTT switch



(often erroneously cited as the model number) is a good microphone, when you find a working example. Many non-functioning T-17s can be resurrected with excellent results. But, I will have more on the T-17 later.

Of the same relative vintage as the T-17 is a Navy-designed mic, generally the nomenclature is a Type 9044 or NAF21364. Many of us know this round-shaped mic as the RS-38. The RS-38 series can still be seen in aircraft installations, often as a transistorized, carbon-compatible unit. I have found all too many of my vintage RS-38 type mics to be of very low output and of poor quality audio. Even the newer one in my Piper Cherokee was replaced. The RS-38 type mic can be overhauled.

Next in the series of mics is the M-15/UR. The M-15/UR is the noise-canceling replacement for the T-17-series mics. It looks about the same but has a characteristic extended snout that accommodates the noise-canceling ports. Like the T-17, the M-15/UR can be overhauled. Note, at this juncture, that all preceding microphones utilize the military standard, 3/8-inch, 3-circuit, PL-68 or PJ-068 plug.

Another vintage mic, albeit a bit more contemporary, is the M-52( ) hand mic. This mic is, in reality, a ground version of an aviation microphone, mounted on a PTT hand-grip. This mic utilizes the snap-in, replaceable, M-51/UR element. Similar to the M-51/UR element is the WWII T-45 lip mic. The T-45 may well be the direct predecessor to the M-51 mic element. The M-52( ) and its variants can be found with either the PL-68 or the newer U-77 connector plug. We'll discuss the U-77, below.

The last vintage carbon mic to be directly addressed is the H-33/PT. This unit is a handset, rather than simply a microphone. The H-33/PT was introduced about the time of the Korean conflict and was used with what's generally accepted as "Old Family" signal equipment. Unlike earlier military mics, the H-33/PT uses the combination transmitter and receiver audio plug, U-77. The U-77 is compatible with many foreign radio sets—by plan and design.

The H-33/PT can be an outstanding carbon mic if the element is in good condition and, if necessary, can be successfully rejuvenated.

The mics mentioned above in this article are by no means a complete list. There were a myriad of WWII and Korean conflict and later telephone-style handsets that are both usable and fully repairable, more often than not via direct replacement with modern telephone elements. It's for this reason I didn't mention them, in detail.

With new designs in military communications equipment in the late 1950s, audio requirements moved away from carbon microphones. The old carbon mic input circuit was replaced by those requiring a low impedance[2], dynamic microphone element. Dynamic elements are said to be of better audio quality and not as subject to some environmental extremes. About the time that the dynamic mic was introduced[3], en-masse, the audio "connectorization" of military ground-based communications equipment also changed. The "Old Family" U-77 was replaced by the smaller "New Family" U-223, and its variants. As a point of possible interest, to date, military and civil airborne equipment have generally maintained the carbon or carbon-compatible design for avionics equipment[4]. To accommodate the new dynamic microphone elements installed in flight helmets, hand mics, and combination headset/microphones, the military adopted carbon-conversion modules and adaptors such as the MX-1646, et al. The same conversion technique is still use in civil and military aviation. Yet another even more contemporary change in military ground-based equipment is the Army's armor and vehicle integrated audio system

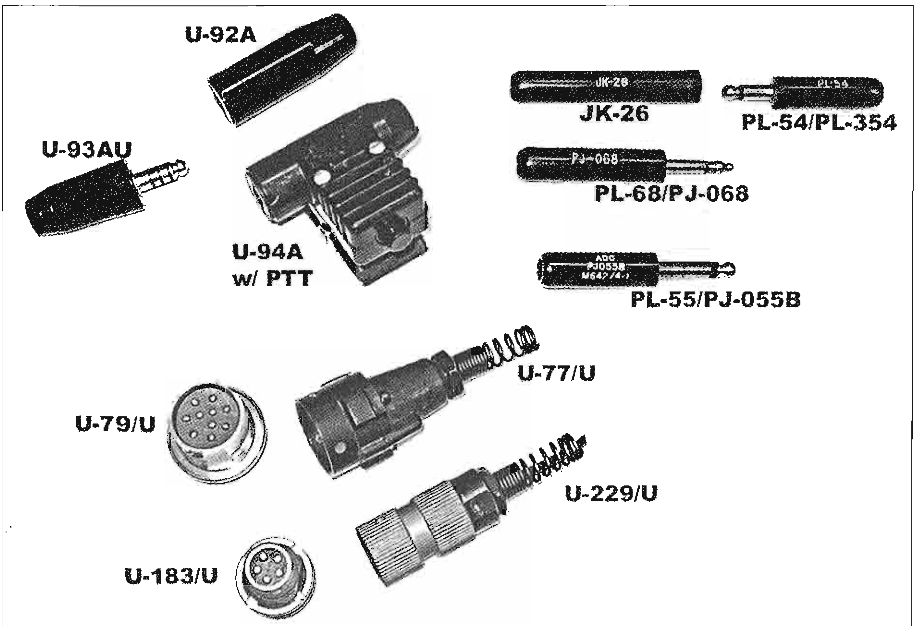
(VIC-1, LVCS, etc.). This system incorporates compatible dynamic mics, but "connectorization" is somewhat unique and is evolving. Discussion of this equipment is outside the scope of this article, beyond informing the reader that although the connectors appear to be standard "New Family," the individual pin assignment is not always identical, inasmuch as these systems accommodate both radio communications and the associated vehicle's onboard intercom system.

Regarding the care and feeding of vintage carbon mics, I offer the following observations and recommendations: While the old tried-and-true (?) method of beating the "bejesus" out of a carbon mic against wooden desk can sometimes produce short-term results, I recommend that attention be directed to the mic element, the bypass capacitor, and the PTT switch.

Beginning with the T-17s, the versions easiest to work on are the original, metal-case T-17 and the plastic T-17B. These mics can be successfully opened and repaired. The most difficult of the series is last of the litter, the plastic T-17D. While previous versions had a replaceable element, the T-17D does not. The T-17D element is integral to the front half of the mic itself. When disassembling the T-17D, the carbon granules will spill out as the element back cover is removed. There's no way to avoid this if the mic is to be repaired. I have tried to repack these elements but have had no success, whatever.

There are two methods of opening up a T-17-series microphone, depending on version. Earlier T-17s used a split-shell housing. Removal of the three screws on the back of the shell will reveal the rear of the microphone element. The bypass capacitor can be easily snipped out and replaced, if desired. I have yet to find a genuinely good capacitor in an old T-17!

If the mic in question is not of the split-shell type, the front of the mic can be opened up by carefully digging out the potting compound around the three mounting screws and then removing them. After cracking the case, there will



be sufficient service loop on the wires to be able to access the bypass capacitor. Some of the potting compound is said to be very tough, but I have always been able to dig the stuff out one way or another. Changing or removing an errant bypass capacitor is fairly easy to do and this alone may restore your mic to service!

To gain access to the contacts on the SW-109 switch, remove the two set screws on the side of the knob, remove the knob, and then the single screw holding the switch. You'll also have to loosen the mic cable to get enough slack to get to the contacts, however. If the capacitor and switch renewal don't complete the repair, the element is probably defective and there's more to be done.

Element replacement in T-17s is problematic, at best. T-17 elements, per se, are not available, to my knowledge. Although the selection of replacement elements is not manifold, what I have been able to successfully do is to either use the microphone element from an H-33/PT (at last check, still available from Fair Radio) or, better still, if you can find a good element from one of those clear plastic 1950s-vintage telephone operator's boom mics. Both of these elements can be successfully fitted to either a T-17 or a Navy RS-38-style microphone. Please note, however, that in most cases it will be necessary to route out a portion of plastic material from the front piece of the microphone to get the element sufficiently close to the voice holes and to allow closure of the case. This is particularly applicable to the T-17D and some RS-38s, where considerable material will need to be removed. The nice thing is, though, when you're done, it's all covered up inside the mic and externally, everything's original!

Have you ever seen a T-17 where someone has glued a telephone element to the front of a T-17 to get it going? I have, and although it certainly is functional, it looks positively hokey—something akin to a pig wearing a gas mask.

Repair of microphones utilizing a snap-in M-51-type element consists of finding either another similar hand mic that one can cannibalize or finding an old, defunct Air Force HS-33 type headset that has an M-51 boom-type mic assembly attached to it.

Overhaul of the H-33/PT is currently a simple matter of procuring a replacement element from Fair Radio. Simply unscrew the end caps and remove and replace the element. Again, if you can locate one, the telephone operator's mic element would be an excellent alternative.

Whichever mic you're working on, remember to clean and burnish the PTT switch contacts. I've seen some otherwise nice mics with severely corroded switches.

Regarding mic cord replacement, if the cord is still in good condition for the major portion of its length, one can simply cut back and reattach. Beware, however, that some vintage mic cords use tinsel wire and you'll have a job reattaching (read: soldering) it. If you take the time, the small cupped crimp lugs used on most of these mics can be cleaned, reformed and used to reattach the cord. If the wire is of the tinsel type, each lug will have a spur that punches through the insulation, making contact. If you have reclaimed the crimp lug, you don't have to remove the insulation or tin the wire, simply carefully re-crimp it. If the cord is a total loss, I have found that light-duty, 3-conductor computer power cords make a very good sources of mic cable. Pick one that is very pliable and that does not have the extra cloth weave, shield, nor drain wire installed, just the three conductors. Although not as flexible as the original, they look "stock" and work well. Also, I have on occasion bought 3-conductor military microphone extension cables to repair several mics. I also buy similar 2-conductor cables to make up headset extension cords. Fair Radio usually has something that will work. Beware, though, although NIB, these cables must be inspected. Finally, military mics have either a wrapped string or a circular brass clamp used to secure the cord to the PL-68 plug. As with the lugs, these brass clamps can be reclaimed for use. Some H-33/PTs came with a heavy-duty, coiled cord. Replacement can be accomplished using one of the computer-type power cords that, in this case, does have the additional drain wire. These cords are not coiled, however. If a coiled cord is considered a requirement, Belden offers several coiled communications cords. Use the U-77 pin connections outline in the Appendix.

Regarding the use of the more modern military dynamic mics, be advised they can be used on most amateur equipment via a miniature matching transformer. Earlier USAF boom mics were low impedance so an 8 ohm to high (5k) or medium (500 ohms) audio would suffice. Later USAF and Army aircraft and Army ground-based boom mics and handsets were of a higher impedance and a nominal 75 to 100-ohm input impedance is required. This includes H-250-series handsets, the Integrated Vehicle Communications headsets, etc. You'll just need to do a bit of testing and buzz out the wiring. Also, unless it's absolutely necessary, use the existing connectors on the equipment! The type of wire used on some of these units can be very difficult to work with and to solder. The required mating connectors are available from numerous sources, including Fair Radio[5] and the Wm. Perry Company[6].

Footnotes:

1. Nominal 50 ohms
2. Nominal 4-10 ohms, later units are 75-100 ohms.
3. Note that dynamic mics were available and could have been used on WWII and later equipment such as the BC-614 speech amplifier (BC-610), the T-47/ART-13 transmitter, and much Army PA equipment.
4. Military fixed-and rotary-wing aircraft and most civil rotary-wing aircraft utilize the NATO U-92-series, 4-pin connectors (see appendix).
5. Fair Radio Sales, 2395 St. Johns Rd., Lima, Ohio, 419-223-2196
6. Wm. Perry Co., 702(R) Beechwood Rd., Louisville, KY, 502-893-9220

Appendix:

Pin Assignments of various military audio connectors (see photo p.24):

- PL-55, PJ-055B 2-circuit, ¼", headphone plug: Tip = Audio Out (white or green), Sleeve = Ground, (black).
- PL-54, PJ054B, PL-354, 2-circuit, ¼" headphone short-cord plug (same as PL-55, above)
- JK-26 2-circuit headphone extension cord (mates with PL-54) (same as PL-55)
- PL-68, PJ-068 3-circuit, 3/8", microphone plug, referred to as a Drake or Collins plug (sic), Tip: PTT (white or green), Ring: Mic (red), Sleeve: Ground (black)
- U-77( ) Unified audio connector (Old Family)

A Audio Out
B Ground
C Mic
E Ground
F PTT
H Ground
K Carrier Control

- U-223( ) Unified audio connector (New Family)

A Ground
B Audio Out
C PTT
D Mic
E N.C. (or special purpose)

- U-92( ) Unified Audio Connector, NATO, Avionic (also referred to as a helicopter plug)
- U-92 Plug, U-93 Jack

Tip 1: Mic Hi
Ring 1, 2: Phones Hi
Ring 2, 3: Mic Lo
Sleeve 4: Phones Lo

ER

The CX Switch

By Breckinridge S. Smith, K4CHE
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Dover, Delaware 19901

"Click, Click, Click." I sat at the kitchen table and slowly rotated the shaft of one of several switches that I had purchased at the local hamfest. Finally, my wife came and peered over my shoulder and asked, "What is that?"

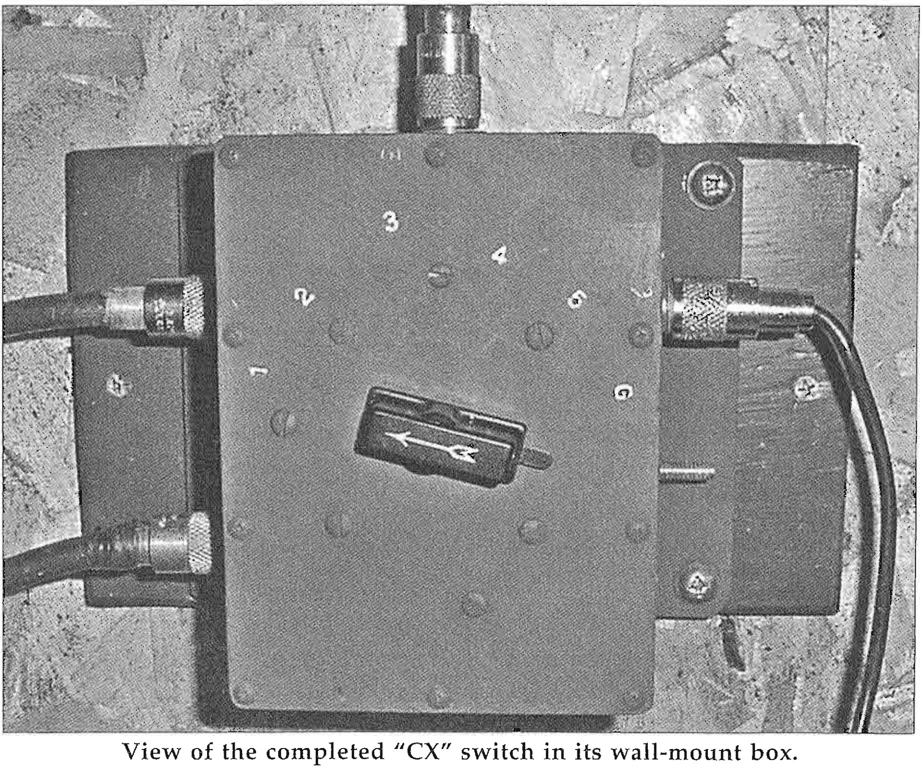
"It's a switch from a BC-375."

She immediately responded with "You had a BC-375 when we were stationed at Travis AFB. You have a lot of switches."

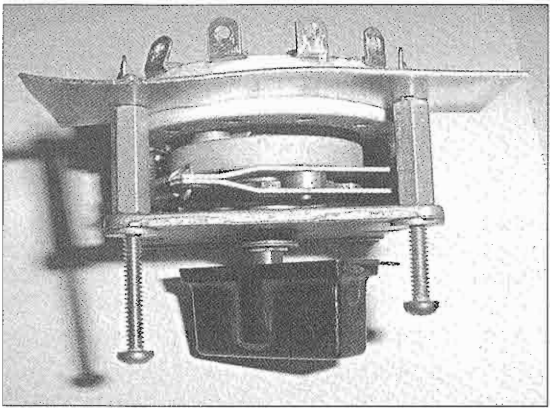
I love my wife, she remembers everything.

I looked at the switch and admired the rugged no-nonsense construction, a construction process that took place in another place and another time. Like the old timer said, "They just don't make 'em like that anymore."

I had plans for the three BC-375 switches that I had purchased at the hamfest; they were going to become "CX Contest" switches. During the last CX (Classic Exchange) contest I noted that several of the stations, especially K2TOP, had the ability to switch rigs and antennas rapidly in order to increase the total contact scores while in QSO with a single station. The K2TOP crew simply told the station they were working to stand by while they switched rigs. This operational technique prompted me to decide to construct several coax switches for use



View of the completed "CX" switch in its wall-mount box.



The BC-375 Switch As It Was Received

in different strategic areas of the shack and include them in my repertoire of tricks for the next contest.

There are several coax switches on the market and the B&W switch in the hexagon box is famous but I have never liked the overall construction and the ceramic wafer switch mounted inside the lightweight aluminum box was frail. The outside of the hexagon shaped box is the ground and common ground point for all the SO-239s and the impedance "bump" is rather long from one connector to the other. There are other coax switches that have die-cast interiors in an attempt to reduce the impedance bump by having "channels" molded into the case to approximate the 50 coax shield while the center conductor makes it way from the SO-239 on its outside to the selector switch contacts on the inside of the case and then back to the selected SO-239 on the outside of the case.

After examining several types of surplus switches for my CX contest switcher, I was attracted to the robust construction of the BC-375 switch and decided to incorporate it into several coax switch projects. Besides, when the BC-375 switch is mounted to a solid plate it really makes a nice "kerchunking" sound when you change positions, you hear and feel the switch when you change positions and the spring loaded detent locks solidly into place. The BC-375 switch is not shaft mounted with a single nut but is secured into place with four 6-32 bolts utilizing the threaded holes on the front of the switch, no nuts are needed. Once bolted in place the BC-375 switch stays in position and will not drift.

I used two metal standoffs to mount a section of small brass stock to the switch to provide a "common ground point" near the switch taps. See **Figure 2**. The brass plate gives a common bonding point for all of the selected coax shields and reduces the "bump" or insertion mismatch. Teflon coax RG-142 with a solid inner conductor wire was used for each coax assembly and each SO-239 has a chassis shield attached. I found that by binding the coax and SO-239 shield connections with some bare #26 bus wire that it would strengthen the connection and make it easier to solder. See **Figure 1**. Sol-

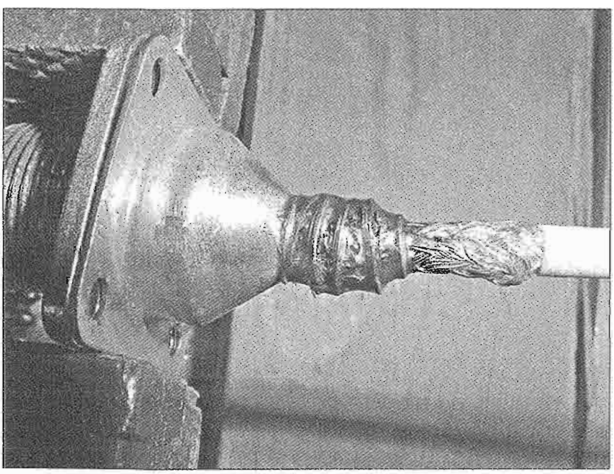


Figure 1

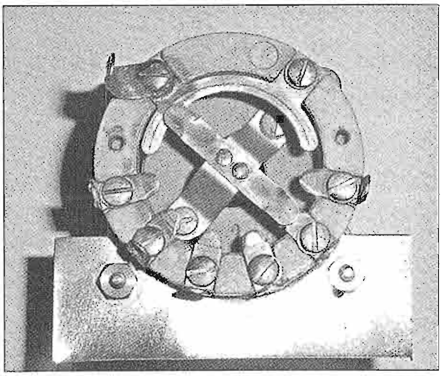
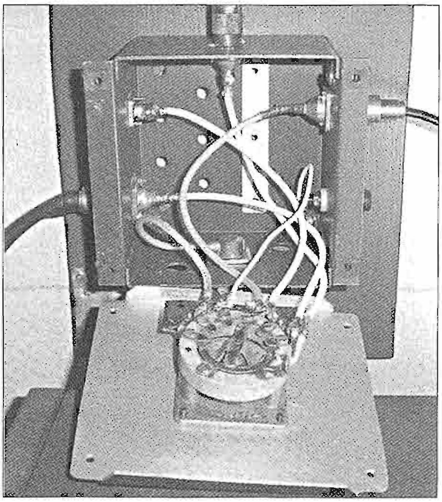


Figure 2

dering the shields to the brass plate was easy using my trusty Weller 150-watt iron. Final touches to the switch panel including numbering the positions by using metal stamps and filling in with white correction liquid. See **Figure 3**.

The switches passed RF testing of 500 watts without any overheating and I could not tell any difference when the CX switch was in or out of the line using an analyzer. When constructing your switch consider reserving one of the tap positions for a ground for your antenna input.

Why use Teflon RG-58 coax? It's simple. The Teflon coax will not self destruct when you are soldering the shield, etc. Where do you obtain Teflon coax? At



Inside View of the Completed Switch Cabinet

the hamfest of course, and it usually goes for about a buck a foot, or you can purchase it from a wire supplier for about $2.25 to $3.00 per foot. When shopping at a hamfest for the cable be sure that it is Teflon. There is a lot of double-shielded commercial coax out there that looks like Teflon. Anyway, try the Teflon coax, you will like it.

The switches are available NOS now from Fair Radio for $3.95 each and the BC-375 knob is included. You can even get ten switches for $32.00. The switches are listed on the Fair Radio web site as the 6-position Tap Switch for the BC-375 and are assigned a stock number of 3Z9605. The SO-239 connectors and connector shields are available from any supplier. Brass or copper plate stock is available at your hobby store.

Happy switching, and I hope to will see you in the next CX contest.

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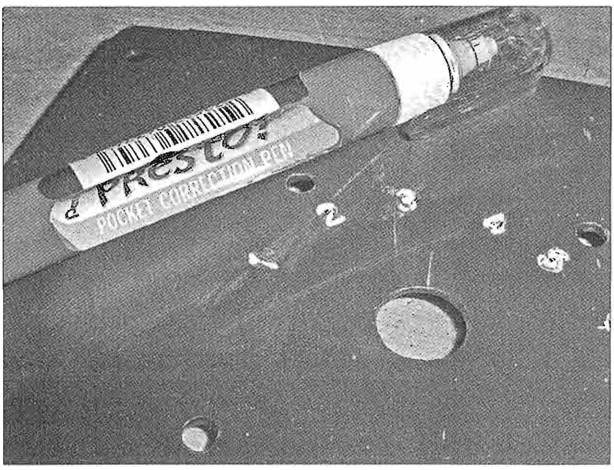

Figure 3

Milestones in the History of Amateur Radio

The Radio Act of 1912 Ordains Amateur Licensing, Part 2

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Implementation of the Radio Act of 1912

Congress delegated administration of the Radio Act of 1912 to the Secretary of Commerce and Labor, who in turn, assigned it to his Commissioner of Navigation, on the grounds that the welfare of maritime activity figured prominently in the provisions of the Act. The Commissioner immediately established a Radio Service Division in the Bureau of Navigation.

Congress intended the Act as a malleable set of guidelines to be interpreted and implemented as new circumstances evolved. It set forth nineteen brief regulations in only a few pages. Consequently, the staff of the Radio Service promptly announced administrative processes and criteria for acquiring licenses. Proclamations were published irregularly in successive bulletins entitled "Regulations Governing Radio Communication". The first bulletin appeared September 28, 1912, two and one-half months before the Act became effective. The second bulletin was issued July 1, 1913, and the third July 27, 1914. I draw extensively from the contents of these three bulletins for the discussion below.

To augment the "regulation" bulletins, the Radio Service began January 15, 1915 to publish, also irregularly, "Radio Service Bulletins", which contained lists of newly licensed stations (except "general" amateur) and, importantly, amendments to the Act. My discussion below also draws on Service Bulletin #3.

The first "Radio Regulations" bulletin, September 28, 1912, announced that the Bureau of Navigation would be establishing nine administrative districts "for the purpose of enforcing through radio inspectors the conditions of the Act of 1912 and the International Convention". The Bureau, guided apparently by its naval mindset, chose to locate a radio inspector in the Customs House of each of the following ports: (1) Boston, (2) New York, (3) Baltimore, (4) Savannah, (6) San Francisco, (7) Seattle, (8) Cleveland, and (9) Chicago. Violations of the Act were to be reported by Radio Inspectors to the Collectors of Customs; prosecutions would accord with navigational laws. Violators could be convicted of misdemeanors and punished by fines not exceeding five hundred dollars and forfeiture of apparatus used unlawfully.

Examinations for operator licenses were to be held mainly at Navy yards, district customhouses, and the Bureau of Standards, Washington, D.C. An application for an examination was to be obtained from a Commandant of a Navy yard, a Radio Inspector, or the Director of the Bureau of Standards. Every applicant who successfully passed an examination was required to take "the oath for the preservation of the secrecy of messages" before his or her license would become effective.

Grades of Operator Licenses

The Radio Act of 1912 declared that every person within the jurisdiction of the United States must be licensed by the Secretary of Commerce and Labor. As noted earlier, operators of military and certain government stations, such as those for time signals and compass alignments, were exempted. The Radio Service in the Bureau of Navigation, which was delegated responsibility for working out the details, thus set forth in the bulletin of September 28, 1912, three grades of operator license—commercial, technical, and amateur.

A commercial operator's license could be one of five distinct grades, which ranged from "first" to "temporary." For example, a first-grade applicant was required to transmit and receive the Continental Morse code at not less than 20 words per minute and to demonstrate a thorough knowledge of the functions of radio apparatus, the provisions of international radio regulations, the Radio Act of 1912, and the use and care of such power-supply needs as batteries. The commercial first-grade license qualified an individual to operate any class of station. On the other hand, requirements could be waived for a temporary permit, which would allow an applicant to operate a station only during an emergency relative to a given occasion.

A technical operator's license would be issued for either experimental or instructional purposes only to holders of commercial first-grade licenses. The licensee was free, while carrying out tests, to use any amount of power on any wavelength at hours least likely to interfere with commercial, government, or distress signals.

The Licensing of Amateur Operators

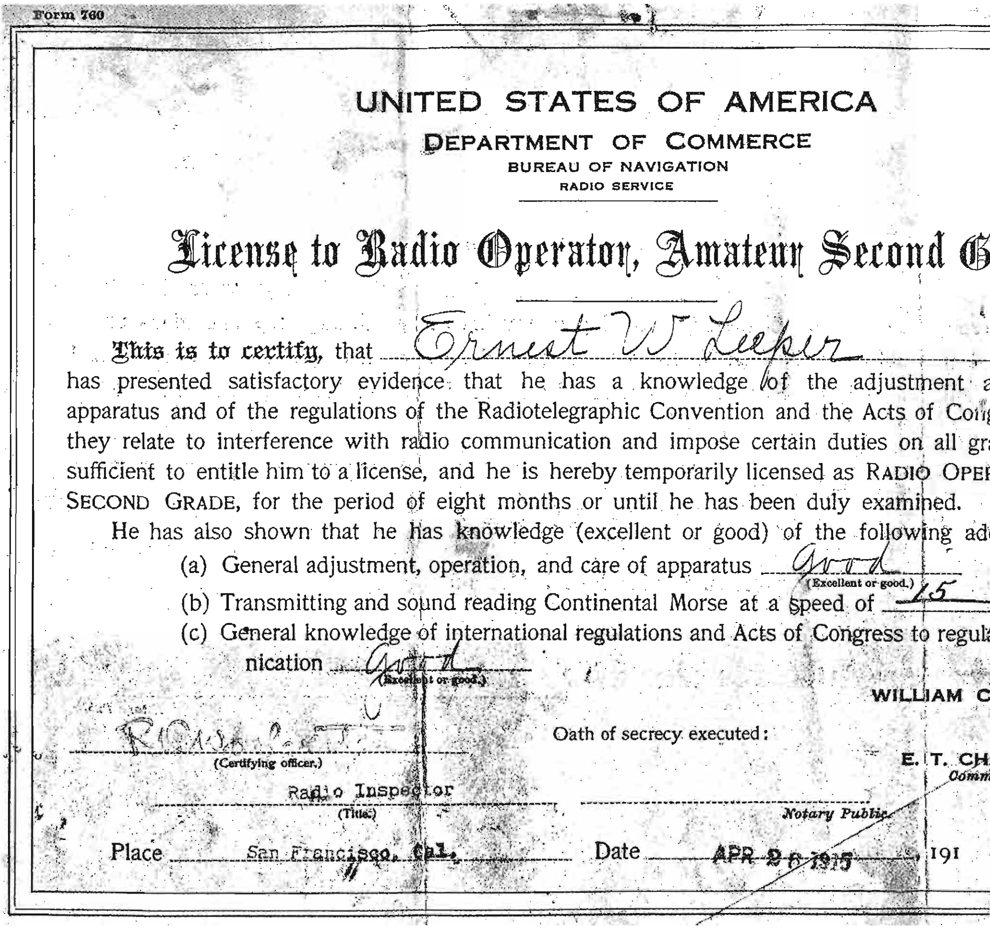
The first bulletin, September 28, 1912, acknowledged explicitly the existence of amateur radio operators. The government, for the first time, offered a rationale for licensing amateurs, but its acceptance of amateurs fell short of an enthusiastic, heartfelt endorsement: "The Department [of Commerce] recognizes that radio communication offers a wholesome form of instructive recreation for amateurs. At the same time its use for this purpose must observe strictly the rights of others to the uninterrupted use of apparatus for important public and commercial purposes. The Department will not knowingly issue a license to an amateur who does not recognize and will not obey this principle".

The Bureau of Navigation (i.e., the Department of Commerce) chose to issue "first" and "second" grades of "general" amateur licenses. Whether applicants were obligated to take and pass a carefully supervised examination determined which grade of amateur license they would be issued.

Applicants who resided near an office of a radio inspector were required to take the examination for a general "first-grade" amateur license. The examination would cover three areas: (1) sufficient knowledge of the adjustment and operation of proposed station apparatus; (2) knowledge of the regulations of the International Convention and the Act of 1912, and (3) ability—as assessed by an examining officer—to transmit and receive signals in Continental Morse code. Importantly, perhaps to relieve the anxiety of nervous applicants, the bulletin of September 28, 1912, stated that "no specific speed rate will be prescribed".

The Radio Service, in 1912, literally "bent over backwards" to accommodate applicants for the first-grade operator license. A Radio Inspector, for example, was authorized to issue a "temporary" first-grade license to an applicant who probably could report for testing at a Customs House, but instead, stated that it would be inconvenient to make the trip. An applicant issued a "temporary" license would be informed that he or she would be examined eventually "on one of his inspection trips". The applicant was expected to be fully prepared to pass the first-grade examination should the inspector show up on his or her doorstep; for otherwise, operator privileges would be cancelled on the spot.

The criteria for the general, "second-grade" operator license were the same as for the general, first-grade license—except that no one actually had to take and pass an examination! The second-grade license was available to a prospective amateur when two conditions were met: when travel for an applicant to a Custom House was implausible or when travel by a Radio Inspector to the applicant's location was similarly doubtful. Applicants



Form 760

UNITED STATES OF AMERICA
DEPARTMENT OF COMMERCE
BUREAU OF NAVIGATION
RADIO SERVICE

License to Radio Operator, Amateur Second G

This is to certify, that Ernest W Leeper
has presented satisfactory evidence that he has a knowledge of the adjustment a
apparatus and of the regulations of the Radiotelegraphic Convention and the Acts of Con
they relate to interference with radio communication and impose certain duties on all gr
sufficient to entitle him to a license, and he is hereby temporarily licensed as RADIO OPE
SECOND GRADE, for the period of eight months or until he has been duly examined.

He has also shown that he has knowledge (excellent or good) of the following ad

(a) General adjustment, operation, and care of apparatus Good (Excellent or good.)

(b) Transmitting and sound reading Continental Morse at a speed of 15

(c) General knowledge of international regulations and Acts of Congress to regul nication Good (Excellent or good.)

WILLIAM C

(Certifying officer.)

Radio Inspector (Title.)

Oath of secrecy executed:

E. T. CH Comm

Notary Public.

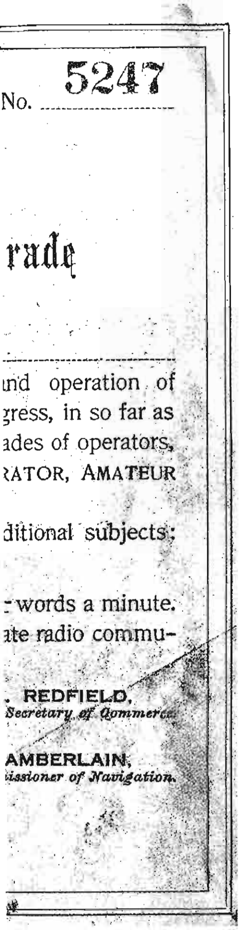
Place San Francisco, Cal. Date APR 26 1915, 191

Figure 2: Ernest Leeper's second-grade amateur license, April 26, 1

were required in writing to convince the Radio Inspector that they were as qualified for an operator license as the amateurs who had taken and passed the first-grade examination.

The second edition of the "Regulations", July 1, 1913, reemphasized the caveat that no license would be issued to an amateur who failed to recognize the importance of never interfering with public and commercial services. Significantly, for the first time, it imposed a mandatory code test upon amateurs taking the first-grade examination, e.g., "The applicant must be able to transmit and receive in Continental Morse, at a speed sufficient to enable him to recognize distress calls or the official keep-out signals. A speed of at least five words per minute (five letters to the word) must be attained". The code requirement was not revised again until a fourth bulletin, the first published following WWI (August 15, 1919), which stated: "A speed of at least 10 words per minute (five letters to the word) must be attained".

The Radio Service Division deliberately beclouded the distinction between first and second-grade licenses in the July 1, 1913, edition. For example, aspiring amateurs were informed that the second-grade license would be issued only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"where an applicant can not be examined or until he can be examined". The two clauses exemplify a confused message. Nonetheless, most second-grade licensees probably interpreted them to mean that a radio inspector might somehow, someday knock on their doors. The threat was obvious. The second-grade amateur had better be as prepared as the "temporary" first-grade amateur for a possible examination. Whether the policy was ever implemented is doubtful.

The third, July 27, 1914, bulletin identified both the procedures by which the examination for the general, first-grade license would be conducted and outlined its content, e.g.:

The code test would run for 15 minutes. It would be divided into three segments of five minutes each at speeds of 20, 12, and 5 words per minute, for the commercial first-grade, commercial second-grade, and amateur first-grade license, respectively. To qualify, commercial-first applicants had to receive the code at all three speeds; amateur applicants had to wait through ten minutes of high speed code for the five-word component. The test would consist of messages with call letters and preambles, conventional signals, abbreviations, and odd phrases. "Simple, connected reading matter" would be omitted. Whenever possible, the test would be conducted using either an omnigraph or another automatic instrument. Applicants would be given credit for the maximum speed that they could attain.

The "practical and theoretical" examination consisted of "seven comprehensive questions" under the following headings and values:

Points, Maximum Value:

a). Experience, 20 points
b). Diagram of receiving and transmitting apparatus, 10 points
c). Knowledge of transmitting apparatus, 20 points
d). Knowledge of receiving apparatus, 20 points
e). Knowledge of operation and care of storage batteries, 10 points
f). Knowledge of motors and generators, 10 points
g). Knowledge of international regulations governing radio communication and the United States radio laws and regulations, 10 points

The experiences of applicants (question "a") would be evaluated from personal statements and from "satisfactory letters or references submitted". Applicants who were unable to attain a passing mark on the code test and those who passed the code test but failed to attain a passing mark on the written test (sixty-five percent) were sent home. Re-examination was not permitted again within three months.

Classes of Station Licenses

The Radio Service Division of the Bureau of Navigation, in its bulletin of September 28, 1912, divided station licenses into either "ship" or "land." The "ship" category included various sizes of maritime steamers, such as ocean and Great Lakes passenger and cargo ships. The "land" category encompassed eight classes: public-service coastal and inland stations open to general business between land and ships constituted the first class. Limited commercial stations licensed for a specific, private service and disallowed from transmitting or accepting messages from other classes of station comprised the second. Experimental and technical and training schools made up the third and fourth. "General," "special," and "restricted" amateur stations constituted the fifth through the seventh classes. Special, high-powered stations that were necessary for transmitting signals exceptional distances, e.g., for transatlantic, transpacific, or transequatorial communication, represented the eighth class.

The Licensing of Amateur Stations

The following regulation (Section 4, fifteenth regulation of the Radio Act of 1912) has always been interpreted as applicable to amateur stations: "No private or commercial station not engaged in the transaction of bona fide commercial business by radio communication or in experimentation in connection with the development and manufacture of radio apparatus for commercial purposes shall use a transmitting wave length exceeding two hundred meters, or a transformer input exceeding one kilowatt, except by special authority of the Secretary of Commerce and Labor" (see also DeSoto, 1936).

The bulletin of September 28, 1912, specified that applicants for amateur station licenses who lived within five nautical miles of a navy or military station were restricted additionally to a transformer input not exceeding one-half kilowatt. These applicants were informed that they would be issued "restricted" amateur licenses.

The bulletin of September 28, 1912, also indicated that "special" amateur stations may be licensed to operate on longer wavelengths and with higher power inputs. Applicants were required to possess two years of experience in radio communications. They were expected to indicate precisely how they would utilize the special privileges. What benefits to radio science would ensue? Any hint of activity associated with "individual amusement" would assure denial.

Starting with the second bulletin, July 1, 1913, the regulations prescribed that station licenses issued to persons holding "temporary" first-grade operator licenses and to persons holding second-grade operator licenses would carry the designation "provisional." If, upon inspection, a station was found to be in compliance, the word "provisional" would be struck out and the date of inspection and signature of the examiner would be inserted at the bottom of the license. If the station was found not to be in compliance, the station license would be cancelled. Compliance signified that the application indicated the precise location of the station (State, county, city, or town, street, and number) and, in respect to equipment, had specified exactly (1) transmitter power (transformer) input, (2) antenna type, height, horizontal length, number of wires in the vertical part and number of wires in the horizontal part, (3) normal sending and receiving wave length was 200 meters, (4) authorization to use any other wave lengths, not exceeding 200 meters, and finally (5) proof if the station had been in operation prior to August 13, 1912.

The Bulletin of July 27, 1914, reported that general (first-grade and second-grade) and restricted amateur-station licenses would be issued directly by radio inspectors. "Special" station licenses would be handled by the Commissioner of the Bureau of Navigation.

Earlier, amateurs were informed in the bulletin of September 28, 1912, that "to prepare, print, distribute and fill out the licenses for apparatus throughout the country will require some time" and that they must be patient. The bottleneck was exacerbated because all ship and land station licenses were to be processed and numbered consecutively; also the call letters of amateur station licenses were to be prefaced by the number of the radio district in which they were located. However, amateurs who had stations on the air prior to passage of the act and who applied for a station license before November or December, 1912 were granted a grace period so that they could continue operating without a license after the act became effective, RENEWAL

DEPARTMENT OF COMMERCE

BUREAU OF NAVIGATION

RADIO SERVICE

Pursuant to the act to regulate radio communication, approved August 13, 1912,

ERNEST W. LEEPER, *a citizen of the State of* CALIFORNIA, *having applied therefor, is hereby granted by the Secretary of Commerce, for a period of* ONE *year , on and subject to the restrictions and conditions hereinafter stated and revocable for cause by him, this License to use or operate the apparatus for radio communication (identified in the Schedule hereinafter) for the purpose of transmitting private radiograms or signals, notwithstanding the effect thereof extends beyond the jurisdiction of the State or Territory in which the said station is located: Provided, That no interference other than may result under the restrictions contained in this License shall be caused with the radio communication of stations of the Government of the United States or licensed stations.*

2. The use or operation of apparatus for radio communication pursuant to this License shall be subject also to the articles and regulations established by the International Radiotelegraphic Convention, ratified by the Senate of the United States and caused to be made public by the President, and shall be subject also to such regulations as may be established from time to time by authority of subsequent acts and treaties of the United States.

3. The apparatus shall at all times while in use and operation be in charge of a person or persons licensed for that purpose by the Secretary of Commerce, and the operator of the apparatus shall not wilfully or maliciously interfere with any other radio communication.

4. The station shall give absolute priority to signals or radiograms relating to ships in distress; shall cease all sending on hearing a distress signal; and shall refrain from sending until all the signals and radiograms relating thereto are completed.

5. The station shall use the minimum amount of energy necessary to carry out any communication desired, and the transformer input shall not exceed one ~~one-half~~ *kilowatt.**

6. The station shall not use a transmitting wave length exceeding 200 meters.

7. The station shall not use a transmitter during the first 15 minutes of each hour, local standard time, whenever the Secretary of Commerce by notice in writing shall require it to observe a division of the time, pursuant to the Twelfth Regulation of the act of August 13, 1912.

8. The President of the United States in time of war or public peril or disaster is authorized by law to close the station and cause the removal therefrom of all radio apparatus, or may authorize the use or control of the station or apparatus by any department of the Government upon just compensation to the owners.

9. The Secretary of Commerce and Collectors of Customs or other officers of the Government authorized by him may at all reasonable times enter upon the station for the purpose of inspecting and may inspect any apparatus for radio communic ion of such station and the operation and operators of such apparatus.

10. The apparatus shall not be altered or modified in respect of any of the ticulars mentioned in the following Schedule except with the approval of a radi spector, or other duly authorized officer of the Government.

* Strike out "one" if the station be within 5 nautical miles of a naval or military station; otherwise strike out '

Figure 3: Front side of provisional amateur station license of Ernest Leeper, 6IZ.

e.g., "where application has been made for a license and the Department has not been able to act, through lack of time, steps toward imposing penalties of course will not be taken". Applicants for amateur station licenses learned also that those who state that they have read both the proceedings of the International Radiotelegraphic Convention and the Radio Act of 1912 would receive "attention before those who have not".

Ernest Leeper's 1915 Successful Attainment of a General, Second-Grade Operator's License and a Provisional Station License

Travel to the nearest site where amateur general, first-grade examinations were conducted was often both arduous and expensive. Many aspiring amateurs, therefore, sought instead to obtain second-grade operator and provisional station licenses. Consider the instance of Ernest W. Leeper, an eighteen-year-old lad who coveted the amateur licenses. He was living in San Bernardino, California, in 1915, when he applied in writing to the radio inspector in San Francisco—about 500 miles away. He succeeded in convincing the radio inspector that he was qualified for a general amateur operator license; moreover, he also persuaded him that his station would comply with all legal requirements.

Figures 2 and 3 denote the licenses that the radio inspector issued to Leeper. Figure 2 shows his general, second-grade amateur operator's license, number 5247. A statement on the license certifies that he had "presented satisfactory evidence" of knowledge of radio apparatus and regulations; furthermore, he is rated good on adjustment, operation, and care of apparatus, knowledge of regulations, and code at 15 words a minute. None of the regulatory bulletins from 1912 to 1919 indicated the periods during which licenses would be valid. Leeper's general second-grade license is issued for an eight month period "or until he has been duly examined". Fortunately, his second-grade license could be renewed any number of times.

Leeper's station license document shows that it is general and provisional, since his station had not yet been inspected. Importantly, the front side listed ten specific regulations that young Leeper must swear to honor as the custodian of an amateur station (Figure 3). The regulations are particularly informative in that some are still applicable, while others are no longer relevant. The second half of rule #5 was changed, in 1990, from a rule based on power input to one based on power output.

The back side (not shown) of the station license identified Leeper's new call letters as "6IZ." It states that he was permitted to operate a 1,000 watt spark transmitter, which probably had a maximum range of 150—300 miles. Although Figure 2 reveals that his operator's license extended for eight months. Figure 3 shows that his station license was valid for one year. The discrepancy is puzzling.

Although Ernest W. Leeper's certificates are representative of those that were issued to pre-WWI amateurs and inform us about his competencies in amateur radio at age 18, we know next to nothing about his subsequent life as either an amateur or an adult. A review of Callbooks, from 1920 to 1950, substantiates that he failed to renew his licenses following WWI. However, an Internet search indicates that his professional career consisted of teaching Industrial Arts at Garfield High School in Los Angeles. Doubtless he retired in the 1960s.

American Radio Relay League (ARRL) Impacts Implementation of the Radio Act of 1912

At the April 6, 1914, meeting of the Radio Club of Hartford, Hiram Percy Maxim offered a conception of an organization of amateurs nationwide that might facilitate coast to coast message relaying. Club members agreed to sponsor the new organization. Application blanks were distributed, and hundreds of amateurs were soon "appointed" as


No. 159 1915

THE AMERICAN RADIO RELAY LEAGUE, Inc.

STATION APPOINTMENT

This Certifies that Radio Station located at 648 Fourth Ave., San Bernardino, Calif. and under the control of E. N. Leeper who holds United States Radio License No. 5247 for Amateur 1st Grade operator, is until further notice and subject to the rules and regulations of the American Radio Relay League, hereby appointed AN OFFICIAL RELAY STATION. This appointment expires December 31st, 1915 unless officially cancelled.

THE AMERICAN RADIO RELAY LEAGUE, Inc.

Clarence D. Tuska Secretary. Hiram Percy Maxim President.

Figure 4: 1915 ARRL certificate that shows Ernest Leeper's appointment as an official relay station.

relay stations. Many of their transmitters had limited range, which diminished message-handling efficiency. Thus, late in 1914, Maxim conferred with the Commissioner of Navigation to promote the idea of issuing special amateur station licenses for operation on 425 meters solely for the purpose of relaying bona fide messages (DeSoto, 1936, p. 41).

Accordingly, the third "Radio Service Bulletin" (1915, p. 9) set forth the following proclamation: "The attention of all concerned is invited to the Laws and Regulations, edition of July 27, 1914. . . . The Bureau is satisfied that the American Radio Relay League is organized with a view to complying with the Laws and Regulations in all particulars, and radio inspectors in submitting their recommendations to the Department as to the issue of special amateur station licenses will give due consideration to an indorsement [sic] on an application by the proper officers of the league. If all the requirements . . . are complied with, the Bureau will approve a limited number of special amateur inland station licenses for members of the league, authorizing the use of a wave length of 425 meters".

Tensions soon developed over goals and administrative activities between members of the Hartford club and proponents of the ARRL, which led in February, 1915 to the separation of the two organizations. Shortly thereafter Maxim and his colleague, Clarence D. Tuska, incorporated the ARRL to establish its legal status (DeSoto, 1936). Significantly, since the Commissioner had delegated partial licensing control of amateur special licenses to the ARRL, Maxim and Tuska, believed that veto power had accrued to the fledgling ARRL. And to enhance its status, they restricted the special license to amateurs who had passed tests at the very highest standards. Indeed, whereas the bulletin of

July 27, 1914, stated amateurs who held amateur second-grade licenses were eligible for the special license, Maxim and Tuska limited the privilege to holders of first-grade commercial licenses: "As is well known among most amateurs by this time, we have secured the co-operation of the Government to the extent that where it seems desirable for the purpose of relay work, a Special License will be granted by the Bureau of Navigation, provided that the applicant holds a First-Grade Commercial License, and provided he is favorably recommended by the League. This does not mean that everybody can secure a Special License. Distinctly the reverse is the case. No Special Licenses are issued except where it is very plain that the interests of the American Radio Relay League require it" ("Special Licenses," 1915, p.7).

Maxim and Tuska proceeded apace to issue new, detailed application blanks for amateur candidates who sought to become either general or special relay stations (see "Application Blank," 1915). The new application emphasized prominently that the ARRL was "Incorporated"—perhaps to provide an aura of legitimacy for the new organization.

Ernest W. Leeper, 6IZ, applied for a "station appointment" to become an official ARRL relay station shortly after he was issued a provisional station license. **Figure 4** shows, over the signatures of Clarence D. Tuska, secretary, and Hiram Percy Maxim, president, that the ARRL issued to him certificate #159. The certificate references his operator license, #5247, but it cites mistakenly that he had attained an amateur first-grade license. The certificate is stamped with a newly created ARRL official seal, which also calls attention to the 1915 incorporation of the organization. Leeper's appointment was set to expire December 31, 1915; the brief time span suggests that Maxim and Tuska intended to send word to station appointees that if they deviated from ARRL standards their roles as official relay stations would be brief.[2]

Epilogue

The status of amateur radio in society was very fragile in 1912. The foregoing discussion of the Radio Act of 1912 discloses that the then prevailing cultural outlook towards amateur radio was institutionalized officially as superfluous "recreational" activity; amateur operators and their stations were licensed partly for classification purposes and primarily to extract from them pledges to ensure that they wholly refrained from interfering with all other radio services. The fledgling ARRL, early on, convinced both bureaucrats and society-at-large that amateurs were both poised and available to expedite private communications among citizens. The "recreational" disgrace that initially saddled amateur radio thus began to dissipate slowly. Nonetheless, as the analyses of the Radio Act of 1912 clearly reveal, the policies of the government of the United States regarding the licensing of amateurs have been from the start, and probably always will be, ever-changing. Who knows what guidelines will dominate in 2012?

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Footnotes:

I am grateful particularly to Ms. Natalie Dane Richdale who provided the January, 1913 picture of her father, Joseph Dane, Jr., who is shown operating a low-power spark transmitter (Figure 1). This outstanding picture wowed members of an audience at the 2006 meeting of the Antique Wireless Association, and I hope that ER readers find it equally captivating. I am grateful, too, to Bill Holly, K1BH. Bill and I spent several hours together scrutinizing his pre-1910 radio parts catalogues in order to identify the components in Dane's amateur station.

I am indebted particularly, too, both to Larry Tinkler (K6LXT), who surprised me at an auction in Southern California when he handed me an envelope with copies of Ernest W. Leeper's amateur licenses and to Steve Flyte (K7SF) who possessed the original copies of the exceptionally uncommon artifacts. Steve Flyte graciously forwarded them to Editor Ray Osterwald (NØDMS) so that he could reproduce them for relatively clear illustrations in Electric Radio (Figures 2 to 4).

Above all, I owe a debt of gratitude to Jack Roubie (K2JDD), a volunteer member of the crew of the AWA Electronic Communications Museum and to Ed Gable (K2MP), Museum Curator. Whereas the Radio Act of 1912 is readily available, it is really a brief proclamation full of lofty phrases. It was intended to be interpreted, amended, and administered by the Department of Commerce and Labor, which accordingly, issued successive editions of "Regulations Governing Radio Communication". These early bulletins may be buried somewhere in the archives of the FCC. Who knows! The one place in the world where they are archived and available for study is the AWA museum. My visit to the museum at the 2006 annual meeting, unfortunately, was necessarily brief, and I left without all the data that I needed. Consequently, over a period of several weeks Jack (K2JDD) answered patiently my requests for Xerox copies of pages from the bulletins. I am thus pleased to thank Jack Roubie for his assistance in the preparation of this paper.

2. For a review (1921—1994) of later developments in amateur radio licensing, see Friedman, N. D. (1995). 83 Years OF U.S. Amateur Licensing. In W.B. Fizette (Ed.), The A. W. A. Review, vol. 9, 225-251. Bloomfield, N. Y.: The Antique Wireless Association.

ER

Product Review: National RF Digital Frequency Display for Vintage Radio Equipment

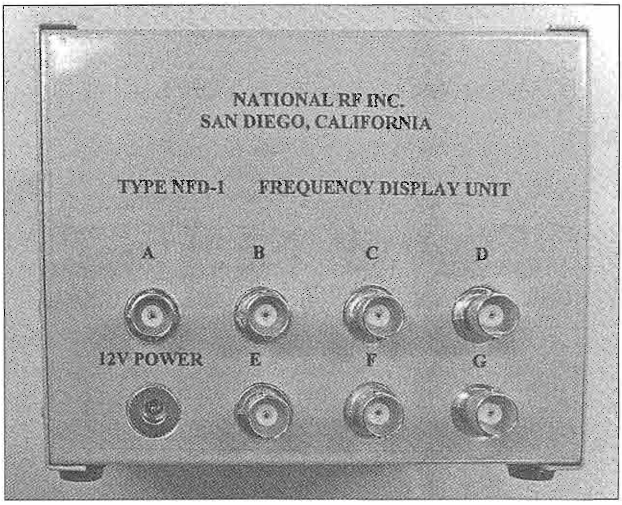
Forty-five years ago, it took me 8 months to save $50 for my first good receiver, the Hallicrafters S-20R that is pictured below. After talking someone into giving me a ride to Pat's Used Electronics store in Denver, Colorado, to pick it up, I soon learned that I'd need to save for a mail-order Knightkit 100-kc crystal calibrator so I could find my way around the bands. In all these years, I have heard many interesting things, probably some that were not supposed to be heard! I still use the S-20R, but I don't have to depend on counting the crystal marker signals to figure out where I'm at any more. In 2007, we have digital frequency counter accessories that make using equipment with analog dials much more enjoyable.

National RF has released a versatile frequency display for vintage equipment, the model NFD-1. It is so simple to use that I had it connected, programmed, and working with the S-20R in 15 minutes.

The NFD-1 works by counting the local oscillator frequency in the equipment it's connected to, and changing that number to represent the incoming RF frequency. The object of the user-programming steps is to let the box know what the incoming frequency is.

It doesn't come pre-programmed for specific equipment, but programming steps are very easy to follow. The 6-page instruction sheet that is packed with the counter is complete and easy to understand. The NFD-1 counter requires a

The National RF type NFD-1 digital frequency display is indicating where the Hallicrafters S-20R local oscillator is tuned.



NFD-1 rear-cabinet view showing the 7 input connectors and the jack for the 12-volt power supply.

wall-mount power supply, which is also provided. The internal processor holds programming in memory while the power is off.

The NFD-1 is designed to be permanently connected with up to 7 receivers. Or, one input can be configured to count a transmitter frequency. On the rear of the unit is an array of 7 BNC connectors, which correspond to positions "A" through "G" on the front-panel selector switch. There are 5 programmable memory positions available, and if you use all 7 inputs, two of them will need to share common memory channels. This is not a problem because vintage equipment uses common oscillator frequencies and offsets.

The NFD-1 has high sensitivity and high input impedance. In the S-20R, the lead between the HF oscillator tube and the tuning condenser is exposed above the chassis. I connected the counter to the S-20R with a 10-cent clip lead and a Pomona BNC adapter. I also got it to count by simply dangling the clip lead near the oscillator tuning condenser.

If you use the counter with well-shielded receivers, such as the Hammarlund SP-600 series, you will need to dig into the HF oscillator circuit and bring out a connection that is coupled via a small-value capacitor or a pickup coil. Some other WWII-era equipment is equally well shielded and extra work will be required to get the counter going. The instruction sheet has a lot of useful suggestions about how to connect into your equipment without loading the oscillator too much.

The NFD-1 has several nice features in addition to the basic counting functions. For example, one of the front-panel buttons, when depressed, will read out the actual frequency being counted. (This function doesn't change the programming.) The 100-Hertz digit can be disabled so that it reads out to the nearest 1 kHz. You may need this option if used with an oscillator having excessive drift. Another nice option is the capability to program a "blanking" function, where the display will go blank after a period of time and come back on when the tuned frequency changes. The NFD-1 is designed to work with a wide variety of equipment. The basic counter functions between 160 kHz and 55 MHz. Between 160 kHz and 10 MHz, it has a minimum sensitivity of –36 dBm. In its programming, an IF offset from zero to 54.85 MHz can be set in memory, and the count can be inverted in case the VFO might tune lower in frequency as the received frequency increases, such as with Collins, Drake, and other equipment. The NFD-1 is completely assembled and ready to go. It is housed in an attractively finished 5x4x3 minibox with protective rubber feet on the bottom. National RF's contact information is on page 64.

(Review by NØDMS)

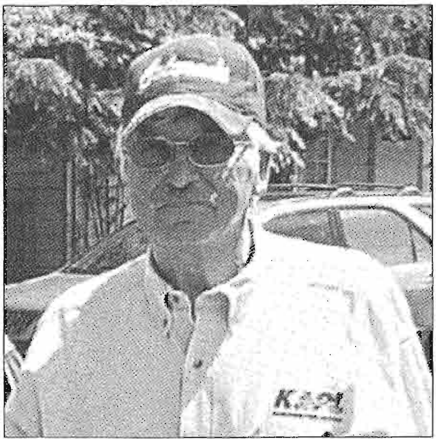
ER

PHOTOS

Editor's Note: "Thank You" to everyone who has recently sent in photos, and please keep them coming so I can run the Photo column on a regular basis!

Colorado Rod Raids Again

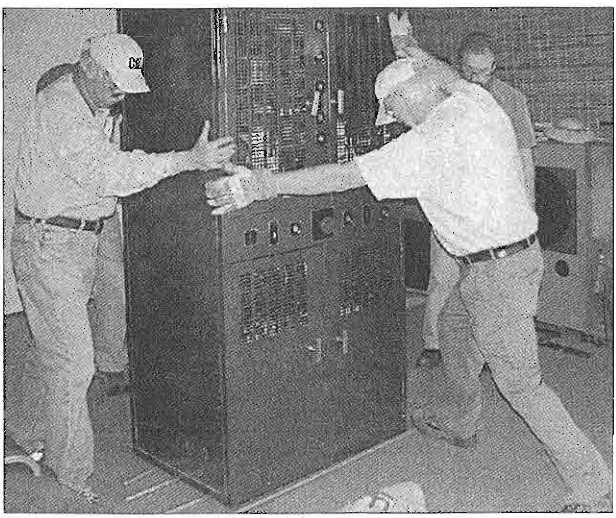
By "Class E Jonny", K6JEK



Colorado Rod, W5CZ

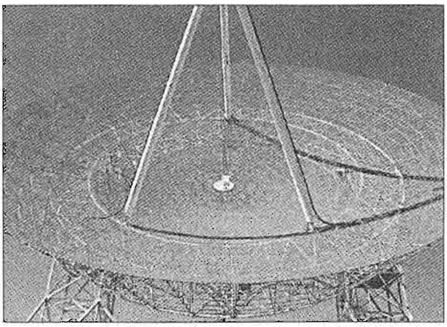
The notorious boat anchor bandito, Colorado Rod, struck again, this time in the heart of the California Territory. He and his scurrilous gang hit the Circle B, Ben W6FDU's San Josè ranch, making off with forty-five boxes of loot, including a Johnson Desk and a Breiting 12. Not content with that, he rode north to the wild west town of Penryn where he lifted a Collins KW-1 from Penryn Mike, W6THW. Colorado was last seen heading east on the Sierra Trail, probably to his hideout deep in the Rockies outside of Denver.

The last time this merciless raider visited California he hit the gold rush town of Mokulemne Hill. He captured a truckload of boat anchors from Gold Dust Gary's spread, lightening K6GLH of a whole wagon of iron, including a Western Electric broadcast transmitter, a Collins 30H, and a hundred other things, even a spark transmitter. But it's never enough for Colorado. His brazen raid this year showed he'll strike anywhere, not just in the lawless gold country, but right in town where folks figured they were safe from him and his kind.



The Western Electric Heist

Colorado had a big gang with him. Before he got down to the business of liberating California of its treasure, he took his bunch to see the sights. He got a tour of the Stanford dish. (http://nova.stanford.edu/~jtwicken/dish.html) Nobody gets a tour of the Stanford dish. They don't give tours; It's behind three sets of locked gates. But, one of his gang, Class E Jonny, K6JEK, called up his compadre, The Professor (Bruce Wooley). The gates opened and the locks fell off. The gang, Salinas Rod (KQ6F), Class E Jonny, Flexy Jeff (K6JCA), Minnesota Ken (W0LJV), The Professor, and Colorado got the royal tour. These boat anchor crazed bandits liked the part about mapping the galaxy by measuring the background radiation from hydrogen atoms but their eyes lit up when they found out you can pump juice into the dish too — 70 KW pulses into a 150 foot dish. The back room has an iron beast that even they hadn't imagined, a five foot Klystron feeding some kind of gas filled six inch hardline. They don't do moon bounce. They do Mars bounce. And don't be a vulture flying overhead.


The Great Stanford Dish

This gang wasn't afraid to show their ugly outlaw faces around town, either. After the dish tour they made their way over to the Stanford Radio Club, W6YX, the storied hangout of legends O.G. Villard, Jr., even Terman. The gang disgraced this hallowed ground with the president of the club, Daniel Clark, as a hostage. He'd been on the dish tour too, but now he had to open up his place. There they met their match, a Yeasu FT1000MP Mark V. This gang knows their way around radios, even new radios. Salinas designs and builds AM and SSB transceivers. Flexy Jeff writes software for the Flex Radio. They all have iron. But this thing with hundreds of buttons had them bamboozled. Finally, Flexy and Salinas got it fired up so they could get on the air and arrange a rendezvous with the rest of their outlaws buddies, the Sierra Boys, Gold Dust Gary (who's gone bad) and Cliff Kurtz, N6ZU. "I've heard you boys on everything you've got but you've never sounded worse than you do on that box" said Gold Dust, a hundred miles to the east in gold country. They planned their holdup. "You come in from the west. Kurtz and I'll ride in from the east and we'll knock off the Circle B tomorrow. Now turn that thing off." The boys never did figure out how to hook up the beverage antennas or switch to the 75-meter four square. They were using a dipole!

The W6YX Button-Pushing Crew

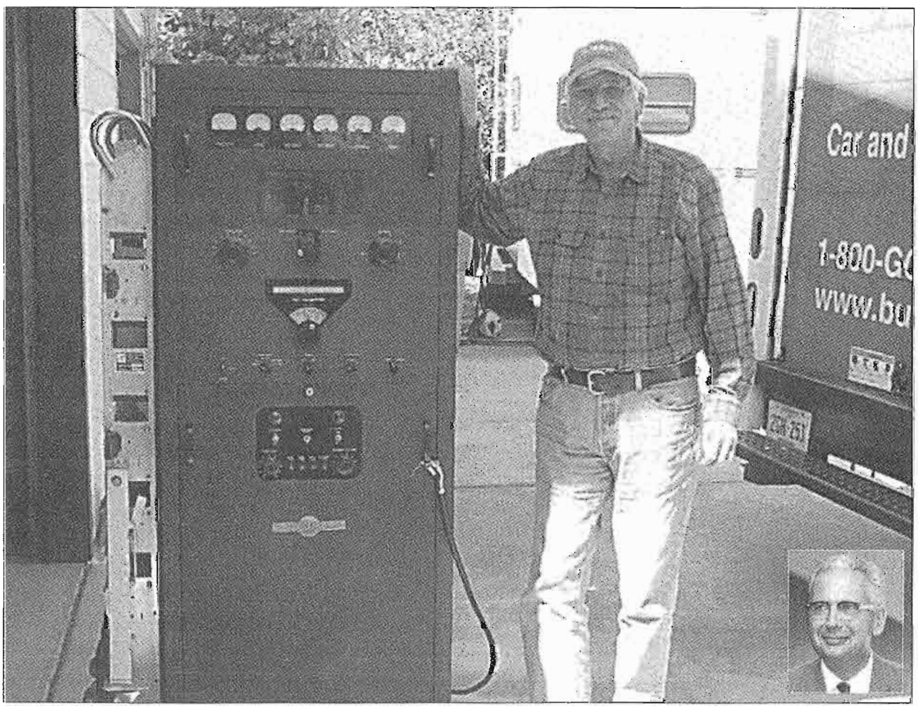
They were seen later at the local cantina sloshing down margaritas, eating fiery salsa, red hot enchiladas, and finishing with cerveza fria. Class E's sweetheart, Señora

The Johnson Desk Kilowatt Captured

Patricia Teresa joined them and showed the boys a thing or two about drinking margaritas.

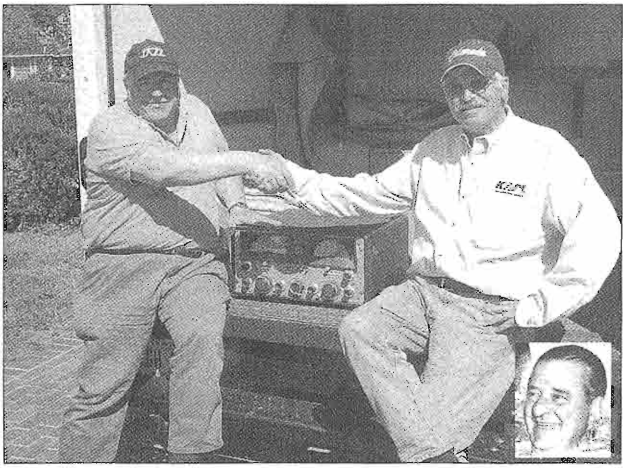
The Circle B gave up without shot. With the Colorado Gang and Sierra Boys surrounding the rancho, Ben decided he'd best just get out of the way. Hour after hour they raided the place. Collins, Hallicrafters, Johnson, Hammarlund, National, Central Electronics, all hauled away without discrimination. Bubble pack was flying. Pacifico Clara cervesa lubricated the raiders. The get away wagon groaned under the load. Some of the gang tried to sneak some of the loot off into their own packs. Class E Jonny went for the CE sideband slicer. Flexy had his eye on a Collins 75A-1. But, Colorado isn't new to his business and none of the stuff got away.

These outlaws are fearless. Instead of riding out of town in flurry, they hung around flaunting their impunity before the helpless locals. They spent the evening drinking and whooping it up at Class E Jonny's hacienda, with Salinas barbecuing vast quantities of meat and



Colorado's Big Haul—The Collins KW-1

Colorado toasting the raiders with round after round of beer and wine. Junk Box Joe (N6DVD) showed up and ran the Collins net using Class E's KWM-2. Les (WB6ORZ)

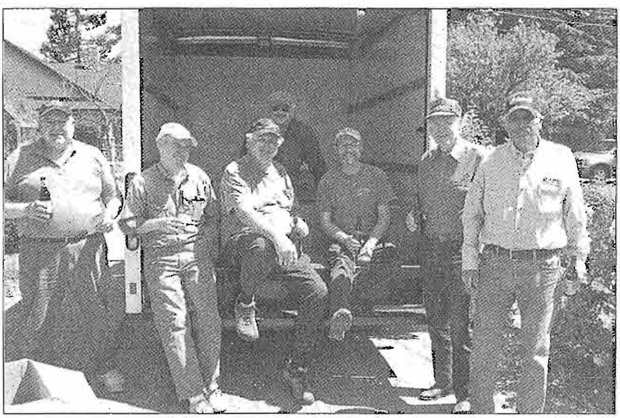


Colorado Rod Captures a Hallicrafters SX-88

treated everyone to tales of earlier exploits. Ben played the piano. Neighbor Pierre brought out a 25 year old Armagnac which these outlaws didn't mind finishing off. Patricia Teresa kept the food coming and wine flowing. The Sheriff was nowhere to be seen.

Lucky for the locals, the next day's swap meet was pretty much rained out. The gang ambled over to Flexy's place, ate even more and congratulated Flexy on a collection of test equipment like these boys hadn't seen before. Just how many spectrum analyzers are enough? Flexy showed Salinas the ins and outs of the latest Flex software. The new kid in town, Jeff, KI6GYZ, showed up and almost started a fight when Minnesota said Newkid's signal was bigger and better than some of these old timers'. Newkid doesn't mind telling you about his fancy audio chain and full wave horizontal loop at fifty feet. It's probably was a good thing for Newkid that the gang was tired from too much drinking and raiding. But this had to end because Colorado wanted to get out of town and go grab that KW-1.

Mike could see them coming from miles away. A big dust plume was wafting towards him making its way west across the Sacramento Valley. A town like Penryn doesn't see a whole lot of visitors, especially all at once. It had to be them, Colorado Rod with the Sierra Boys. He knew what they were after too, the KW-1. But what was he going to do? He and his buddy Doc (K6HLO) couldn't hold them off by themselves. It wasn't like he could round up a posse to help. This was Penryn, not Frisco. If they left, Colorado might help himself to everything, the 75A-4's, the HRO 50R1, the 183D. So he and Doc waited. And then they came. Maybe the gang was tired from three days of debauchery. Maybe they were just feeling kindly. All they did was liberate the KW-1 and leave. That was it, a clean heist. No partying. No shouting and shooting. They took the goods and rode out of town.



The Raiders are Relaxing

The citizens of California breathed a sigh of relief to see the back of that man, Colorado Rod. But who can sleep easy knowing he's on the loose? Where will he pounce next? Maybe in your town!

ER

VINTAGE NETS

AM Carrier Net: Sunday mornings, 8:30AM local Eastern time, 3835 kc. QSX W2DAP. Friendly format.
Arizona AM Nets: Sat & Sun: 160M 1885 kc @ sunrise. 75M 3855 kc @ 6 AM MST. 40M 7293 kc 10 AM MST. 6M 50.4 Mc Sat 8PM MST. Tuesday: 2M 144.45 7:30 PM MST.
Boatanchors CW Group: QNI "CQ BA or CQ GB" 3546.5, 7050, 7147, 10120, 14050 kc. Check 80M winter nights, 40 summer nights, 20 and 30 meters day. Informal nightly net about 0200-0400Z.
California Early Bird Net: Sat. mornings @ 8 AM PST on 3870 kc.
California Vintage SSB Net: Sun. mornings @ 8AM PST on 3860 +/-
Colorado Morning Net: Informal AMers on 3875 kc daily @ 6:00 to 6:15 AM, MT. QSX KØOJ
Canadian Boatanchor Net: Daily 3725 kc (+/-) @ 8:00 PM ET. Hosts are AL (VE3AJM) and Ken (VE3MAW)
Collins Collectors Association (CCA) Nets: Sunday, 14.263 Mc @ 2000Z. Informal ragchew net Tue. evening, 3805 kc @ 2100 ET, Thu. 3875 kc. West Coast 75M net, 3895 kc 2000 PT. 10M AM net 1800Z, 29.05 Mc Sunday, QSX 1700Z. CCA First Wednesday AM Night each month, 3880 kc starting @ 2000 CST, or 0200 UTC.
Drake Technical Net: Meets Sun. on 7238 kc, 2000Z. Hosted by John (KB9AT), Jeff (WA8SAJ), and Mark (WBØIQK).
Drake Users Net: Check 3865 kc, Tue. nights @ 8 PM ET. QSX Gary (KG4D), Don (W8NS), and Dan (WA4SDE)
DX-60 Net: Meets on 3880 Kc @ 0800 AM, ET on Sun. QSX op is Mike (N8ECR), with alternates. The net is all about classic entry-level AM rigs like the Heath DX-60.
Eastern AM Swap Net: Thu. evenings on 3885 kc @ 7:30 PM ET. Net is for exchange of AM related equipment only.
Eastcoast Military Net: Sat. mornings starting 0500, 3885 kc +/- QRM. QSX Ted, W3PWW. It isn't necessary to check in with military gear, but that is what this net is all about. Late checkins are welcome.
Florida AM Group: A large group meeting every Sunday, 7:30AM ET, 3875 kc and pre-net checkin 7:00AM ET, 3675 kc. QSX Maury, N4GUI. Also, Florida vintage SSB net "AFLAC" meets Wed., 3910 kc, 9PM ET. QSX Warren, W1GUD.
Fort Wayne Area 6-Meter AM net: Meets nightly @ 7 PM ET on 50.58 Mc. Another long-time net, meeting since the late '50s. Most members use vintage or homebrew gear.
Gulf Coast Mullet Society: Thu. @ 6PM CT, 3885 kc, QSX control op W4GCN in Pensacola.
Gray Hair Net: One of the oldest nets, @44+ years ,160 meter AM Tue. evening 1945 kc @8:00 PM EST and 8:30 EDT. Also check www.hamelectronics.com/ghn
Heathkit Net: Sun. on 14.293 Mc 2030Z right after the Vintage SSB net. QSX op W6LRG, Don.
K1JCL 6-meter AM repeater: Operates 50.4 Mc in, 50.4 Mc out. Repeater QTH is Connecticut.
K6HQI Memorial 20 Meter Net: Flagship AM net 14.286 Mc daily for 25+ years. Check 5:00 PM Pacific Time.
Lake Erie Boatanchor CW Net: Saturday morning, 1 PM ET, 7094 kc QSX op Steve (WA3JJT) or Ron (W8KYD).
Midwest Classic Radio Net: Sat. morning 3885 kc @ 7:30 AM, CT. Only AM checkins. Swap/sale, hamfest info, tech. help are frequent topics. QSX op is Rob (WA9ZTY).
Mighty Elmac Net: Wed. nights @8PM ET (not the first Wed., reserved for CCA AM Net), 3880 +5 kc. Closes for a few summer months. QSX op N8ECR.
MOKAM AM'ers: 1500Z Mon. thru Fri. on 3885 kc. A ragchew net open to all interested in old equipment.
Northwest AM Net: AM daily 3870 kc 3PM-5PM winter, 5-7 PM summer, local. 6M @50.4 Mc. Sun., Wed. @8:00 PM. 2M Tues. and Thurs. @ 8:00 PM on 144.4 Mc.
Nostalgia/Hi-Fi Net: Started in 1978, this net meets Fri. @7 PM PT, 1930 kc.
Old Buzzards Net: Daily @10 AM ET, 3945 kc in the New England area. QSX op George (W1GAC) and Paul (W1ECO).
Southeast AM Radio Club: Tue. evening swap, 3885 @7:30 ET/6:30 CT. QSX op Andy (WA4KCY), Sam (KF4TXQ), Wayne (WB4WB). SAMRC also for Sun. Morning Coffee Club Net, 3885 @ 7:30 ET, 6:30 CT.
Southern Calif. Sun. Morning 6 Meter AM Net: 10 AM on 50.4 Mc. QSX op is Will (AA6DD).
Swan Nets: User Net Sunday 2200z winter 14.250Mc ±QRM. QSX op rotates Jim (WA5BDR), Jay (WB6MWL), Norm (W7RXG), Bill (W4WHW). Tech Nets: Wednesday 2300z 14.251Mhz / Saturday 1900z 7235 kc QSX op Stu (K4BOV)
Texoma Trader's Net: Sat. morning 8:00AM CT 3890 kc, AM & vintage equip. swap net.
Vintage SSB Net: Sun. 1900Z-2000Z 14.293 & 0300Z Wed. QSX op Lynn (K5LYN) and Andy (WBØSNF)
West Coast AMI Net: 3870 kc, Wed. 8PM Pacific Time (winter). Net control rotates between Brian (NI6Q), Skip (K6LGL), Don (W6BCN), or Vic (KF6RIP)
Westcoast Military Radio Collectors Net: Meets Sat. @ 2130 Pacific Time on 3980 kc +/- QRM. QSX W7QHO.
Wireless Set No. 19 Net: Meets second Sun., monthly, 7270 kc (+/- 25 Kc) @ 1800Z. Alternate 3760 kc, +/- 25 kc. QSX Dave (VA3ORP).

CLASSIFIEDS

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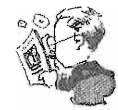

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SERVICE FOR SALE: JOHNSON "TURBO" RANGER, Valiant, Viking 500, Viking II, includes panel and cabinet refinish. Hammarlund 180(A), National 300, 303, R390(A). http://w4pnt.8k.com Patty & Dee's Marina: 534 W. Main St. Waynesboro, VA 22980 540-249-3161 Cell: 540-480-7179, w4pnt@highspeedlink.net

FOR SALE: 50 year collection of radios and parts, PU local in NY area. Rudy, W2ZIA, 716-937-9279

FOR SALE: Dynamotor PE94A. TR McElroy telegraph keys. 2 homemade transmitters. Set of Japanese airplane instruments. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids, IA 52402. 1-319-393-8075

FOR SALE: Heathkit SB301, SB401, SB600. With disk mic and SB401 parts rig. $325 + shpg. Shannon Latham, W3SML, 2339 Whitmore Shop Rd, Harrisonburg, VA 22802 540-867-9294 w3sml@hotmail.com

FOR SALE: Tektronix 575 curve tracer with complete manual copy, $225. Ross Wollrab, 228 N. Oakcrest Ave, Decatur, IL 62522-1810, 217-428-7385, REWollrab@aol.com

FOR SALE: Hickok 810 sig tracer-$25 Precision 10-54 tube tester-$40, E200C—$20, RCA SR Voltohmyst-$20, B&K VTVM-$20. Carter, 434-979-7383, celliot14@earthlink.net


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FOR SALE: EICO Tri-Band Model 753 SSB/AM/CW with manual exc cond, $75 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: ARRL Handbooks-1933 thru 1986. All very good to as new, ask for list. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: NATIONAL NCX-3 transceiver w/power supply and manual, exc cond, $150. John Snow 1910 Remington Ct. Andover, KS 67002 316-733-1856

FOR SALE: 2 SCR-274N/ARC-5 transmitters: 1 T-20, 4.0-5.3. 1 T-22, 7.0-9.1 Mc some mods on both, $15 each plus $20 shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: HAMMARLUND HQ-I00A receiver exc cond with manual, $150 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: SCOTT 800B receiver all chrome w/new 15" speaker and manual, $400 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: INTRAC 2000 Model C-1570-C test set by Motorola;. New with all cables and manual $500 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: R-390A/URR field and depot maintenance manual (not a copy) TM 11-5820-358-35 $30 postpaid. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: General Radio 1001-A RF generator $50, BC-221-AJ with power supply $25, plus shipping costs, for details contact Mike, VE7MMH, at: mike46@shaw.ca or 604-988-0112

FOR SALE: Mint TS520 Kenwood HF amateur transceiver with operator and service manuals. William Landby, WØDCM, 218-386-1654

FOR SALE: 7 Bearcat & Regency scanners, $100. Heathkit HW7, $100. Oak Hills QRP Explorer, $100. Kenwood TK800, $75. Gary Henman, 2944 Briarwood Dr, Mt. Prospect, IL 60056 812-689-5082

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FOR SALE: Collins 312B-5 Station Control (round), $425. Yaesu Monitor Scope, YO-100, $185. Mike Grimes, 5306 Creekside Ct. Plano, TX, 75094. 972-898-7251, K5MLG@verizon.net.

FOR SALE: Collins 32S-1, 312B-3, 75S-3, 32S-3, 312B-4, 75S3-B, 32V-1, 75A-1, 75A-2, 75A-4, 51S-1, 30L-1, 30S-1. National: HRO-60, NC-57, NC-183. Drake L4. Kenwood R-820, TS870. Yaesu FRG-7. Bob, W6CYX, w6cyx@arrl.net or 408-251-3843

FOR SALE: New Jan 6SG7gt tubes. Tubes & boxes look like new. $7.00 for 5 plus $4.05 shipping. Email for large quantities or write. Wayne Letourneau, PO Box 62, Wannaska, MN 56761 letourneau@wiktel.com

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FOR SALE: Chinese Army type 65 hand crank generators for 102E radio sets. Ken, KD6B, kd6b@bendbroadband.com 541-923-1013, POB 310, Redmond, OR 97756

FOR SALE: "Unique Radio Parts", LLC. www.wa9tgt.com (Replacement parts for "Drake" radio equipment)

FOR SALE: Atwater-Kent dual speed tuner repair kit. Complete details at www.adamsradio.com Adams Manufacturing CO., POB 1005, Lincoln Park, MI 48146

FOR SALE: Galena crystals and/or parts to make your own crystal radio. Also have radio tubes. Len Gardner, 458 Two Mile Creek Rd, Tonawanda, NY 14150, radiolen@att.net

FOR SALE: Telephone Filters, suppress >1MHz interference, plug in, 1/$7, 2/$11, 3/$14, 4/$16.75, shipped U.S. Brian Harris WA5UEK 3521 Teakwood Lane, Plano TX 75075 brian.k.harris@philips.com 214-763-5977

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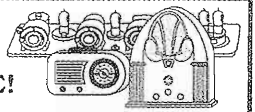

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BOOKS FOR SALE: Radio books, magazines, catalogs, manuals (copies), radios, hi-fi, parts. Send 2 stamp, LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857. ka1edp@juno.com

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

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

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WANTED: Philco Model 47-1230 chassis, basket case is fine. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

WANTED: Old QSL card of mine. KN8GID or K8GID. Will pay reasonable fee. Buck, WØRST, bfetters@aol.com or 636-226-6159

PARTS FOR SALE: Aluminum heat dissipating plate and grid connectors for all 3, 4 and T series Eimac tubes including 3-500Z, 4-1000, 304T's and others. Alan Price, fixer7526@wmconnect.com

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WANTED: Wavetek III manual needed for SN = 048387 including boards 110-113H, 111-118E. Tom, W4PG, wtw@rti.org 919-541-6110

WANTED: Meter for Eico 720 transmitter or basket case with meter. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

WANTED: Used HF receivers of all types in very good to extra good condition. Jim, 43 Burnham St., Apt A2, Belmont, MA 02478

WANTED: R-366/TRR-5 HF Receiver Manual for purchase or to rent/borrow to make a copy. Jim, KB1NJZ, 39 Ridgeview Lane, New Boston, NH 03070. 603-487-5284.cavanjj@msn.com

WANTED: Collins Service Bulletins for 651S-1 HF Receiver. Contact mmoss@mindspring.com

FOR SALE: Hallicrafters Panadapter SP-44 with manual $165. T368 exciter with schematic $55. Vic, 810-367-2087, wd8dwr@arrl.net

WANTED: Vibroplex Key Parts for Original Standard or Delux. Lever bar with rod and spring needed most, knobs other bits may also help. Finish is unimportant. Tom Mackie, W2ILA, 14 Washington St., Jamestown, RI 02835 w2ila@cox.net

WANTED: National 1-10 or 1-10A RF section, or complete parts unit. Ivan, WA6SWA, 703-237-9511, ihxxv@cox.net

WANTED: Johnson Viking I in good condition. Can pickup in WA-OR-CA or will pay to ship. Please call Robert, W7MKA, at 541-476-2064, robert.h.goff@gmail.com.

WANTED: Hallicrafters PM-23 speaker. W9STB telegrapher@hotmail.com, 715-892-0238

WANTED: Johnson Ranger II, avg condx will be fine. Charlie 941-747-2082, k4zks@tampabay.rr.com

WANTED: Antique radio parts. National RF90 choke. About 1 inch in diameter and fits into grid leak clips. HF impedance #10, looks like a grid leak, is marked #10 HF impedance. Pilot #130 RF choke, has two knurled nuts. United Laboratories (or other?) 200 ohm rheostat, Bakelite, about 1-3/4" diameter. I will be happy to pay an unreasonable price for any or all. Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059 505-286-1370

WANTED: Johnson CB model 323. Sonar J-23, other 23 channel CB radios, base or mobile. Ed Fluehe, WA7DAX, 1649 E. Stratford Ave., Salt Lake City, UT 84106. 801-484-5853

WANTED: National AN/FRR-24 receiver components and info. See http://www.virhistory.com/ham/frr24.htm Nick, KD4CPL, nick@3rdtech.com 919-929-4342 (NC)

SIGNAL ONE CX11 WANTED: Looking for Signal One CX11 / CX11A transceiver. Will consider radios needing work and parts-only radios. Bob KD7FT; kd7ft@earthlink.net 206-375-3234

WANTED: Someone with a collection of Short Wave Craft, Radio Craft from the 1930s to collaborate on a series of articles on a substantial collection of original items form that time period. Please call Chuck, WØIUH, 320-277-3242

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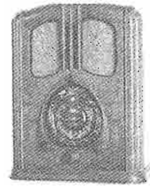

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WANTED: James Millen plug in oscillator coils for Millen 90881 linear amplifier, Millen parts #s 43011, 43015, 43021, 43041 and 43081. Gary K2PVC; gschonwald @earthlink.net 917-359-8826

WANTED: Technical Materiel Corp (TMC) power supplies PS4 (low voltage and bias) and PS5 (high voltage) for the TMC PAL 1K kilowatt linear amplifier, also known as the RFD or RFA. Gary K2PVC; gschonwald@earthlink.net 917-359-8826

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Lehr, ND 58460

Phone: 701-378-2341 FAX: 701-378-2551, email: frntcap@bektel.com

WANTED: Squires-Sanders SS-1R and SS-1V. Bob, WØYVA. 703 450 7049; robert@isquare.com

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WANTED: Hallicrafters HT33 with salvageable power supply. The RF section is not required to be useable, need a power supply to contribute to one that is. Gary Schonwald K2PVC. gschonwald@earthlink.net phone: 917-359-8826

WANTED: Technical Materiel Corp rack mounted antenna tuner and RF /SWR meters to be used with the 350-watt or 1000-watt TMC linear amplifiers. Will consider other TMC transmitting equipment and accessories for collection and on-air use. Gary Schonwald K2PVC. gschonwald@earthlink.net phone: 917-359-8826

WANTED: Need two Westinghouse RT35 0-1 RF amps, 3-1/2" round Steve Bartkowski, 1-708-430-5080

WANTED: Meter movement for Western Electric transconductance tube tester KS-15750. Walter Hughes, WB4FPD, 6 Academy Ct., Berryville, VA 22611 540-955-2635

WANTED: Vacuum Tubes: 279A, 212E, 249B, 258B, 271A, 242A, C120, C100A, 804, RK20, CK70, GL805, C201, ZB-120, 802. Components for rebuilding Collins 30J RF output deck, including Cardwell or equivalent dual section variable 440 pF and 240 pF capacitors. Components for Collins 12H /12N speech input console, including preamplifiers and program amplifiers. Rod, W5CZ, 303-324-2725, rodperala@aol.com

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WANTED: Will buy SP-600 and some other Hammarlund equipment, working, not, or incomplete. Al, W8UT, anchor@ec.rr.com 252-636-0837

WANTED: Pearce-Simpson manual/ schematics for VHF marine radio, model "Catalina", JR Linden, K7PUR, PO Box 4927, Cave Creek, AZ 85327, jrlinden@usa.net

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WANTED: Clean National Select-O-Ject, NC-183DTS and Heath VX-1. Contact Ric at c6ani@arrl.net.

WANTED: ITT-Mackay Marine 3010-C Receiver, late S/N, complete and in good or VG conditions, with original box and manual. The item has to be shipped to a friend in Ohio (not outside U.S.). Send your offer to Paolo Viappiani, Via Valle 7, 19124 La Spezia, Italy, or pviappiani@tin.it

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WANTED: Early QSL cards from my Grandfather, Hal Smith (SK). His calls were KH6KA, K6YJR, K6OQE. Gladly reimburse postage plus modest finder's fee! Phil Wilson, 1355 Big Otter Dr, Blue Ridge, VA 24064 k6cra@arrl.net

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WANTED: National NTE-30 Transmitter. Any condition, any price! I love National. Sylvia Thompson, n1vj@hotmail.com 33 Lawton Foster Rd., Hopkinton, RI 02833. 401-377-4912.

WANTED: One of my "KN8GCC" QSLs from the mid-1950s. Tom Root, 1508 Henry Court, Flushing, MI 48433, wb8uuj@arrl.net 810-659-5404.

WANTED: Any TMC equipment or manuals, what have you? Will buy or trade. Brent Bailey,109 Belcourt Dr., Greenwood, SC.29649, 864-227-6292, brentw2@earthlink.net

WANTED: Seeking unbuilt Heathkits, Knight kits. Gene Peroni, POB 7164, St. Davids, PA 19087. 215-806-2005

PRESS WIRELESS, NY: Photos, information wanted on Hicksville, Baldwin, Little Neck, Centereach, Northville facilities. George Flanagan, 42 Cygnet Dr., Smithtown, NY 11787 w2krm@optonline.net 631-360-9011

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

WANTED: Top prices paid for globe shape radio tubes, new or used. Send for buy list or send your list for offers. Write or e-mail: tubes@qwest.net. See www.fathauer.com or send for catalog of tubes for sale. George H. Fathauer & Assoc., 123 N. Centennial Way, Ste 105, Mesa AZ 85201. 480-968-7686, Call toll free 877-307-1414

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: 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: TCS & TBY Navy radios. Ken Kolthoff, K8AXH, PO Box 215, Craig, MO 64437. 913-634-3863.

WANTED: WW II German, Japanese, Italian, French equipment, tubes, manuals and parts. Bob Graham, 2105 NW 30th, Oklahoma City, OK 73112. 405-525-3376, bglcc@aol.com

WANTED: QSL card from W9QLY, Frank (Mac) Maruna, from 1956 or before. WILL PAY TOP DOLLAR. Don Barsema, KC8WBM, 1458 Byron SE, Grand Rapids, MI 49506, 616-451-9874

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

WANTED: ARC-5 rcvrs, racks, dynamotors. Jim Hebert, 900 N. San Marcos Dr. Lot 77, Apache Junction, AZ 85220

WANTED: Front panel for Kenwood VFO-230. KH7TU, Ken Thomas, PO Box 4003, Lihue, HI, 96766, 808-647-0645, captdale2@hotmail.com

WANTED: Harvey-Wells Odds-'N-Ends: Speakers, phones, mikes, manuals, supplies, prototypes, military, aircraft. Kelley, W8GFG, 219-365-4730, 9010 Marquette St., St. John, IN 46373

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 or www.r-389.com

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

WANTED: Receivers. Telefunken E1800, Rohde Schwarz, EK-56/4, NC-400, Racal 3712, Hallicrafters SX 88, Collins HF8054A, Collins 851S-1. Manual for Racal R2174B(P)URR 310-812-0188(w) alan.royce@ngc.com

I NEED INFO!: Radiomarine T-408/URT-12/USCG/1955. Sam, KF4TXQ, PO Box 161. Dadeville, AL 36853-0161 stimber@lakemartin.net 256-825-7305

WANTED: Scott Special Communications rcvr. EA4JL, please call Kurt Keller, CT, 203-431-6850

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

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

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 jstitz@pacbell.net

WANTED: Westinghouse SSB Transmitters MW-3 (Exciter, Amplifier, Power Supply). Also, MW-2 (AM). Will pickup anywhere. Gary, WA4ODY, Seabrook, TX 77586, 281-291-7701 myctpab@earthlink.net

DONATIONS WANTED: Southern Appalachian Radio Museum, Asheville, NC, where others can view your radio treasures. For general information or donations call Clinton Gorman, Curator, 828-299-1276

WANTED: WW-2 IFF Equip FM-80 rack BC-126F RA-105A 1-221, BC-1293. Will pay top dollar. Steve Bartkowski, 1-708-430-5080, 7702 Austin Ave, Burkank, IL 60459

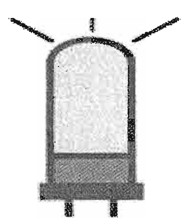
WANTED: National Radio 6 meter converter for NC-300 receiver. Must be working. Louis L. D'Antuono, WA2CBZ, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

WANTED: R 390, R 390A and R 392 receivers dead or alive or parts/ assemblies. Any condition considered. Will pickup if you have enough items. Glenn, WA4AOS, 864-684-2956

WANTED: Mint, complete or parts sets. Hammarlund SP-600 JX-28 version, has nomenclature tag R-620, doesn't have name engraved on panel like others, 1937 RCA ACR-111, RCA CR-88B version, RCA AR-8516, TMC CV-1758 SSB converter, and DEI Defense Electronics TR-711 telemetry receivers and modules. Will send custom shipping carton for easy transaction/shipment. Dan Gutowski AB8VM P.O. Box 142 Dexter, MI 48130 734-718-7450. dg16ms26@msn.com

WANTED: Electric Radio Tuning Meter as shown in many back issues of ER. Also need a10 Amp Variac, anyone have one for sale? Joel, W7EPA 928 231 3674 or W7EPA@ARRL.net

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



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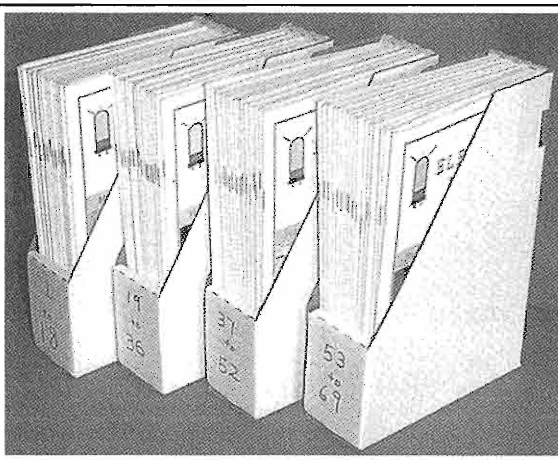

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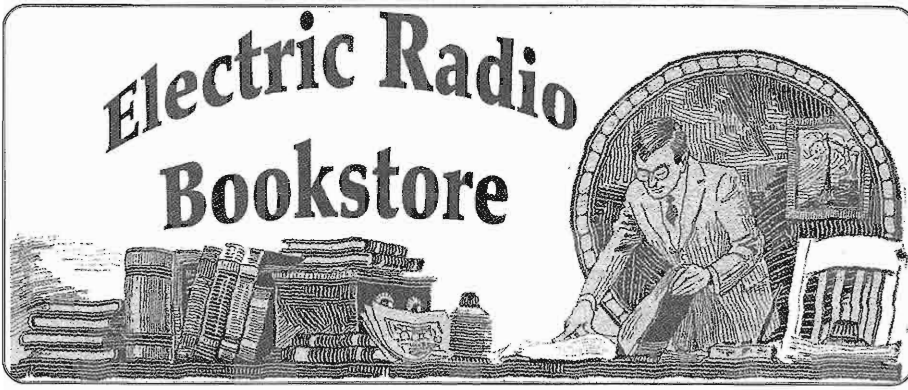

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A. Atwater Kent, The Man, the Manufacturer and His Radios: This 108 page paperbound book describes Atwater Kent's biography, and his rise from a saleman and inventor of electrical equipment to become one of America's foremost radio manufacturers and a household name. There are historic photographs and diagrams on nearly every page, and color plates with vintage AK advertising, by Ralph Williams and John P. Wolkonowic. -- **$25.95 - 10% = $23.35**

A Pictorial History of Collins Amateur Radio Products: Jay Miller's (KK5IM) classic volume describes the amateur radio products produced by the Collins Radio Company. It has high-quality historic photographs on nearly every page, and the text is backed up by Miller's personal research. ---------- **$39.95 - 10% = $35.95**

A Family Affair, The R.L. Drake Story: The complete story of the R.L. Drake story, as told by John Loughmiller, KB9AT. 273 pages all about the history of the company, product descriptions, technical repair tips, and great shack photos make a must-have volume for Drake users and collectors. ---------- **29.95-10% = $26.95**

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