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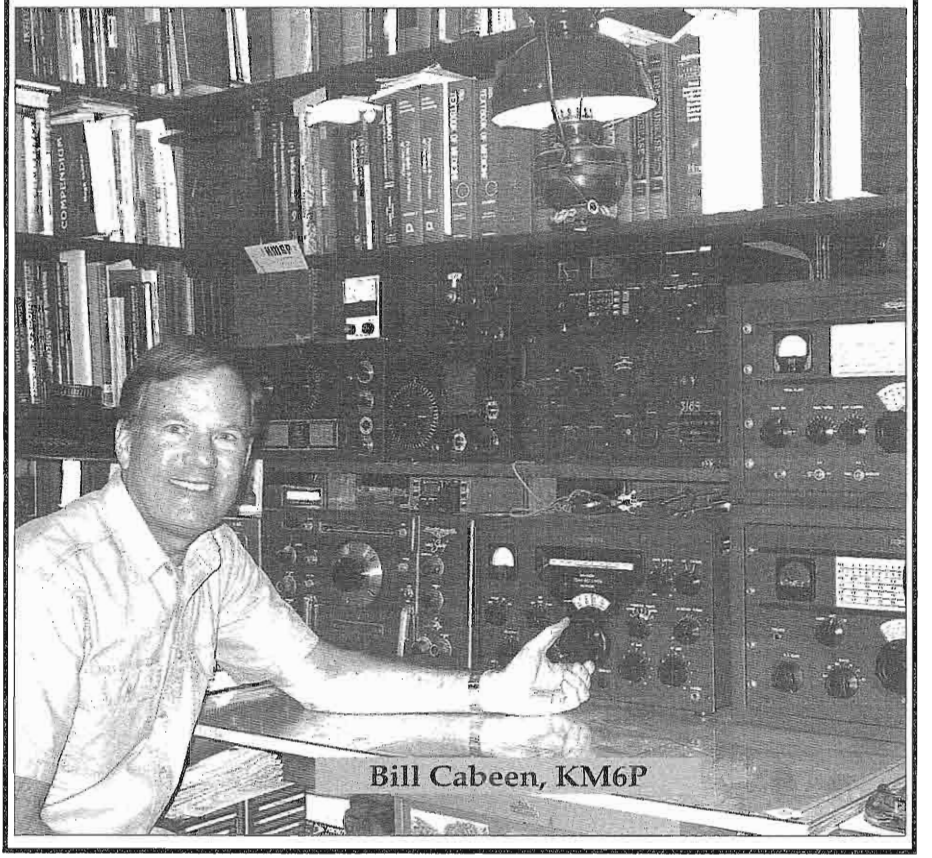
ELECTRIC RADIO

celebrating a bygone era

Number 172 September 2003



Bill Cabeen, KM6P

ELECTRIC RADIO

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

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

Regular contributors include:
Bob Dennison (W2HBE); Dale Gagnon (KWll); Chuck Teeters (W4MEW); Bruce Vaughan (NR5Q); Bob Grinder (K7AK); Jim Hanlon (W8KGI); Brian Harris (WA5UEK); Tom Marcellino (W3BYM); John Hruza (KBØOKU)

Editor's Comments

Equipment Reliability

Recently my wife April and I made a trip into the mountains of Northern Colorado to buy a National NC-100XA that had been abandoned in a cabin by its original owners. I carefully removed a lot of dust and dirt with compressed air and replaced an open type 80 rectifier. I could find no evidence of it ever having been repaired. I brought it up slowly on a Variac, and to my amazement found it to be completely operational without excessive hum. As I write this, it is monitoring 14.286 mc. Will any electronic equipment produced today still be working as designed 60 years from now? What a tribute to James Millen, Dana Bacon and the team at National!

What's All This BPL Stuff, Anyhow?

When I first heard of "BPL" I thought it was in reference to the Brass Pounder's League! When I started to do a little reading about BPL, which stands for Broadband over Power Line, I realized that it is not nearly as much fun as the old Brass Pounder's League. It is a threat. Anyone who is active on the HF or VHF frequencies, or who is an SWL, is advised to learn as much as they can about its effect on our allocations. If fully implemented as planned, it could permanently change Amateur Radio, as we know it. No amount of shielding or filtering will get rid of it.

The BPL of today is a scheme to deliver broadband Internet services by using the utility power lines as a gigantic antenna. Apparently there are two systems that differ only in the way the service is delivered. They use unlicensed Part 15 devices. Unlike a typical Part 15 device, the BPL boxes will need to be placed at roughly 2000 foot intervals along the power line routes, and will occupy entire chunks of spectrum at HF and VHF as opposed to a typical point source of noise that emanates from conventional Part 15 equipment—such as a cordless telephone.

This new technology is being pushed by the Utility Power Line Council (UPLC),

[Continued on page 11...}

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Cover: Bill Cabeen (KM6P) is on the air frequently from Pacific Palisades, California with many vintage transmitters. Bill is shown here at one of his classic operating positions.

The Novadyne-
A Beginner's One-Tube Receiver

by Bob Dennison, W2HBE
82 Virginia Ave.
Westmont, NJ 08108

If you are a beginner ready to try your hand at building your first radio, this article was written for you. Here is a set that has been kept simple, low in cost, and needs no external power supply or batteries. This set uses headphones so you can listen to your favorite radio station all day long or even late at night without disturbing other members of your family. This set tunes the standard broadcast band and the 160-meter Ham band.

Figure 1 shows the front panel of my receiver. A friend had given me a large Kurz Kasch dial so that's what I used. This dial features a nine to one ratio—that is, the small knob has to turn 4 ½ revolutions to turn the tuning capacitor, C1, 180 degrees, or from one end of the band to the other. This permits easy and exact tuning. But don't despair, you can use any knob or dial that fits the shaft of your tuning condenser.

You will need a grid-cap connector and these are hard to find. As a last resort, you can make one out of a paper clip. To support various components and wiring we use terminal strips or insulated tie points. The Radio Shack terminal strip has five lugs but it can be cut with a hacksaw if you need only one or two lugs.

The 6F7 requires a seven-prong tube socket and these are becoming a bit

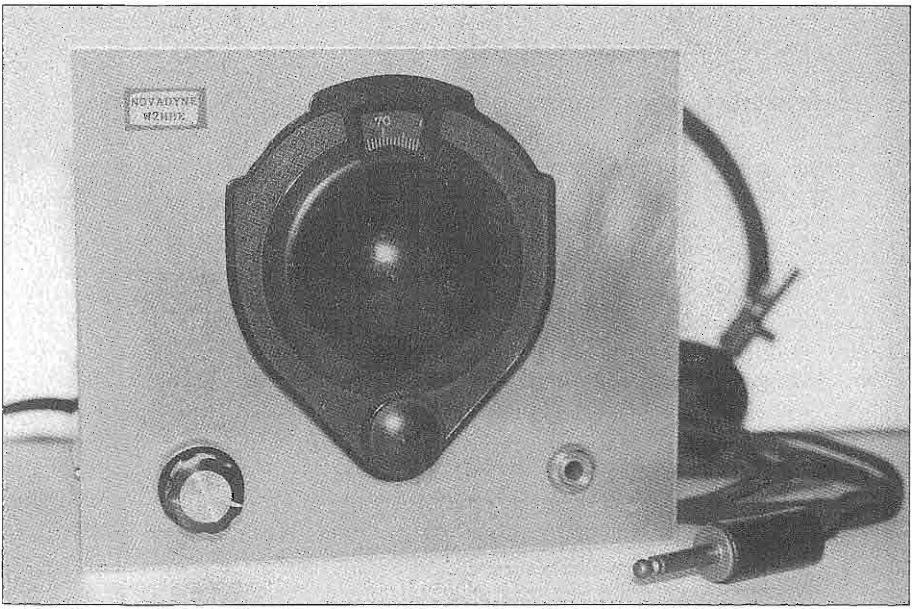


Figure 1: The front panel of my 1-tube regen receiver which I named Novadyne. I remember how each month back in the 1930's, Short Wave Craft would feature several radios for the experimenter and they always gave them fancy names such as The Dragnet, The Skyscraper, The Gainer, or The Argonaut.

scarce. Check with your ham friends. Seven prong sockets come in several sizes so be careful. There is the very small socket for miniature tubes like the 6AL5, a small size (.75 inch) for tubes like the 6F7 and 6A7, a slightly larger size (.855 inch) for the 53 and 6N7 and still larger sizes for certain transmitting tubes.

The wiring diagram of the Novadyne is shown in Figure 3. This radio makes use of the wonderful 6F7 tube, which contains both a triode and a pentode in one glass envelope. And, better yet, the heater current is only .3 amperes, just half of what you'd expect. The pentode in this tube is a remote cut-off type. Way back in the early 1930's James Millen, while Chief Engineer of the National Radio Company, discovered that the remote cut-off tubes such as the 35 and 58 gave exceptionally good results as regenerative detectors. To quote Millen, "The nearer the tube approaches the spill-over point, the less effect increasing the screen voltage has upon the tendency to oscillate. Consequently, we have a regeneration control that permits of readily obtaining a higher degree of regeneration with the attendant smooth sliding into oscillation so much sought after in ham receivers of the past—"

Regeneration is controlled by R2. In

Figure 2: A view behind the front panel shows the homebrew coil form in the Novadyne.

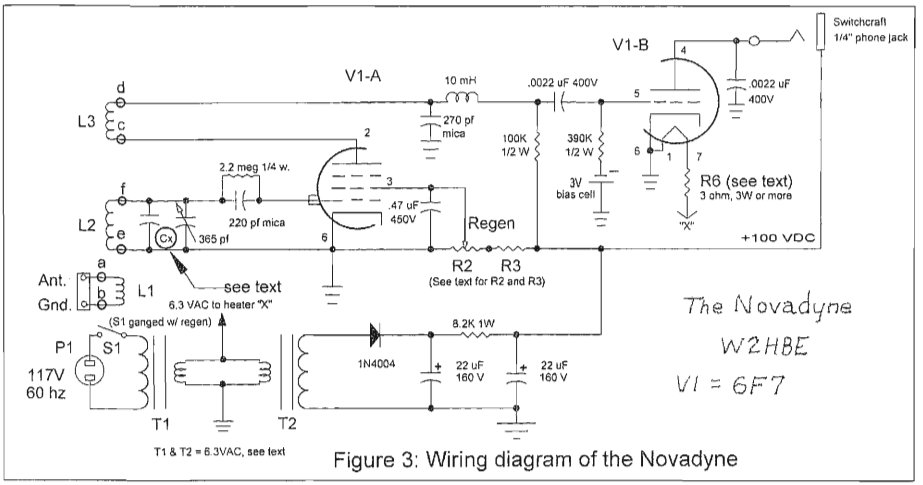
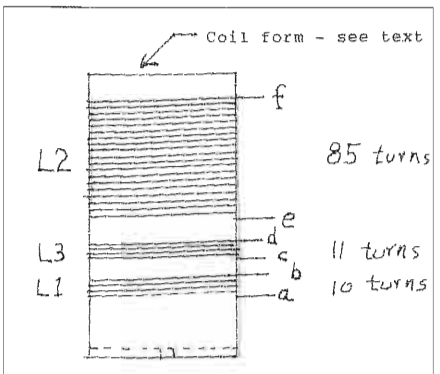


Figure 3: Wiring diagram of the Novadyne

most articles such as those seen in Short Wave Craft, QST, or various handbooks, the value of R2 is almost always given as 50K. If you have a 50K pot, then use it and at R3 use 39K. In my case, I had an 80K pot with a switch (S1) attached, so I used it. This led to making R3 56K. When you're building a radio, you often can save time and money by using parts on hand. If you go slowly, keep records of what you're doing, you will learn a lot, save money, and have fun!

The triode section of V1 is used as an audio amplifier to insure good headphone volume. This section requires three volts bias, which is supplied by two dry cells. I used the tiny AAAA size and epoxied them onto the inside rear apron of the chassis. They will last the lifetime of the set since no current is taken from them.



All coils use No. 30E, close wound.
Coils spaced ⅛" apart.

Fig.4. Coil data for the Novadyne.

The Coil

Refer to Figure 4. You will need a coil form on which to wind coils L1, L2, and L3. I used a plastic pill bottle 1.25 inches in diameter and 2.8 inches long. Ask your pharmacist for a clean, unused bottle, as it is very hard to remove the labels they put on these containers. The main winding, L2, consists of 85 turns of No. 30E wire. You can drill small holes (No. 55 drill) at each end of each winding. I mounted a solder lug at the top of the coil form to support the wire going to the grid cap. This protects the top end of L2. Be careful to connect L3 as shown—if you reverse connections C and D, the detector will not regenerate and signals will be very weak. If your 6F7 is good and you have wired the set correctly, the detector should regenerate properly. As you turn the regeneration control clockwise to slowly increase the detector screen voltage, you should hear a "plop" sound when the detector begins to oscillate. The detector screen voltage at which this occurs will depend on several things such as the make and condition of your 6F7, the frequency your set is tuned to, and the length and height

of your antenna. You may find that the screen voltage is anywhere from 8 to 20 volts. If the signals come in loud and clear, that is all that matters.

Power Supply

Power transformers are much too expensive for a beginner's radio. So, we used two cheap filament transformers connected back-to-back as shown in Figure 3. With a simple half-wave rectifier I get 135 volts, which after filtering yields 100 volts, which is a simple and cheap solution. One transformer (T2) is mounted under the chassis and the other (T1) is on top, directly over T2 so that only two 6-32 screws are required. Since this set uses so little B+ current, a rather large filter resistance can be used at R7 and good filtering and low hum is obtained.

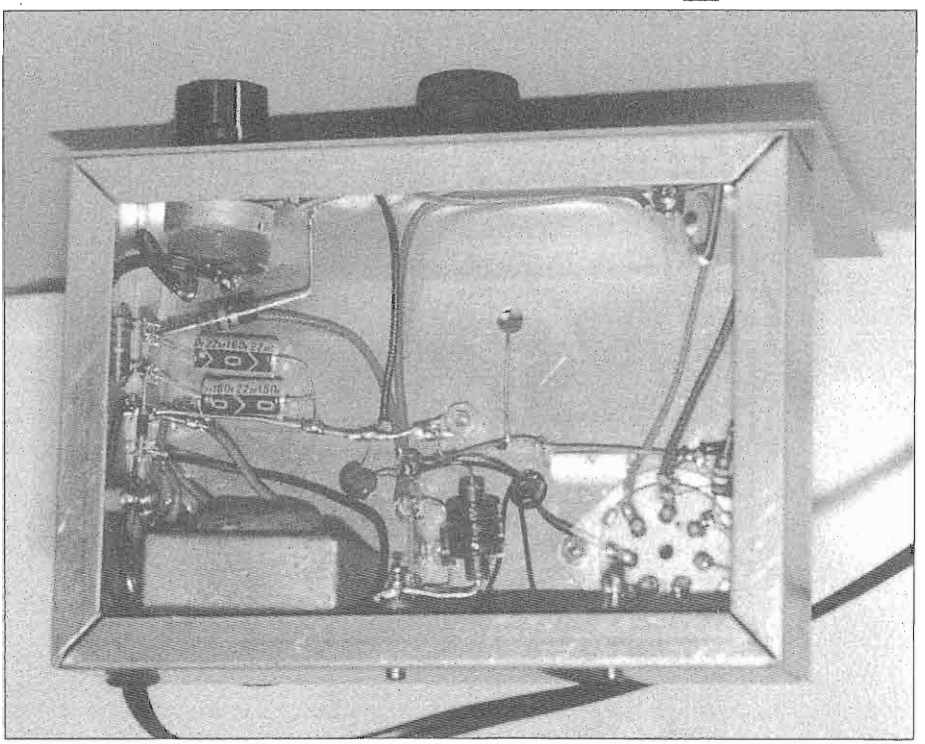
Caution

The full B+ voltage (100 volts) is connected to the frame of the headphone jack and this is present on the front panel. To see if this was safe, I touched my left hand to the panel and my right forefinger to the headphone jack and felt nothing. I have a heart pacemaker so I need to be cautious. This test was made indoors on a dry wood floor on a low-humidity day. If your headphones have exposed terminals and you're on a damp basement floor and it's hot, sweaty weather, then be very careful.

Conclusion

Take your time, do a neat job and check your wiring carefully. My set worked right from the start and yours should also. Some fellows keep a record of stations heard and some write to the stations asking for a verification card. I don't know if stations still verify reception, but if so, it should be a nice hobby. If you include return postage, I'm sure you will get a reply. Good luck and happy listening!

ER



Your receiver should work right away if it is wired correctly as described in the text.

A Tribute to Bob and Bruce

by Richard Lucas, K4JEJ
6065 Felter St.
Jupiter, FL 33458

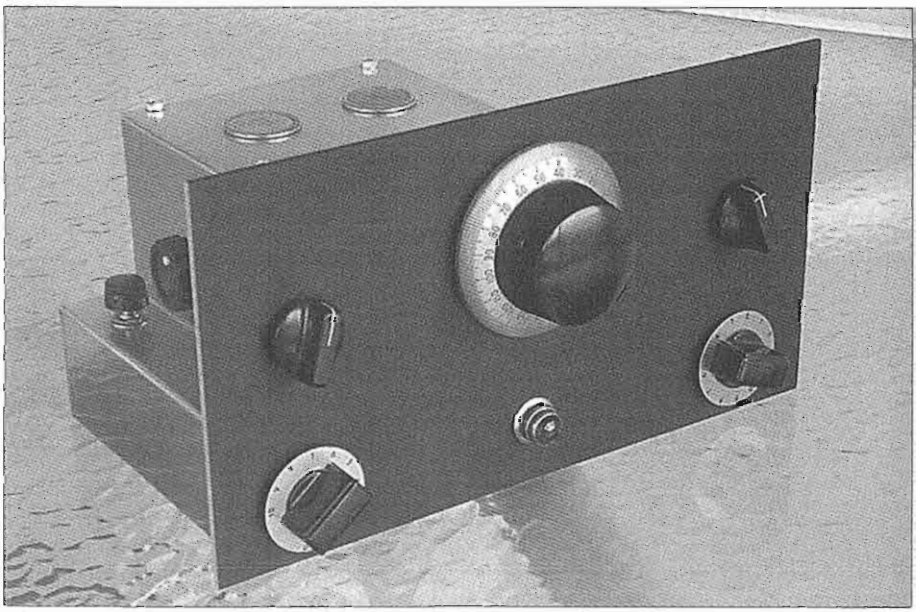
Bob Dennison (W2HBE) and Bruce Vaughan (NR5Q) really should share in the credits for the building of this receiver. It was only after researching their fine articles that I decided to build a "retro" radio of my own, based loosely on the 50's, when I was first licensed.

Miniature tubes had just recently been introduced, as had the "new" 6146. The hobby was a lot more exciting in those days, at least to me. Most everything for this project came from my junk box, with a little help from Antique Radio Supply...but I shamelessly stole many of the ideas right from the pages of ER.

There is really nothing new about this receiver. The tube line-up is a 6HS6 detector followed by 12AX7/6AK6 audio stages. Plug-in coils are used and the design includes the switched insertion of a variable pad in the front-end and a UTC 2KC Low-pass CW filter in the audio section. Regeneration is controlled with variable screen voltage on the 6HS6. The power supply has 2 stages of filtering and balanced filament feeds.

After I got it together and fired it up, one thing became painfully clear: this regen is a lot more about form than function! It becomes obvious that I spent more time on the layout than I should have in following good engineering practices. Indeed, this receiver was wrought with all the regen problems you ever heard about, plus a few more of it's own.

However after giving this some thought, I made some real progress in a couple of areas. The easiest to cure was that of having way too much audio gain. With both halves of the 12AX7 working full-tilt, the microphonics and acoustical feedback were the loudest things I heard in the speaker. Removing the cathode bypasses from both stages "tamed" this beast in a hurry.

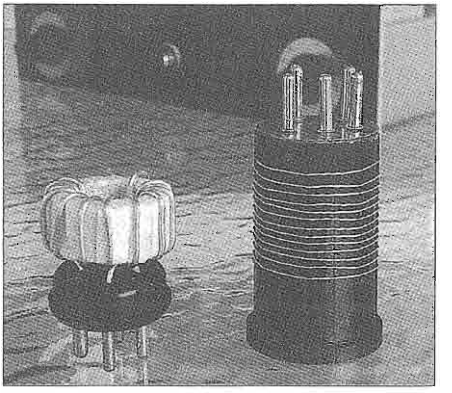


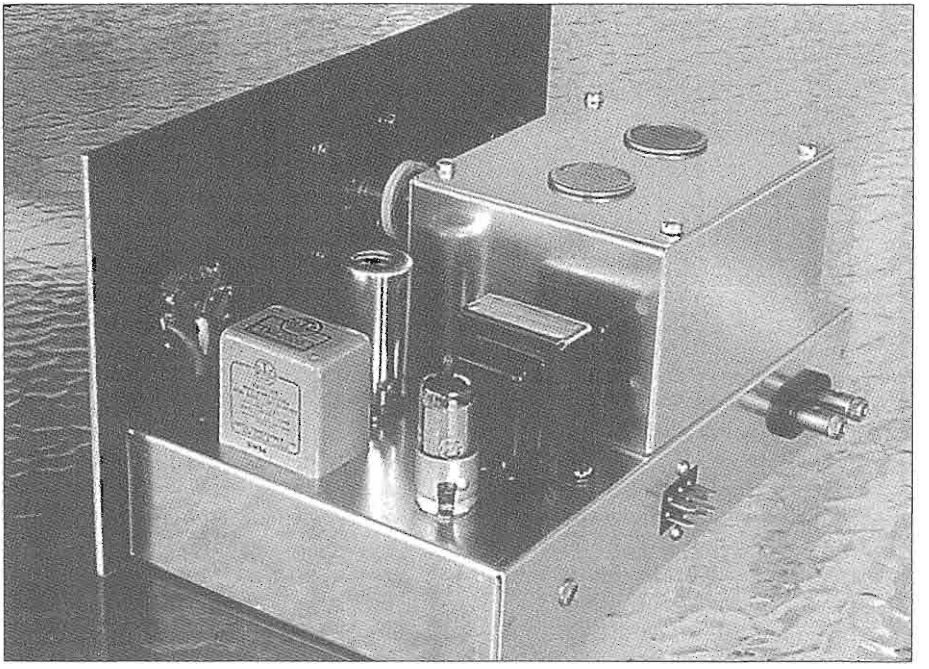
One stage of preamp would really have been plenty.

Next was a cure for another design flaw. I'd forgotten just how destructive an aluminum shield could be to the Q of a conventional coil, but I thought it important to keep all the RF components in a shielded enclosure. So rather than redesign the whole receiver I opted to rework the standard plug-in coils to a toroidal design. These coils are self-contained and don't really care much about their environment. The one pictured has an inductance of approximately 11 microhenries on a core of unknown mix, about an inch in diameter. The photo shows both the original and the new coil designs. The difference in performance is dramatic! It works like a whole new radio now, and the only problem is a local BC station that dominates until the station goes to low power at sunset. A tuned trap in the antenna lead should notch him out.

Some purists may object to the use of modern-day gimmicks, like the solid-state diodes in the power supply, zeners in the 6HS6 screen and the switch to toroidal coils. These things weren't around in the 50's. Hey, I never claimed to be a purist. This radio will stay just the way it is. It's worth it just looking at those great old National knobs. Who knows, it might even get a nod of approval from Bob and Bruce!

ER





The two photos on this page and the photo on the facing page show the author's recently completed receiver and the craftsmaship used in its construction.

Updating the Automatic Noise Limiter

by Brian Beezley, K6STI
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A noise limiter clips an audio signal to reduce the amplitude of impulse noise. It prevents the waveform, which includes the desired signal and noise pulses, from exceeding a certain level. This can be effective when the noise pulses are thin and tall, less so when they are wide and short. An aggressive noise limiter may target the latter by using a clipping level well within the normal amplitude range of the desired signal. This will generate audible distortion by limiting the signal itself.

If the clipping level is adjustable with a front panel control, you can trade noise reduction for audio distortion as conditions warrant. This is a nice arrangement, but it requires additional parts, wiring, front-panel space, and operator attention. Many communications receivers settle for an automatic noise limiter, where circuitry automatically sets the clipping level based on the carrier level.

ANL is a good idea, but the implementations I've encountered distort the audio so badly that I would not want to use them. Apparently the designers were so keen to limit noise amplitude that they were willing to sacrifice considerable audio quality. Perhaps they reasoned that since the signal was already corrupted by noise, additional distortion to quiet things down was justified.

But audio clipping has benefits beyond limiting external noise. Many receivers generate impulses of their own when you change bands or invoke other functions. I once made the mistake of wearing headphones while changing bands on a Hallicrafters SX-24. The impulse the bandswitch generated was so intense that my ears rang for several minutes. I was afraid I might have damaged my hearing. Later I looked at the audio waveform on a scope. The normal audio level was about a volt, but the band-change impulse was 100 volts or more. I never imagined the receiver could generate so much short-term energy. Had the receiver's ANL been so transparent that I could have left it always engaged, this impulse never would have reached my ears.

In addition to limiting receiver switching impulses, ANL has another benefit for receivers with good bass response. It can eliminate the loud thumps that occur when tuning rapidly across a band filled with strong signals.

Conventional ANL circuits generate distortion another way by measuring the carrier level with an RC filter on the detector output. As described last month, this network can seriously degrade modulation acceptance by backbiasing the detector diode. This can generate audio distortion even when ANL is turned off.

Preferred Circuit

Figure 1 shows the ANL circuit I prefer to conventional circuits. It eliminates the ANL's RC network and uses the AVC capacitor to measure carrier level. R1 + R2 is the detector load, while R2 / (R1 + R2) determines when clamp diode D2 conducts. D2 limits detected audio to the voltage on AVC capacitor C3. (C2 removes any residual IF signal and isn't essential to ANL operation.)

The sum of R1 and R2 affects modulation acceptance, while their ratio determines when ANL clips. I pick the sum as described last month, and the ratio so that D2 conducts only when

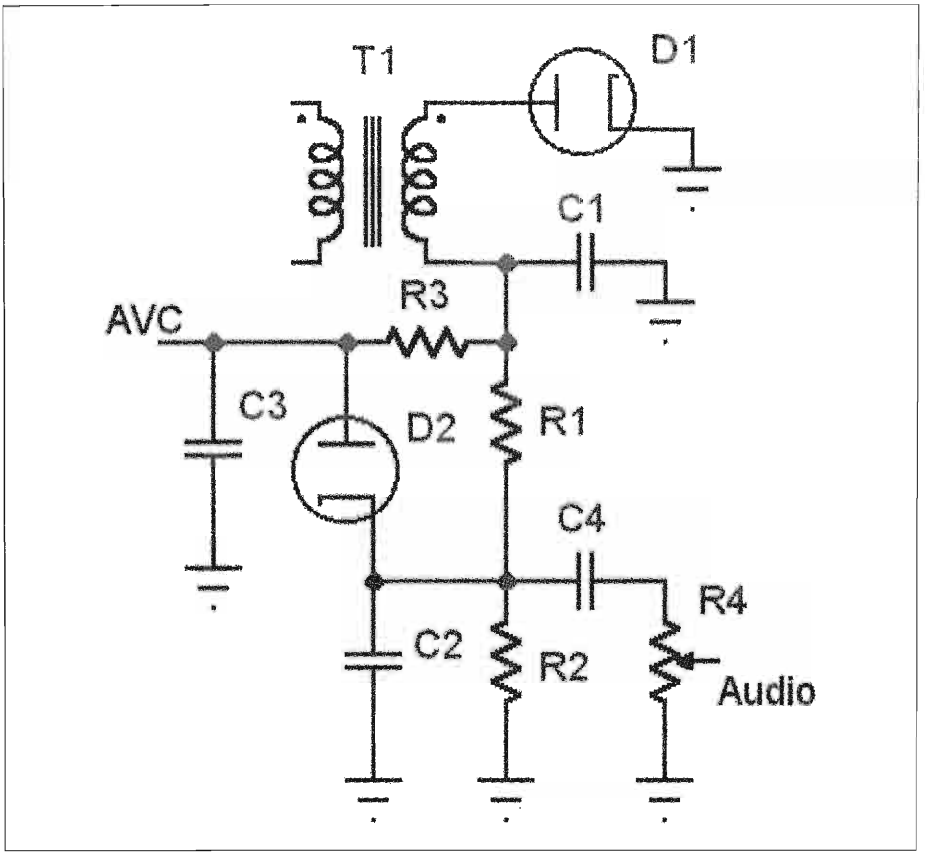

Figure 1: Schematic for the preferred ANL circuit as described in the text.

modulation exceeds 125%. This is the maximum upward modulation permitted for AM broadcast stations. You may find one or two local stations that exceed this limit some of the time on some program material. These stations are useful for testing. To pick R1 and R2, I tune to a local station that hits modulation peaks of 150%. I adjust R1 and R2 until D2 begins to conduct on signal peaks. Then I check that D2 never conducts on stations with 125% modulation. With the ANL threshold set this way, I never hear ANL artifacts or distortion, and I can leave it on all the time. I used 60k ohms for R1 and 46k ohms for R2 for the ANL circuit in my National NC-57.

I don't have a signal generator that amplitude modulates beyond 100%. Instead, I use my spectrum analyzer in nonscan mode with its linear detector to find a broadcast station with the modulation peaks I want. If I didn't have a spectrum analyzer, I would find the value of R1 and R2 where most broadcast stations just begin to clip. Then I would reduce R2 until no sign of clipping remained.

When limiting occurs, D2 injects some charge into C3 so that repetitive noise pulses tend to increase the AVC voltage and reduce the audio level somewhat. The effect isn't great unless D2 conducts for a sustained period. If you encounter a strong signal while tuning, for example, D2 will quickly charge C3. Once C3 charges to about

40% of the carrier level, D2 stops conducting and R3 charges C3 the rest of the way. This provides a very useful fast-attack AVC characteristic for strong signals. It permits you to use a long AVC time constant without suffering sustained audio blasts. An article next month will explain how a very long AVC time constant can minimize selective-fading distortion.

If your receiver shorts C3 to disable AVC, D2 will clamp the audio to ground. C3 must remain operative when AVC is disabled unless you disable ANL at the same time. A SPDT contact that switches the AVC line between ground and C3 will solve the problem, but sometimes you'll have to improvise. I've installed a SPDT relay in receivers that had only SPST switch contacts.

Although there is no steady carrier in CW mode, the detected BFO signal will keep C3 charged to a level where CW tones do not clip.

With R1 and R2 selected as described above, noise limiting is not as great as when the clipping threshold is within the normal modulation range. When I pick these component values, I trade some noise reduction for clean audio. I don't use ANL to suppress external noise because I keep my neighborhood free of impulse noise sources. Instead, I use ANL to suppress receiver switching impulses and tuning thumps, and to permit a very long AVC time constant. You can adjust R1 and R2 to put the clipping threshold wherever you want it.

Performance on Impulse Trains

To demonstrate the ANL circuit, I generated a 70%-modulated AM signal near 10 MHz with one signal generator and combined it with the output of a second generator sweeping 1 to 20 MHz every 17 ms. As it passed the receiver's frequency, the swept signal demodulated to a pulse 300 microseconds wide. I varied the relative levels of the two

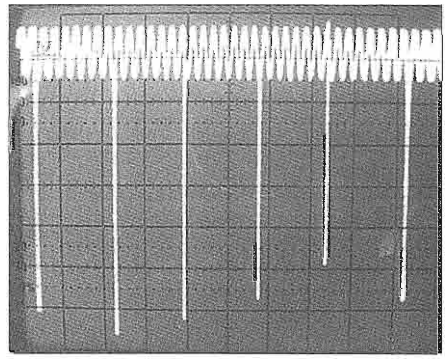

Figure 2: A train of noise pulses 17 milliseconds apart, ANL disabled.

generators to obtain the impulse level I wanted. Figure 2 shows the voltage across R2 in my NC-57 with the ANL circuit disabled. Figure 3 shows it with ANL enabled. While ANL has greatly reduced the impulse amplitudes, it also has dropped the signal about 3 dB. Pulses this rapid and strong raise the AVC level somewhat. This prevents the clipping threshold from being very close to the demodulated signal level.

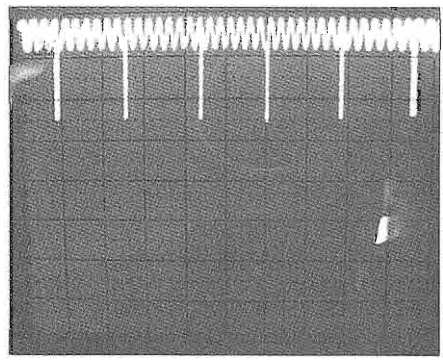

Figure 3: The same 17 millisecond pulse train shown with ANL enabled.

Figures 4 and 5 show ANL action for pulses 100 ms apart. Here I used a 100%-modulated signal. Because the pulse density is lower, AVC is less affected and the pulses are clamped closer to the desired signal.

The circuit of Figure 1 permanently engages ANL. If you want to be able to

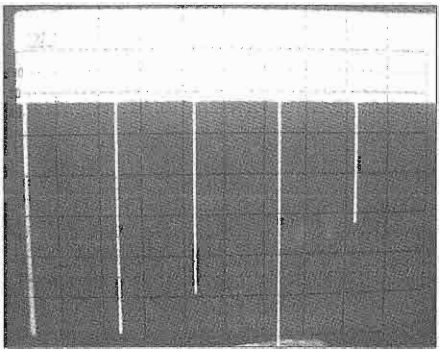

Figure 4: Noise pulses 100 milliseconds apart, ANL disabled.

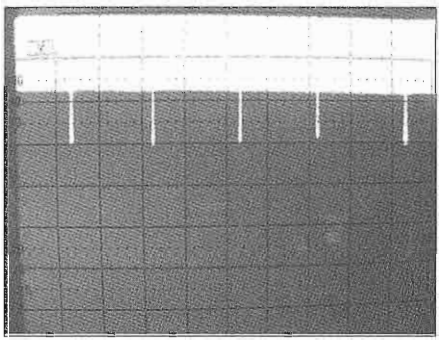

Figure 5: 100-millisecond noise pulses with ANL enabled.

turn it off, add a switch in series with D2. Since ANL is permanently on in my receivers, I use the ANL panel switch to select AVC time constants. The only time I find ANL undesirable is when sweeping the IF during receiver alignment. An internal switch (or unsoldering a lead) solves the problem.

With ANL always engaged, you begin to trust your receiver not to startle you with an unexpected outburst. I find that having it on all the time makes tuning and listening more pleasant.

ER

[...Comments, from page 1]

(UPLC), which is a Washington DC lobby association made up of utility representatives, equipment manufacturers, and lawyers. It is a subsidiary of the respected Utilities Telecommunication Council (UTC), which began as an FCC licensing service for power utilities. In the mid 1990's UTC became an industry lobby in addition to its spectrum and licensing services.

In 2002, the UTC and another company known as the Shpigler Group issued several case studies about the business case for, and the technology behind BPL. I am not able to obtain copies of these studies because they are for sale only--at a cost of at least $900.00 each to non-members of UTC.

In June 2003, the FCC issued a Notice of Inquiry regarding BPL. They were looking for comments on how to regulate the technology, and about the UPLC request to increase the Part 15 transmit power for the BPL transmitters. The deadline for comments was August 1, 2003 and then extended to August 20, 2003. I regularly monitor the FCC's web sites, and as of this writing—August 28, 2003—I am unable to find any updated information about any pending action. However, the FCC web site makes the claim that broadband Internet services are a "priority" with them.

At the UPLC web site, I found the following information dated 8-28-03, "For Immediate Release:"

FCC Commissioner Kathleen Abernathy to Keynote UPLC Annual Conference

WASHINGTON – Federal Communications Commission (FCC) Commissioner Kathleen Q. Abernathy will deliver the keynote address September 22 during the 2003 Annual Conference of the United Power Line Council (UPLC) at the Ritz-Carlton, Pentagon City in Arlington, Virginia.

"With the increased attention Broad-

[Continued on page 16...]

The Collins 310B Exciter

by George Stevens, WØATA
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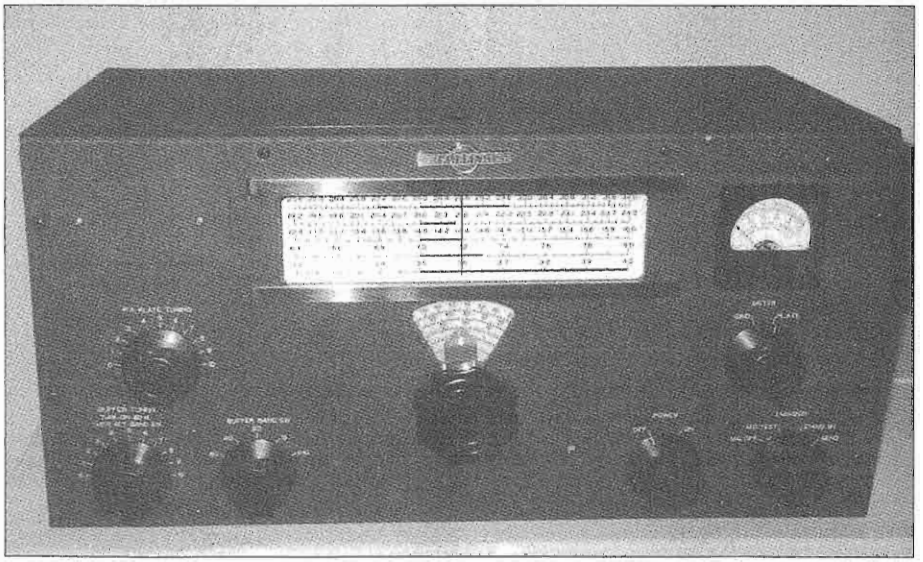
The first listing by the Collins Radio Company for the 310B appeared on page 44 of the 1948 Radio Amateur's Handbook. This unit seems to have the same general circuitry as found in the Collins 32V series and the 310A and C. For its time, and before TVI, it was considered to be the premium of all Ham band exciters.

In those days I was using a BC-696 on 80 meters and a BC-459 that doubled in the 1625 plate circuit to 20 meters, driving push-pull 1625 and 829B amplifiers. This worked well enough but there was always the lack of accurate frequency readout. The desire for something better surfaced when I first saw the 310B advertisement in 1949.



The Collins 310B first appeared on dealer shelves in the late 1940s.

The price of the 310B was listed at $190.00, a staggering amount in 1949, and certainly for a 16-year-old youth. Fortunately, due to the sale of my grand prizewinning baby beef steer at our local county fair for a big premium, I was able by 1950 to consider purchasing one. My father, sensing my extreme interest in electronics that might, and did, lead to a lifetime vocation, approved the purchase. It was not without a lot of soul searching, I am sure, for a farmer who had to watch every penny carefully and certainly did not understand ham radio. The unit opened up a whole new world for me and the frequency calibration and stability made for easier operation on the ham bands, especially during contests.

The 310B circuitry was pretty much standard for most of industry and did not change much until the use of fre-

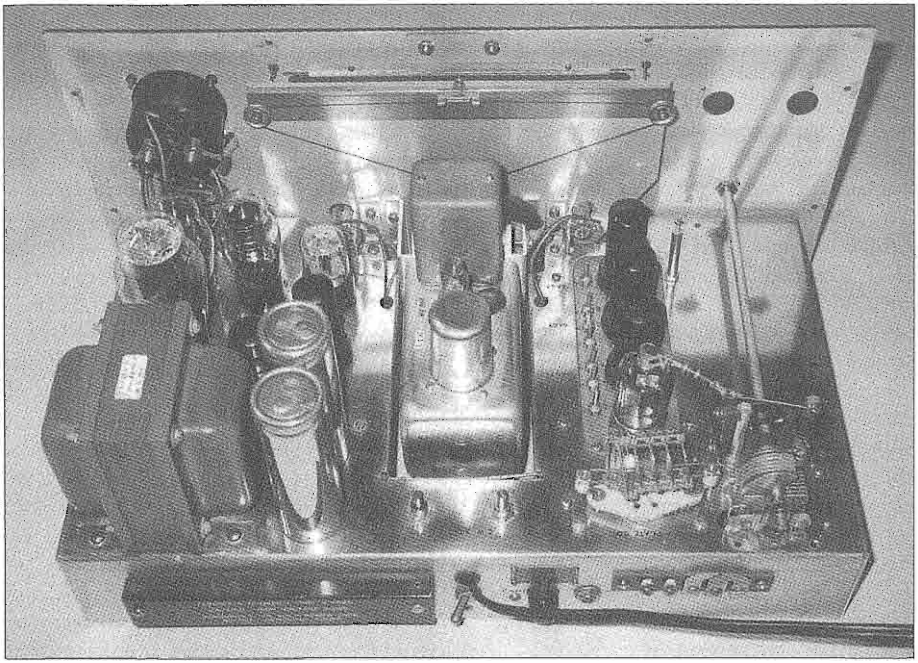
quency mixers became the norm. The unit started out with a premium (red) RCA 6SJ7 in a 70E-8A PTO unit. The PTO was available for purchase as a separate unit to save money. Its fundamental frequency is 1.6 to 2.0 megacycles (for you old geezers out there). The first stage, after the PTO, is a 6AG7, which always doubled to 80 meters. (Later I will tell you how to use the unit on 160 meters as well.) The second stage was another 6AG7 that doubled to 40 meters. The third stage 6AG7 doubled the 40-meter signal to 20 meters. To obtain output on the 15-meter band the second stage tripled the 80-meter signal and the third stage doubled it again. Ten meters was a little more difficult. The second 6AG7 had to quadruple the 80-meter signal to the 20-meter band to allow the third stage to double again to the 10-meter band.

Following all these frequency multiplier stages is a lonely 2E26 that runs straight through on all bands for a nominal carrier output of 15 watts, enough to drive most pentode type tubes to a full kilowatt. The 2E26 final uses four plug-in, 75-watt coils with a 75-ohm link circuit output to drive an amplifier. The same coil is used on both 15 and 10 meters. This transmitter was also available with a built in series-parallel tunable matching antenna network configuration with two coils for the five bands. This version was the 310B-3 but fewer units were sold because of the greater cost of $215.00. This makes the B3 unit much harder to find today. A rectangular plate, on the B1, covered up the two holes in the front panel used by the B3 antenna tuner switch and capacitor. Many B1 units found today do not have the plate. It was obviously taken off at some point and got separated from the main unit. Hams back in those days did not worry much about possible resale values and they did not mind drilling extra holes where they wanted them either. We shudder now at the thought. How many of those plates are now in the landfill?

There are three power supplies built in to the unit, using two separate windings on the power transformer. The first, with its own choke and filters, is a 5Z4 that delivers 300 volts for the 6AG7's and 6SL7 sidetone oscillator. Two voltage regulator tubes in series take this voltage down to a regulated 255 volts for the 6SJ7 master oscillator. A tap on this winding supplies 75 volts to a 6H6, which develops a minus 60 volts bias. This voltage is used in the block grid keying circuit and for the 2E26 bias. The second winding is rectified by a 5R4 and has its own filter choke and capacitors. It provides 500 volts for the plate of the 2E26.

Keying the unit, or putting the unit in the SEND position with the key unplugged, removes the blocking bias from the first two 6AG7 tubes allowing their operation. This raises the cathode voltage on the first 6AG7 to 15 volts, which is enough to turn on the sidetone oscillator. It also could supply audio blocking voltage to a 75A receiver of that early era, probably a 75A-1. The oscillator keying can be monitored with a 500-ohm or higher listening device. External relays were used in push to talk and other special external circuit functions

Alignment of these units is not an easy task. When in doubt, don't do the alignment. If you do, make sure you record all the original settings for the slugs and capacitors and hope that the previous owner hasn't messed with them either. If you own a good frequency meter this is helpful, but be aware that frequency multiplier stages always contain more than one frequency in their outputs. Use of a good oscilloscope is strongly recommended so you can determine the strongest, and desired frequency. The 310B units are more than 50 years old. Be careful



WØATA's 310B has been removed from its case for this illustration. Typical Collins quality construction is evident throughtout this exciter.

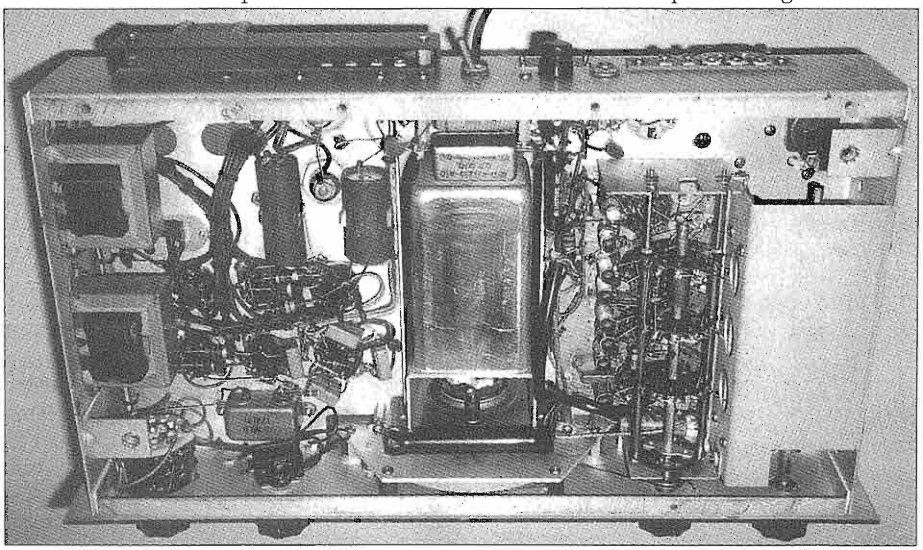
turning the slugs and capacitors. They may be stuck in their positions. Gently rock them back and forth to loosen them or use a little heat to break them loose. The bypass capacitors found in this area provided some interstage shielding but are very fragile. If you break one, a disk ceramic should be a satisfactory substitute.

If you must work on the PTO unit be very careful not to lose the ball bearing that is on the back end of the tuning shaft. I have swept the floor more than once to find the one I dropped. To avoid this, do not remove either the front or back structure plates of the unit, which are used to keep tension on the bearing. To remove the cast aluminum cover it is necessary to remove ONLY two recessed head screws on the front head assembly, the cover over the 6SJ7 and the 6SJ7 itself, the four pin phenolic contact assembly strip where the power enters, the silica desiccant unit next to the tube, and the cover over the external adjustment screw. The slug rack is a series of oval metal pieces that the arm of the powdered iron core rides over. Unless you change some of the components it should not be necessary to recalibrate the unit. If you do, loosen the screw holding the individual oval slugs and push them in or out while listening to the oscillator output on a calibrated receiver or measure the frequency on a counter once every complete turn of the dial, which is 25 khz. Sixteen turns cover the 1.6 to 2.0 mhz fundamental frequency. Calibration was considered a "factory only" task in 1948 but today it can be done in the field if necessary. Leave the silicon desiccant capsule alone. It has stabilized over the years and there is no need to remove moisture inside the sealed can. If you bake it out it will slowly absorb moisture again and recalibration may be necessary.

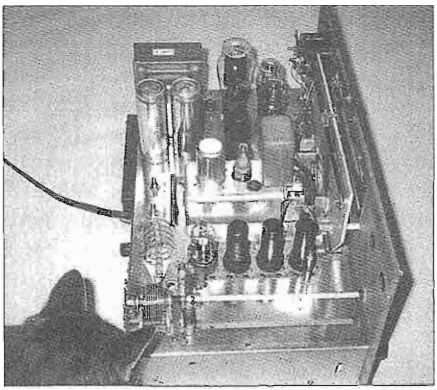
DO NOT attempt to clean the dial glass. Water will quickly wash all the frequency numbers off and you will be talking to yourself in a foreign language in short order. The only fix is to obtain a photocopy of an undamaged dial glass from a Collins collector and place it behind a new piece of glass of the correct size.

Putting this unit on 160 meters is not difficult. Take out the first 6AG7 tube, put in an octal test socket adapter, and plug the 6AG7 back in. Take the rectangular plate off the front of the unit by removing the two screws. Tie the plate inside the unit so it won't wind up in that landfill I talked about earlier. Place a 340 mmfd variable capacitor in one of the unused holes; making sure that it is well grounded. Using a short flexible test lead and an alligator clip, connect the hot side of the capacitor to pin 8 of the test socket adaptor. Using a switch to accomplish this adds too much capacitance to the circuit for normal operation and is not recommended. Adjust the 340 mmfd padding capacitor until 160-meter output is obtained. Record the setting. You will also have to plug a 5-pin, 160-meter coil into the 2E26 amplifier output circuit. B&W and Bud both made such a coil up into the 60's, or you can fashion your own using a five-pin tube socket and appropriate coil. The jumper can be attached at the same time as the coil is changed.

It may be interesting to note that I traded my 310B in on a Viking II in 1953. I built a VFO to drive the Viking so there went my frequency calibration. A few years ago I got a call from a friend who knew I was a ham radio operator. His father had a piece of ham gear that he wanted to sell but he didn't know much about it. To my surprise, when I contacted him it turned out to be a 310B. Needless to say some money quickly changed hands and I again had one. It has been completely checked out, aligned, and repaired where necessary. I hope to have it on the air shortly, both as a low powered transmitter and later on as a driver for an 813 amplifier. I may have to do some external filtering and shielding to avoid TVI but will keep it in original condi-



Once the Collins 310B is properly restored and working, this is an area that will be little seen due to the world-famous reliability designed into this equipment.



The night op (K1TTY-?) inspects the 310B tube line-up.

tion at all costs.

Perhaps in a later article I will expound on those first few wonderful years of Ham radio, which will never be forgotten. Those of us who were amateurs before and just after the big war had experiences that will never again be possible. We did not have "appliances" then, or appliance operators either. But then, we did not have moon bounce, or computers, or a lot of other fun things of today.

73, Steve, WØATA

Notes:

1. My thanks to Don, WBØZTO for editing this article.

2. One of the pictures of the 310B shows a "cats whisker". This is not to imply that Collins used this type of technology in 1948.

3. My revised Factory Test Methods Specifications procedure for the Collins 75A-4 should be available soon.

ER

[...Comments, from page 11]

band over Power Line deployment is being given by the FCC, having one of the Commissioners address our industry at the UPLC Annual Conference is something that all attendees will find constructive," said UTC President/ CEO Bill Moroney. "We are honored to have Commissioner Aberthnathy share her views on the emergence of new broadband platforms, like BPL, and how the Commission can fulfill the congressional mandate to take all actions necessary to remove regulatory impediments."

Abernathy was sworn in as FCC Commissioner on May 31, 2001 after being nominated by President George W. Bush and unanimously confirmed by the Senate. She is responsible for representing the public interest in policy areas under the FCC's jurisdiction, such as the regulation of broadcast television, cable and satellite telecommunications, wireless telephony and consumer protection. Other positions held at the FCC include Telecommunications Legal Advisor to FCC Chairman James H. Quello and Legal Advisor to Commissioner Sherrie P. Marshall.

Abernathy's experience in the private sector includes Vice President of Public Policy at BroadBand Office Communications, Inc., partner at the law firm of Wilkinson Barker Knauer, Vice President for Regulatory Affairs at U.S. West, Inc., and Vice President for Federal Regulatory at AirTouch Communications, Inc. ..."

"... Broadband over Power Line (BPL), the delivering of high-speed Internet connectivity over existing electric distribution lines, is now a reality in North America [Where?...ed]. This new technology will enable utilities to provide a range of commercial services, such as high-speed Internet access and home networking, while also enabling these companies to improve the reliability and efficiency of electric ser-

[Continued on page 24...]

Installment 3

W. J. Halligan
Newspaper Reporter and the State of Radio 1923-1924, Part 2
Listener Vignettes Inspired by the Advent of Radio and Vignettes Inspired by Radio Associated Witticisims.

by Robert E. Grinder, K7AK
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Full outline of Part 2:

A. Vignettes inspired by the 1923-1924 era
   1. Contemporary happenings
   2. Pertinent statistics
   3. Radio manufacturing in the United States
   4. Radio in other countries
   5. Musings—Bill Halligan
   6. Emerging need for an international language
B. Listener vignettes inspired by the advent of radio
C. Vignettes inspired by radio associated witticisms
D. Epilogue
   1. The Pallophotophone
   2. The patent mess
   3. Radio in other countries
   4. Wavelength or frequency?
   5. Reginald A. Fessenden
   6. Emerging need for an international language
   7. References

B. Listener Vignettes Inspired by the Advent of Radio

London citizens get the correct time from "Big Ben," in Trafalgar sq. Several Boston citizens have found that the criterion of correctness, so far as "time" goes, is Motorman Fitzgerald who runs the "midnight" from Adams sq. Fitzgerald has a crystal set on which he catches Arlington time signals every noon. Midnight commuters are all synchronizing their watches with Fitz's. [3/5/1923]

French cafes and dance halls find radio a cheaper source of musical entertainment than hiring an orchestra, now that the minister of finance has raised the tax on paid entertainers. [3/7/1923]

Students of shorthand and typewriting are putting radio to a novel use. Several of them have found that their speed is enormously increased by taking down the spoken words sent out from the broadcasting stations. [3/15/1923]

Edward R. Danforth of 67 Eddy St., West Newton, has found a new and important use for radio. The Danforth family ceases its babel, he says, only when the radio set is functioning. And during this lull in domestic chaos Mr. Danforth finds ample time to peruse his evening Telegram. [3/23/1923]

Jack Falvey, well known in financial circles, is unable to decide between Boston and New York as the city of his choice. Seeking to avoid charges of favoring one city or the other, he has installed a radio receiver in each of his

homes in the two cities. Now, when he's in Boston, he hears all that's going on in New York, and vice versa. [4/20/23]

Radio has made possible the broadcasting of radio extension courses. While engaged in an extensive course of study the student may listen to the same lecture and hear the same recitations as students attending these institutions. Microphones installed in the lecture and classrooms of the educational institutions and wires carry lectures and technical discussions to the broadcasting stations, where they are sent out into the air and picked up by the extension course student, if the latter is provided with a receiving set. [4/20/1923]

Radio music recently broke the silence of Leo Kuehn of Detroit, who has been deaf and dumb for 26 years. For the first time in his life he was able to hear voices and music and to speak words, the first he has ever spoken. The silence was broken in the Detroit Free Press radio station when Kuehn participated in an experiment that will eventually enable him to speak. A set of high-powered receivers were attached to the amplifying panel and with radio frequency amplified 20 times, M. R. Mitchell, radio engineer at the station spoke the word "Ford" into the microphone. Kuehn heard sounds, but wrote down on paper that he did not understand the word. It was repeated and he understood. He then signified that he wanted to talk, and he said "Holy, Holy, Holy" in a weak voice. It is said by specialists that Kuehn will never fully regain his hearing. He will, however, through radio, be enabled to learn the use of his vocal organs. [4/20/1923]

Several New York hospitals have installed radio receiving sets in the convalescent wards and excellent results are reported. Dr. Dowling of the Boston City is a truly progressive man and he, no doubt, will ask that his institution be equipped with a radio for the use of the patients. [4/25/1923]

Another radio widow made her appearance in Los Angeles, Calif., the other day. One small inoffensive radio set has been named as co-respondent in a divorce complaint, which has been filed in the Superior court in that city. The principals are Mrs Grace Purdy and Kenneth C. Purdy. Mrs. Purdy charges that instead of furnishing her with money for clothes, Mr. Purdy used all his free change on radio material. This in spite of the fact that his income was stated as over $500 a month. Not only did the recalcitrant husband spend all his money for radio, but he spent all his time in the company of his new desire, declares his wife in the complaint. [4/25/1923]

Crowds on Atlantic City's boardwalk were surprised, one Saturday afternoon recently to hear voices of invisible speakers and singers above the boom of the surf and the myriads of sounds peculiar to the "Great Wood Way." The sounds came from a set of amplifying apparatus, technically known as a public address system, installed by the Western Electric Co. and being tested for a group of city and hotel officials. A motor truck carrying the vacuum tubes, control apparatus and batteries was parked alongside the Brighton Hotel. Wires connected it with a microphone in the concert hall of the National Exhibitors and to sound-projectors mounted at intervals on the Brighton and Traymore. Speeches and music were distributed clearly along 2000 feet of the Boardwalk. [4/27/23]

Helen McShane of Somerville and her radio are inseparable. She's moved her set to the chiffonier so that while she's fixing up to go out to a party or some other function, she can listen to WNAC or WGI. She maintains that some of the dance music which filters into her station [sic] before she leaves

for a dancing party is necessary to a successful evening or something like that. [5/3/23]

While in Atlanta recently on a radio inspection trip, Commissioner Carson, of the Department of Commerce, was advised that his best team of mules had disappeared from his farm in a nearby state, and, being in the broadcasting station of a local paper, he let their loss be broadcast with a description.

A few days afterwards when in Nashville, he was advised that his mules had been found wandering miles from home. Whether radio was responsible for their discovery or not cannot be proved, the commissioner says, but he believes it was instrumental in their release from temporary confinement.

"I was glad to get them back," he added, "they were good mules." [5/17/23]

In keeping with the rapid progress in the radio movement it will soon be possible to "listen in" from rooms of a large hotel in Minneapolis, which has contracted for the connection of each of several hundred rooms with radio plugs. The guest will not have to invest in a receiving set, as headphones may be rented for a small fee from the clerk's office. [5/17/23]

Miss Alice Dennett of 82 Glenville Ave., Allston, a particularly charming BCL finds radio both interesting and instructive. She is studying shorthand and obtains much of her practice from the lecturers at the local stations. [5/24/23]

Harley Carter, of the Weymouth Light and Power is one fan who has found a good use for radio. He traces leaky transformers by mounting a single tube set on his flivver. He thus saves the company some money and at same time removes the atmosphere of one of the most annoying kinds of interference. [8/16/23]

The property room, backstage of the Boston Theatre, is the scene of much interest and excitement these days. Never in all its 69 years of existence has anything so drawn the case-hardened attaches of the theatre as the radio set which has been installed there. Bill Donnelly, the stage manager, is the owner and operator of the set. His audience or group of attentive listeners—or whatever you will, include actors and actorines on the bill, Charlie Frank, the orchestra leader; Charles Harris, the house manager, and about everybody else connected with the theatre.[5/31/23]

Another and probably the most novel use to which a radio set may be put is reported by Mrs. Catherine Rutherford of 28 Alaska St, Roxbury. No need now for the male member of the Rutherford household to pace the floor at night in an endeavor to lull the lusty-lunged heir to sleep. One phone on the baby's ear and the broadcasting station does the rest. [8/15/23]

Charlie Wilson of Glenville, Ave., Allston, is another returned camper. Being an out-and-out radio bug, and seeking to avoid the rubber stamp idea, he named his cottage WNAC. He says that every kid who passed the place knew what the letters meant, saying: "look, there's Shepard Stores." [7/13/23]

Father Burke of St. Augustine's parish, South Boston, is an ardent radio fan. He has purchased an excellent three tube set for the use of the boys of the parish. The set saw service this summer at the parish camp at Manomet and is now being installed in the rectory to be used by the boys' club during the winter. [9/6/23]

Bill Coady of Watertown, veteran newspaper photographer is active again after a two week illness. Bill, who owns one of the best and most complete receiving sets in Boston, says that he found great solace in radio while confined to the sick room. [9/16/23]

Rev. Earl E. Harper of Auburndale

has installed a receiver in the Centenary Methodist Church, of which he is rector. [9/17/23]

Everett A. Kelley, of Saunders St., Allston, is one of the many who have found a practical use for their radio receivers. Mr. Kelley is superintendent of a division of the "El," and in this capacity he must know the kind of weather which is to be expected. His son is a radio expert, having had his training in the army. [9/21/23]

Here's a problem which Edward O'Rourke of 61 Mindon St., Roxbury, would like to have solved. Might call it a problem in economics, or something of the kind, but here it is: Mr. O'Rourke has four daughters and a four-tube set. The said four females insist on hogging the works, or relegating the kindly father to the background whilst concerts are being broadcast, we are told. And now the father, anxious and eager to enjoy the blessing of radio, and realizing that the family must be allowed a share of the entertainment, is debating whether he should now buy four sets of phones or one loud speaker. [9/29/23]

A group of girl radio fans, all of them employees in the radio department of a Boston store, are forming a club which they will call the "Radio Girls of Boston," or something like that. The members to date are the Misses Blanche McCourt of Malden, May O'Hearn of Somerville, Rae Davis of Dorchester, Fanny Crow of Somerville and Georgia Kilbride of Allston. [10/4/23]

Jim McDonald of Charlestown, he of the automobile and sheik fame, is twirling the dials in great shape. Why, argues Jim, need a fellow be a part of the angry mob which awaits the baseball scores outside a newspaper office, when one has a radio set? [10/12/23]

Picture an old country store, a county seat, with the men of the district sitting around on the counters and cracker barrels, bandying the news of the day. In just such an atmosphere, place fully equipped radio receiving set and you'll have an idea of what Homer Burnham's "Overbrook Store" in Wellesley looks like, almost any night now. [1/8/24]

Dr. Arthur Gwinnell of Columbia St., Allston, plans to carry the principle of "comfort for waiting patients" even further than others of his profession. Where doctors usually provide magazines and papers while patients are waiting for treatment, Dr. Gwinnell has purchased a radio set which he will install in his waiting room. [1/12/24]

At least nine families and certainly many more suffered destruction of their aerials during recent gales which raged in this vicinity. The wind worked particular havoc on the roof of an apartment block at 74-78-82 Glenville Ave., Allston, which until the big wind, was nicely adorned with nine beautifully constructed antennas. Then something gave way and the aerials which had previously been pointed at with pride by their several owners, became a tangled mass of wire and insulators. Among the orphans of the storm was Ed Coady, widely known theatrical photographer. [1/24/24]

Discomfiture bordering on mental illness usually awaits a new initiate to a fraternal or social order, as he awaits his turn to "ride the goat." Realizing this, Nonantum Lodge , I.O.O.F. of Allston, has decided to be charitable to the newcomers. A radio set is to be installed in the outer lodge room with which, it is hoped, the applicant will be kept in good humor while awaiting the grand festivities. [2/5/24]

Operators at WHZ, Springfield had the experience of hearing the concert being broadcast from their station recently as it was picked up in Natick. "Alf" Hoy, a resident of Natick was receiving the Springfield program loud and clear. He put through a call for the Springfield station over the land telephone line, and when the connection

was made, he placed the telephone transmitter near his loud speaker. The Springfield operators declared that they heard the programs perfectly. [2/27/24]

There are moments in the life of a newspaper man when murders and riots and other things which project themselves into the news columns are nonexistent when the world, so far as news is concerned, is at rest. During such times the reporters on the "night side" at police headquarters twirl the dials of their new three tube set, successfully bringing in stations from all parts of the country. And when their tasks are completed each night they return the apparatus to its place of daily repose, a locker, which to the dismay of the "day gang," is heavily padlocked. [3/4/24]

Joe Fahey, bail commissioner, has made at least two life-long friends in patients at the Boston City hospital. Realizing the boon radio is to the sick, Joe recently installed two receiving sets at the hospital for patients there. It would be a great old world if there were more men like Joe. [3/19/24]

Radio experimenters tried what they consider a more difficult test than that made under the Hudson River recently. They took a receiving set into a tunnel 200 feet underground, where ground capacity was high, and report they heard signals from Chicago and Philadelphia. [3/31/24]

Another example of restored hearing through radio comes from Farmdale, Ill., where Helen Houston had lost use of her ears after an operation. A high note from a singer from a Davenport, IA., station is said to have broken her deafness. [4/28/24]

Poor children of Detroit recently were converted to radio without cost. A Detroit radio manufacturer furnished enough to receive local concerts. They were already so tuned that they needed no adjustment. [4/28/24]

C. Vignettes inspired by Radio Witticisms

"Radio will reform criminals," reads headline. "What'll it do to them that aren't criminal?" asks a well-known fan. [3/ 7/23]

Loop antennas ought to sell in China like the oft mentioned "hotcakes." In one Chinese city difficulty is experienced with natives who refuse to permit the erection of outdoor aerials because they fear the wrath of the god Fungshui who objected to all projections in the air. [3/8/23]

Here's a good one from Q.S.T.—The mayor of San Francisco recently dedicated a broadcasting station in his city and in his talk invited everybody who heard him to send in a collect telegram so that he could see how far his voice was carrying. By midnight, at least one telegram had come from every state in the Union, and by daylight it was estimated that the mayor had incurred a total bill of $3,000, with the possibility that the figure might be doubled. [3/14/23]

George H. Clark, of the Radio Corporation may be a good engineer, but he's also a good comedian. He kept the audience of broadcast listeners and "hams" in "stitches," as the saying goes. [4/3/23]

The call letters of the Detroit police department are KOP. Someone with a sense of humor must have issued this one. [4/5/23]

For a plain, untechnical definition, static is that thing in radio that sometimes sounds like frying eggs and sometimes like the cat's meow. It's what you hear when you can't hear anything. [4/30/23]

The first wireless "tail-e-phone" in Leadville, Colorado, was taken there by C. B. Cooper, New York representative of the Crosley Manufacturing Company, Cincinnati. The old photograph, which Mr. Cooper values highly, shows a group of construction engineers and was taken in 1905, when they installed

the first wireless [sic] telephone equipment in Leadville. The "tail-e'phone" gets its name from the fact that one of the engineers has hold of the tail of the burro and its tip is placed to his ear. [5/4/23]

Scene: More than a dozen grown men seated in an ante room of the Nonantum lodge, I.O.O.F., of Allston, all talking at once of variable grid-leaks, tubes, condensers and what not. The pounding of a gavel is heard in the main meeting room. But no one heeds the pounding nor the querulous voice of the noble grand, who is trying frantically to bring the meeting to order. Suddenly a bomb explodes. The more than a dozen grown men, together with others not in their group, begin rapidly to ascend in what is generally believed to be the direction of heaven. A passing aeronaut observes that the more than a dozen, etc., are still deeply engaged in conversation even as they pass him on their way up to what is conceded by many to be the direction of heaven. This is not in the least remarkable, gentle reader, for these more than a dozen, etc., are radio bugs. [5/20/23]

S. G. Brightman of Breck Ave., Brighton, vice grand of Nonantum lodge, I.O.O.F., of Allston, is a great radio fan. As he is on the sick committee of the lodge, his time is all taken up between radio and sickness. [10/5/23]

Two hams were heatedly discussing 1-CRE's manner of signing his call. We shall refer to them as A and B. A declared that he didn't take favorably to the way 1-CRE had of separating the letter E from the rest of his call. Whereupon B pointed out that if 1-CRE were to get the letters closer together, 1-CRE would get all his DX cards. Which may or may not have been a witty remark. [10/12/23]

Follow the minutes of a meeting the "Wonderers Club" as recorded by 1-KH:

Quiet please. The meeting is called to order. Our business this evening takes up considerations, a thought and a wondering.

Consideration number one is that we have a receiving set with amplifiers and a loud speaker, and the set is tuned to X meters wavelength.

Consideration number two is that we have a radiophone transmitter which is entirely separate from our receiving station, and that this transmitter is also tuned to X meters wavelength.

Consideration number three is that we place the loud speaker of our receiver before the microphone of our transmitter. Both sets being placed in operative condition.

Consideration number four is that we shout "hello" into microphone of the transmitter and listen.

The thought is that the speech will be transmitted by the transmitter and received by the receiver from the transmitter, and amplified and loud-spoken directly into the microphone of the transmitter and re-transmitted and re-received, etc., etc., etc., et cetera.

The members will now please join in wondering how many times our spoken "hello" will be re-transmitted and re-received before combining conditions connive to conquer this conjuration.

The meeting is adjourned for further consideration of the subject. [10/13/23]

"All I seem to be able to pick up on my radio set is 'frying sounds,'" Tom Edison, world renowned inventor, is reported as saying. Probably, not unlike another famous man, Tom's set is in the kitchen. [11/1/23]

1-QA has many friends. One of them recently offered him the price of a bottle of glue so he could put up his ham cards. How's that for generosity? [11/15/23]

Puzzle—Who is the ham with the patent leather haircut? Oh; girls, Look,

1-COC! [11/20/23]

Tell 1-BHO to spit out his chewing gum before he uses phone. HI HI. [5/20/23]

Everybody knows the wonders of radio, with concerts and church services and radio theaters, and the things not so common such as radio movies and the transmission of power by radio. But now comes Eddie Curtis, the South Boston radio engineer and sighs because science has not yet advanced to the point where he can partake of his Thanksgiving turkey by radio. [11/28/23]

Headline says "Radio Corporation will sell tube transmitters." Anyone who has done business with the widely known corporation would hardly suspect they were going to give 'em away. [1/21/24]

Atty. William R. Scharton, it has been learned, is a radio fan of the first water. Tackling the new science with his customary enthusiasm, "Billy's" conversation these days is richly interspersed with couplers, detectors, and ticklers. Al Jacobs, a close friend of Scharton insists on calling the crystal detector the "tickler," and making similar "bones." [1/24/24]

The ether about station, KFK, the experimental station of the Westinghouse Electric Co. in Hastings, Neb., is highly charged electrically, at least the dog population of that section will tell you so. Two stray dogs came wandering within the enclosure which surrounds the station, and which serves to prevent anyone from coming in contact with the insulated counterpoise when the station is in operation. They played around the ground and were running under the counterpoise system, which is placed only two feet above the ground. Suddenly, an agonizing yelp was heard, and two streaks of brown and black fur came running wildly for the gate. The current had been turned on in the antenna, just preparatory to broadcasting, and the animals became caught between the highly charged counterpoise and the ground, thus forming the circuit which effectively "grounded" the radiating system. [1/25/24]

A recent military exhibition in Cincinnati had a radio receiving set fastened to a hat. Next they will be equipping them with transmitters and talking through them. [1/28/24]

Powel Crosley, Jr., recently spoke from WDAP, Chicago, and asked Dr. McMillan, the explorer, whose ship is a few degrees from the North Pole, for a No. 1 iceberg to be placed in the yard of his Cincinnati home. A radiogram from him saying he received the order and that the iceberg had been shipped was received at the Chicago station. By the size of the piece of ice the iceman brought to Mr. Crosley's home, he thought the iceberg must have been carried near the firebox of a locomotive. [1/30/24]

A voice from the telephone in the WLW radio station asked for the manager of the six-piece orchestra which had just finished the number. All six musicians rushed to the phone to get the message. [1/30/24]

Every individual emits a radio wave, according to a Paris expert. These waves, like finger prints, are of lengths peculiar to individuals and may be picked up by a receiving set of particular design, the expert claims. Some local amateur should get his wave meter in operation and give the rest of the world the dope on the waves we mortals work on. [2/14/24]

George Lewis of the Crosley radio plant was asked to suggest some sort of code work that could be used in a forthcoming contest to be held from the WLW station. His suggestion was to reverse the order of the letters WLW. [2/19/24]

A European inventor has devised a loop antenna on a tube like a bicycle

tire. When wanted for use it is inflated so that the wires are held out in loop form. [2/23/24]

The musical program given during the food show in Cincinnati was broadcast by Crosley's WLW station directly from Music Hall. A wag telegraphed he heard some one eating soup. [3/10/24]

The annual dog show in Cincinnati was appropriately announced by an English bulldog belonging to Dr. Glenn Adams from the Crosley studio. Mrs. Nan Hats-off, the wonderful animal, stood right up to the microphone and made a few "rebarks" to the listeners which were interpreted by the doctor. [3/26/24]

At the Great Lakes Naval Training Station, where radio operators are trained, the new fangled psychological method of increasing speed in code reception, while the partly trained gobs sleep, is being used with as great success as met the initial sleep instruction tests at Pensacola. One night, after sending at high speed to 17 sleeping embryo operators equipped with "ear muffs," a petty officer ended his watch with the code message: "Hey gobs, get up; it's five-fifty-five!" Much to his surprise the snoring ceased, three of the men awoke, and in a few minutes the other 14 rolled out, asking what was the matter. The flabbergasted petty officer now admits night code practice may not increase receiving speed, but he knows it will get the students up at four bells.[3/27/24]

The proprietor of a radio store on Portland St. discovered the cause of the many hums and other noises he was picking up, when climbing to the roof of his establishment he found a wire from a power line had fallen across his aerial. Fortunately the wire was insulated or he might have received something more than mere hums. [3/29/24]

A new superstition is going the rounds especially through the farming population of Europe. It is the belief that radio is responsible for thunder and lightning. The result is an opposition to the growth of radio in Europe. [5/3/24]

[Editor's note: The conclusion of Part 2 will appear next month in the October issue of Electric Radio]

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[...Comments from page 16]

vices to their customers. The UPLC Annual Conference will provide technical details directly from the companies on the cutting edge of deployments. Find out how soon BPL might be available in your area, and what services that it could support there."

My conclusion from this research is that the industry groups would like everyone to think that BPL is a "done deal". I think it is quite a way from being a service one can sign up for. The equipment has not been proven, hasn't worked in other countries, and full implementation will be extremely expensive. The BPL network will have to accept interference from other services as does any current Part 15 device--*unless they get the rules rewritten*. Does this mean that it is OK for the power company's service technician to wipe out Internet service for an entire neighborhood when he picks up the 2-way mic to call the dispatcher? How about police department operations, or the rescue service? Or our AMI nets?

I think support of the ARRL and their efforts to represent us in this matter is critical. You can call them to obtain paper copies of information about BPL. They have excellent information available at these web sites: ww.arrl.org/news/features/2003/06/19/2/ for general information, and at www.arrl.org/tis/info/HTML/plc/ for links to all kind of information about BPL. Please consider financially supporting ARRL in the fight against Broadband Power Line if at all possible.

Keep those filaments lit!

73, Ray, NØDMS

Reviving Another Old Workhorse- The RCA BTA-1R1

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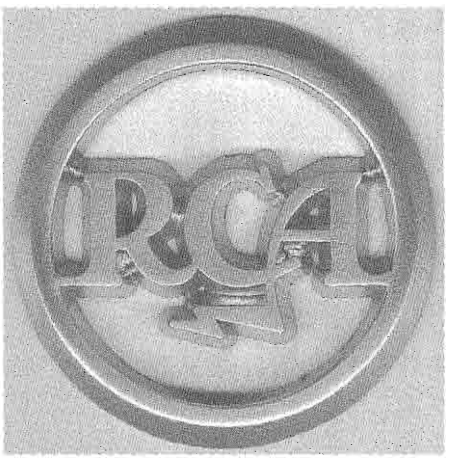
Introduction

The RCA BTA-xxRx series of transmitters was manufactured from the late 1950's thru at least the late 1960's. The RCA *Broadcast News*, Edition #100, April 1958, featured the first public announcement of the then-new rig. The 1kW output unit that I have came in four model versions, the BTA-1R, 1R1, 1R2, and 1R3. Only minor differences occurred between models, especially the later versions. The original 1R used a full wave 3 kV DC HV supply with a pair of 8008 rectifiers and a choke input filter. The plate transformers in this version had a history of early failure due to winding to frame shorts. The remaining versions used a solid-state (SS) HV bridge supply with a much more reliable plate transformer. The 1R also used heat generating power resistors for power cutback to 500 or 250 watts while the 1R1 and later versions had extra primary taps on the plate supply transformer to allow an efficient reduction in PA and modulator plate voltages. All versions use a 600V SS choke input LVDC supply for the AF and RF driver stages, a SS bias sup-

ply for the audio stages, and 4 separate filament transformers for the various tubes. A Conelrad kit was offered as an option to allow emergency operation on either 640 or 1240 kcs thru at least the 1R1 model. A solid state RF driver was offered as an option for the 1R3. The 1R series was the next to the last of the RCA 1 kW AM rigs with the more compact BTA-1S offered later. Primary power is 208 to 240 VAC 30A SP and a continuously powered 1-amp 115VAC circuit for the crystal ovens.

The 1R1 uses a pair of 2E26's and a pair of 4-400's in push pull for audio. A complete audio and DC bias negative feedback system is employed along with a 50-henry modulation reactor to improve distortion and frequency response. Along with the out of phase audio, a portion of the plate voltage is fed back to the 2E26 grids as a positive grid voltage of about 20 volts. The 2E26 cathode voltage is 40 volts giving -20 volts bias. For low distortion, the AC and DC voltages should be within 2% of each other, tube to tube.



A small plug-in printed circuit board holds the crystal ovens, crystal switching relays, the 6AK5 oscillator and the 5763 buffer. The RF driver is a 6146 to a pair of 4-400's in parallel for RF. Up to three crystals can be selected. The RF driver circuits are somewhat broadband. There is one tapped choke- like coil on the 6146 plate that is set for optimum drive. The PA 4-400 screens are self-modulated from the B+ thru a day/night (high-low power) switched screen-dropping resistor. There are no other tuning adjustments or frequency determining parts in the oscillator or driver stages. The output circuit is a PI-L with an additional series tuned 2nd harmonic trap. No harmonics on 80M here! RF taps are provided from the 6146 cathode to feed a frequency counter and from the antenna output circuit to feed a modulation monitor. The later is simply a 350 uH choke coil with 6 taps to allow feeding about 1 watt to a 75 ohm terminated cable to the modulation monitor. More will be said about this coil later.

The 1R1 has a motorized RF power control, single knob tuning, and one switch operation from 1 kW to either 500 or 250 watts. This makes setting up the "night" position to the legal limit 375 watts output easy and maintains reasonable transmitter efficiency. The transmitter control and metering can easily be remoted to the shack and a custom built panel is being constructed at W3LW just for that purpose. The blower that cools the 4-400's is quite noisy so the 1R1 cannot be in your AM "studio". Since this transmitter lived its life in an unheated transmitter shack, I decided that it would find a nice home in my garage.

History

This particular RCA transmitter was manufactured in 1962 and was first used at WXUR-AM, 690 kcs in Media, PA. It later was purchased by WVCH, 740 kcs, in Chester, PA, after WXUR lost its license because of violations regarding the FCC fairness doctrine, the only station ever to loose its license from that FCC rule. But that's another

Figure 1: The big oven at work drying the modulation reactor.

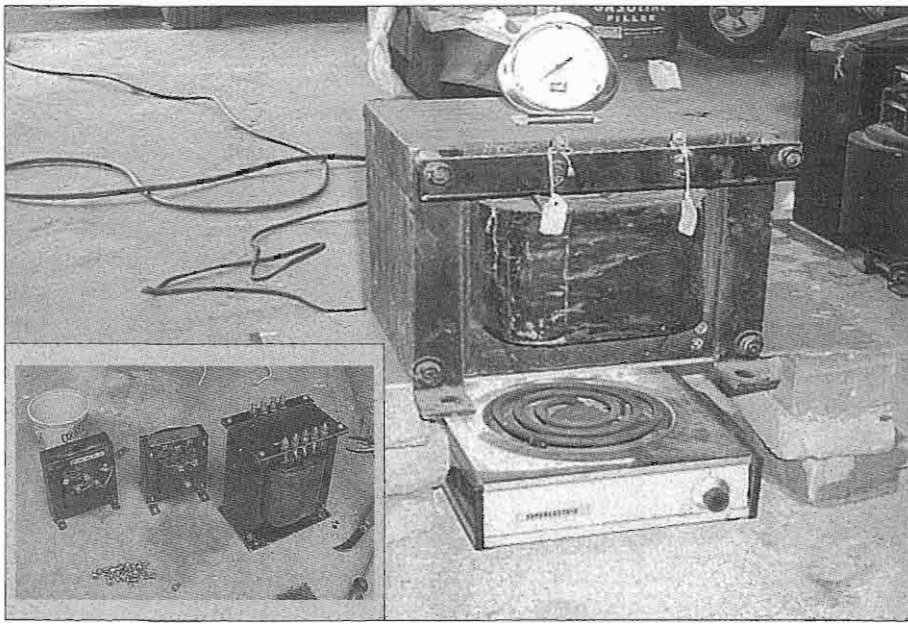
story. In fact, from my location, I could see the WXUR 4-tower directional array before it gave way to a housing development. I acquired the transmitter in February 2003 from WVCH. It had been out of service for several years. I used a local moving company to move it rather than killing myself. That turned out to be a smart move and the transfer went smoothly.

Restoration

After getting the rig to the garage, I decided that I should do quite a lot of work prior to applying any power. I planned on cleaning everything up and then checking the rig on 740 kcs before making the change to 160M. I secured a copy of the RCA "IB", instruction booklet from my friend of many years, William, W4BZ.

The rig had some rust mainly confined to the cabinet base and to some of the "iron'. I removed the 4" electrical raceways and the two mounting rails from the bottom and cleaned up the rust, applied Prestone® Rust Remover and Protector and sprayed the parts with several coats black satin enamel. The transmitter was positioned on a pair of 4" x 4s" and 1" strips to allow easy removal of these components. My trusty "Johnson Bar" made this task as well as exact positioning of the 1000 pounds plus rig easy. A lot of time was spent removing dirt, a little bit of mouse residue, and general "gook" from the rig. This process used forced air, vacuum, and various cleaners including Fantastik® and Goo-Gone®. The black 'RCA style" knobs were cleaned and polished on a cloth wheel with jewelers rouge.

A check of all the iron with a 1000V 1000 megohm ohmmeter showed excessive leakage (less than 1000 megs) in the modulation reactor, the driver plate transformer, and the control transformer. The control transformer makes 110VAC for relays and lamps from the 240V input. The smaller transformers were baked in the kitchen oven at 140 degrees F for 5 hours. For the very heavy 50 henry modulation reactor, I fashioned a homemade "oven" using a



The guts of the big oven showing the large 50 henry modulation reactor are in the main photo, and the inset photo shows how the control and driver HV transformers look after baking and re-dipping in transformer varnish. The third unit is a spare control transformer.

thermostatically controlled single burner hotplate and a hood made from an old water heater jacket (Figure 1). This allowed me to cook the transformer out in the garage near the rig. An oven thermometer allowed me to set the oven temperature to 140 degrees F and after 25 hours of "baking", the leakage was cured. All of these transformers and chokes were then dipped in transformer varnish to reseal the winding from new moisture incursion.

The RCA AM rig, and most commercial rigs, use nickel-plated brass hardware. This is beautiful hardware but, after time, the nickel shows some tarnish. A weak (20-1) solution of muratic acid in water cleans up this hardware beautifully. After the acid bath, which was limited to about 1 minute maximum, I neutralized the parts with baking soda then a triple rinsed in clear water. All hardware that was removed for any reason was treated this way. In addition, the RCA uses custom sockets for the 4-400's. These were completely dis-assembled and the hardware and contacts were all cleaned in the acid bath. Contact resistance was checked after assembly and found to be less than 0.1 ohm.

The wiring harness was in pretty good shape so was not replaced except in a few areas where some wiring had become brittle. The HV wiring was all in excellent condition and only required a little external cleaning with Fantastik®. The 1.9 mH plate choke and the 500 uH modulation monitor tap coil were both cleaned and re-doped with coil dope. All out of tolerance resistors were replaced including some precision resistors used for metering. All capacitors were checked and all were found good. All switch and relay contacts were cleaned and burnished. The plate, day and night contactor fixed

and movable contacts were removed, cleaned in the acid solution, and re-installed. The two HV relays in the 4-400 plate and screen circuits were completely dis-assembled, cleaned and re-assembled to remove the load of black soot on and in each one. The two 6 uF HV filter caps were cleaned up and the brackets painted machine grey. The 3 HV mechanical crowbar HV shorting assemblies associated with the front door and rear panels where completely dis-assembled, cleaned and lubricated to eliminate sticking. A HV grounding stick from another RCA transmitter was installed.

The blower that came with the transmitter was a replacement unit and runs on 110VAC rather than the original 240VAC. The engineer simply returned the power to the transmitter frame rather than the neutral. Since I was running a new 30A 240 SP circuit for this transmitter, including a 2-pole breaker panel near the rig, I used 4 wire cable and BX, and made the neutral available in the transmitter. There is a spare terminal on the input AC panel to attach the neutral. A new wire running through the wiring harness completes this circuit so that the fan/filament switch/breaker still operates as RCA designed it to trip off power to the filaments if the blower motor freezes up. By means of taps, all the principal transformers allow using primary power of from 197 to 251 VAC SP. This allows setting all filament voltages to tube manufacturer specifications. At W3LW, my line voltage is usually between 242 and 246 volts so I had no trouble with finding the correct tap for either the 5.00 V for the 4-400's or the 6.3 V for the smaller tubes. There is a 100 watt Ohmite® WW power resistor and an AC primary voltage voltmeter to allow "trimming" of this voltage from the front panel.

I completely dis-assembled the power control assembly. The little reversible motor and gear train were

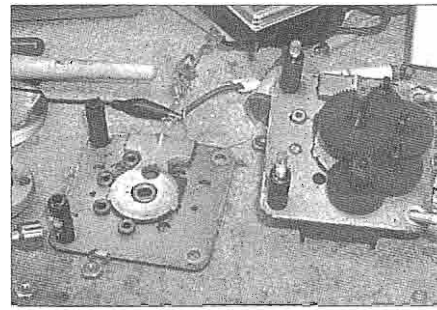
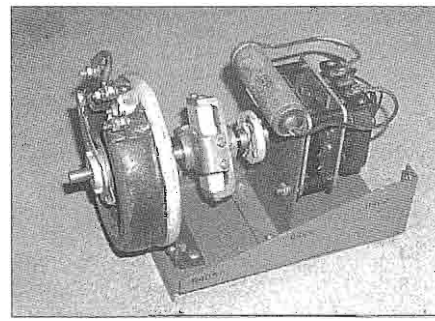


Figure 2: The RF power control motor after disassembly.

loaded with gunk. After cleaning, the motor and felt lubrication system for the gears was re-oiled with light machine oil and all worked as expected. As shown in Figure 2, this motor has an ingenious felt wick system to allow oil to get to each and every gear bearing. The power control operates a 400 ohm 225 watt Ohmite ® WW pot in series with the HV to the final. This allows a small variation in the HV to set the power output correctly. In commercial AM broadcast service in the U.S., the FCC power tolerance is %5-10% of licensed power.



This is how the RF power control motor and its 225 watt pot look after reassembly on their chassis.

Mike (KE4LGX) of NC Total Electronics has mixed up for me the two shades of RCA Umber Grey paint used in RCA equipment of this era. I think that he plans to have the RCA paint available on his web page. I will use

the paint to repaint the inside bottom of the cabinet, do some minor touchup elsewhere as needed, and for the custom remote control panel I am presently constructing.

In its earlier life at WXUR, an additional 4" meter was added on the right side of the cabinet in the spot where the pilot light that shows that the crystal switch was in the CONELRAD position was located. This DC meter was used as a remote indicator of "common point" antenna system current. Since it was not original, I removed the meter and cut and painted a panel to cover the new 4-1/8" diameter hole. The Conelrad crystal pilot light was re-installed on this pate. In the future, I might actually do a "body repair" fill and repaint so as to hide the fact that a change was made but that can wait. A small indicator that probably showed remote control status was mounted above that assembly. I used a ½" hole plug suitably painted to cover up that hole. In the final setup, I installed a 5 amp RF current meter on the top of the cabinet and in the 50 ohm coaxial output to measure actual transmitter power output. An old thermocouple RF ammeter is immune to SWR and if the resistive component of the antenna Z is known, the actual RF output in watts can be calculated from I^2R.

The rear mounted air intake filter is a standard 20" x 25" x 2" paper frame furnace filter available at your local hardware store.

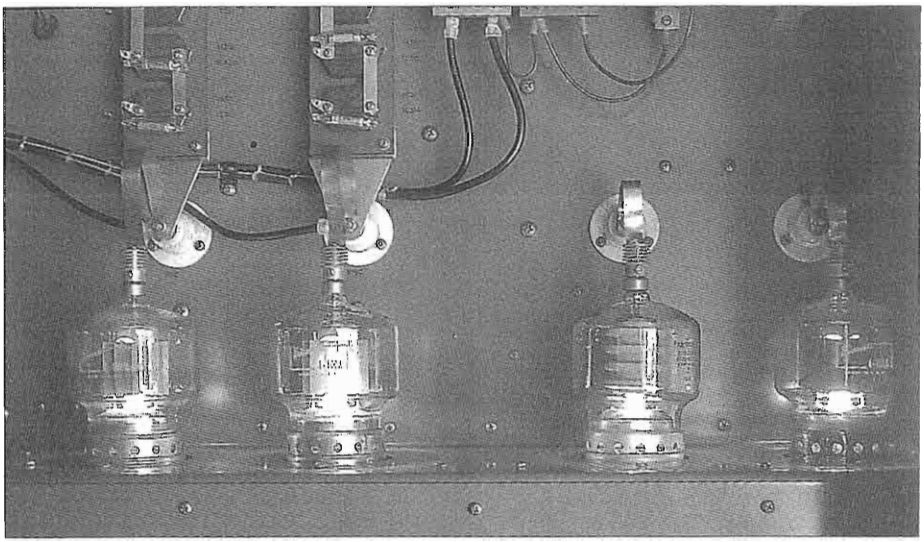
Initial Testing on 405 Meters (740 kc)

After completing most of the cleanup and resistor changes, I completed the AC power run. A new 30A circuit direct from the main power panel feeds a 2-pole breaker panel in the garage. From there a run of 3 wire with ground #10 BX runs over to the transmitter. A separate 115V always ON plug-in circuit feeds the crystal oven circuit.

Power was applied with the AC input to both the driver plate supply and the HV supply disconnected. (Actually the HV components were not yet re-installed at this time.) In this transmitter there is a plate circuit type relay with contacts in series with the 3000V plate voltage line to prevent HV from reaching the RF final if the LV supply is not operating. This is necessary as there is no fixed bias on the RF 4-400's and the 600 VDC LV supply drives the xtal oscillator and RF drivers as well as the modulator screens.

To temporally operate the all control circuits, a jumper was required to get around the three AC interlocks associated with the front door and rear panels. This jumper can be installed from the input terminal strips. The convenient jumper points also bypass the Plate On TD relay but at this phase of testing, with no HV connected, that doesn't matter. The filament circuits were adjusted first. Next the operation of the plate time delay (TD) relay was confirmed. The plate contactor and HV ON light worked as expected. Finally the several relays involved in day/night (high/low power) switching were checked. The night contactor was a bit noisy and was adjusted. The PA screen voltage HV relay was chattering and also required some work to quiet down. The 2-pole relay that switches in an audio attenuator to allow matching audio levels between day and night was missing and was replaced with a suitable relay. Finally the coil wire to the little relay that switches the modulation monitor RF input from high to low power was broken and was easily repaired.

After the installation of a new utility shed out in the back yard to house the lawn care equipment displaced by the RCA transmitter, I was able to return to working on the RCA rig. In May of this year I was able to bring the rig up on low power on 740 kcs and the RF section connected to my 2500-watt dummy load worked with virtually no difficulty. At that point I was having some problems with the 4-400's in the modu-



The 4-400A's aglow at 1 kw output with modulation into the station load on 1945 kcs. The modulators on the left are showing a medium red color which is normal.

lator. The right tube was drawing excessive plate current. Several tubes were tried with the same result. Then I took a break for Dayton!

By early June, I returned to the work. A little troubleshooting showed that there were no apparent DC problems. The bias was correct at about -145 volts and the screens were running at about 650 volts. A check with the oscilloscope showed about a 100 kc oscillation in the audio section. This is what was causing the excessive current. To make a long story short, when I reassembled the negative feedback ladders after cleaning, I reversed two of the. 01 and .003 mica capacitors. This mistake caused the oscillation. Putting them in correctly solved the problem and now the modulation worked as expected.

Next I tried full power. The transmitter came right up and with 2800 volts on the plates. At this time I still have the plate transformer primary taps set on the 251-volt position. The rig made about 4.2 amps into the dummy load. 4.2 amps in 50 ohms is 882 watts output. The final plate current at this time was 0.45 amperes. With 3100 volts on the plates, the plate current at 1000 watts output should be 0.46 ampere.

Conversion From 405 to 160 Meters

The manual for the BTA-1R1 shows that only fixed capacitors in the output circuit were changed and/or re-configured from channel to channel from 530 to 1620 kcs. I calculated the actual reactance of each existing fixed capacitor at 740 kcs and then selected capacitors to result in the same reactance at 1945 kcs. Following this step allows for maintaining the approximate L/C ratios that the transmitter was designed around. Figure 3 shows the output circuit values I used on 160. The actual output network tuning is accomplished by coil tap clips and in the case of the PA plate coil, a large silver plated slug that slides in and out of the PA tank coil and adjusts from a front panel rotary knob. Like all broadcast transmitters with pi-L output tanks, it is essential to have an antenna tuner that matches to

RCA BTA-1R1 METER READINGS
6/15/03
8/3/03

PARAMETER	740 Kcs LOW PWR	740 Kcs HIGH PWR	1945 Kcs LOW PWR	1945 Kcs HIGH PWR
OSC_1	95%	94	104	101
OSC_2	67%	66	62	60
$BUFF_G$	58%	58	57	59
$BUFF_P$	85%	85	116	115
AMP_G	113%	112	114	112
AMP Ik_r	83%	111	92	95
AMP Ik_i	86%	117	134	118
1stAF Ik_r	56%	63	58	63
1stAF Ik_i	48%	55	49	56
2nd AF Ik_r	28%	29	28	28
2nd AF Ik_i	22%	22	30	30
E_{pa}	2.0kV	2.75	1.95	2.9
I_{pa}	3.2 A	4.6	0.44	0.465
FIL LINE	235 VAC	235	238	237
RF OUT	2.0 A	4A	480 W	850 W

All readings with no modulation
Into dummy load
740 kcs readings taken before shorted filter choke was discovered.

Table 1: Meter readings before and after conversion to 160 meters.

50 ohms pure resistive so that the components can be set inside the TX on the dummy load and then fine tuning is accomplished with the front panel PA dip control and with adjustment of the antenna tuner. Wide frequency changes are not possible with this type of system but that is usually not a problem as AM on 160 is confined to a small area. I initially set up this rig for the Grey Hair Net on 1945 kcs. I may add some switching for 1860 kcs later taking some ideas from the optional CONELRAD conversion kit schematic. I also have a home brew 200-watt output rig that can operate throughout the band. I used standard G-2 size capacitors everywhere but for the output capacitor and the 2nd harmonic trap capacitor, which was type G-1. I initially used a G-1 size on the plate coil input capacitor 1C304 but it quickly failed. I am not sure if the capacitor was just tired or underrated. 1C304 on the input side of the plate-tuning coil is actually 300 uuF instead of the calculated 250 uuF because that value is what I had on hand.

First I should say that the adjustment

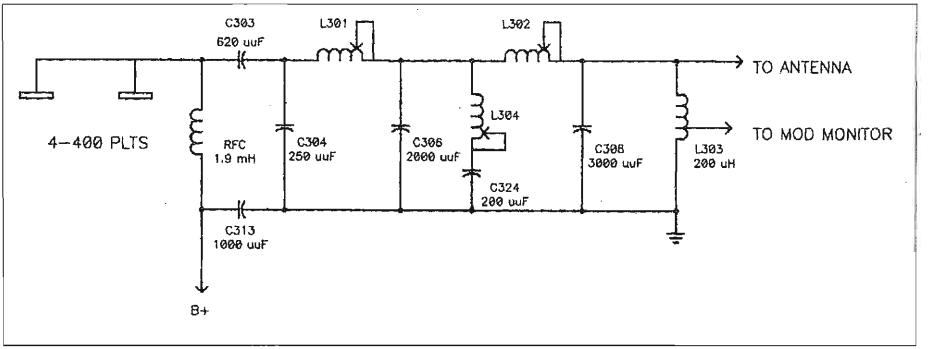


Figure 3: The actual circuit values I used to convert the transmitter's output network to 160 meters.

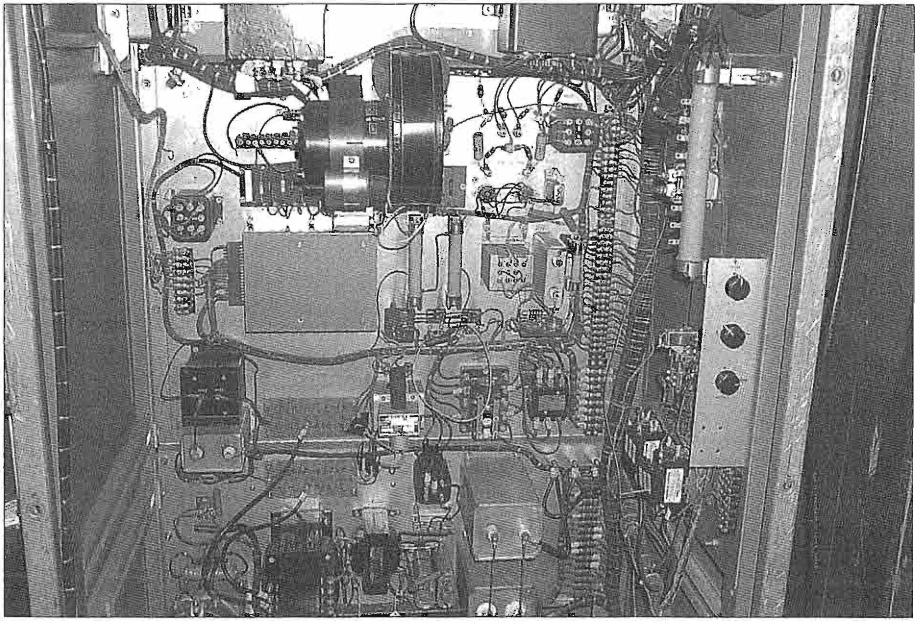
procedure involves a lot of trial and error and in turning the HV ON after each change and then OFF before the next one. Remember ***Safety First*** here! For the changes, all transmitter tests were initially completed into a known good 50-ohm dummy load. The RCA BTA-1R1 manual has an excellent section on tuning up the rig from scratch and I followed that procedure with no difficulty. To move the transmitter frequency, I first set it up on 1550 kcs because I happened to also have a crystal for that frequency. In fact that extra step proved to be unnecessary as the conversion went smoothly. The 6146-driver plate coil tap was moved from tap #2 to #5. In my rig, this tap resulted in the greatest 6146-grid drive. The PA grid drive is read on the switchable front panel "percent" multimeter and was 112% on 740 kcs and 116% on 1945 kcs.

The tuning of the PA output network involves first setting the 2nd harmonic trap coil away from any resonance and then, by trial and error and starting with the approximate tap number from a chart in the instruction booklet, finding the point where the PA plate current dips completely within the range of the front panel knob. Since I selected capacitors with reactance's similar to before, I expected the starting coil taps for 1945 to be near what they would have been for 1620. In fact this turned out to be generally true. The plate coil was tapped 59 turns from the bottom end, the harmonic coil at 25 turns away from the chassis, and the output coil at 8 turns from the chassis.

Next, the second harmonic trap is set using an RF probe and adjusting the coil taps for maximum RF voltage across 1C324, the trap tuning capacitor.

Finally, with the transmitter set to operate on high power, the pi-L output coil is adjusted tap by tap in increasing inductance to increase output power to 95% of the desired power output while maintaining the plate tuning exactly in dip. If you run out of range on the plate tuning, change the PA plate coil by one tap in the correct direction to continue to be able to dip. Since the "slug" is metallic, a slug full in means you need less active turns and full out means you need more. As stated in the RCA "IB", optimum efficiency occurs with the slug nearly out.

When you achieve 95% power with the PA exactly in dip, simply rotate the plate tuning slightly counterclockwise for 100% power and that's it, you are finished! The final readings at this point on high power were E_p = 3000 volts, I_p = 0.46A, P_o = 882 watts, Eff = 0.64%. No internal RF adjustments are needed for operation in the low power



This is the middle rear section of the transmitter. The cover is over the crystal oscillator buffer assembly. The audio driver sockets are immediately to the right of the blower.

position. The PA Plate Tune may require a slight adjustment from the setting used at high power.

A looking and listening check of the modulation with a Heath SB-610 and my Sony 2010 portable radio showed the audio was superb. Feeding in another BC station from my R-390 AF line output and then comparing the audio "direct" and on 1945 kcs showed no perceptible difference in sound.

On Air Tests

At this point, I decided to give the rig a test run on 160 M. A new link coupled antenna tuner was constructed for the balanced feeders used at W3LW. The antenna is a doublet about 176 feet in total length and 35 to 55 feet high and fed with 500-ohm open wire line. Experimentation with a General Radio 560 Impedance bridge and with a 40-watt exciter allowed adjusting the untuned link and the coil tuning and taps for an excellent match on 1945 kcs. The only problem noted was my line currents are not equal and this has yet to be rectified. The antenna tuner parallel tuned tank, which is made of #10 enamel coated wire, also gets a bit too hot if the rig is on air for a long period of time. I suspect I need coil material with a larger diameter conductor. That is a project for later.

On July 1st, 2003, I checked into the Grey Hair Net on 1945 kcs. The only problem noted was my audio was a bit bassy, as I had not had an opportunity to set my audio processing as yet.

Proof of Performance

After the initial contact, it was time to make some standard measurements to see how the rig was performing. For this purpose, I used a Harris AM-80 modulation monitor that I obtained from Chuck Teeters (W4MEW). This unit required some repairs and calibration, most notably the Hot Carrier diodes were leaking and the RF sensitivity pot had a bad section. After changing these and all the electrolytic capaci-

tors as a precaution, the modulation monitor seems to be OK. It was calibrated against an RF envelope at 50 and 100% modulation. The monitor has a high fidelity audio output that can be used for off-air monitoring and for connecting a distortion analyzer to measure the transmitter audio frequency response, distortion, and noise. For that, I use an HP 334A distortion analyzer.

Initial checking showed that I was unable to drive the AM-80 with enough RF to calibrate the instrument. The typical AM station monitor has a 75-ohm input and wants at least 8 volts RMS of RF. It turned out that the 350 uH coil had way too much inductive reactance at 1945 kcs to deliver any more than about 4 volts to the monitor. To make the coil useful, I removed about 1 inch of the #24 wire off the top of the winding, which lowered the total inductance to 200 uH. This was sufficient to still "bridge" the transmitters output transmission line and yet obtain the necessary voltage to the modulation monitor. If you plan to use just an oscilloscope as an RF envelope monitor, no modifications to this output tap coil would be needed.

A test showed high hum, which turned out to be 120 cps. By high, I mean only about 30 dB down from 95% modulation. The hum should be at least 50 dB in this rig and all other noise at least 60 dB down. To make a long story short, first the HV plate supply filter choke was found to be partially shorted which raised the HV and allowed about 100 volts of 120 cps ripple to the PA and modulator plates. A temporary replacement with a UTC CG-104 solved that problem but then there was still hum. This time it was 60 cps. Since all the power supplies are full wave and all ripple was checked and found to be 120 cps, the only thing left that could cause 60 cps ripple in the output was the filament circuits. The low level stages were all OK and what fixed the problem was to reverse the filament leads on one of the two PA tubes so that the grid-cathode modulation from the AC filament transformers to the two tubes cancelled. That lowered the 60 cps hum to acceptable levels. There was still some 120 cps hum remaining which appears to be from my substitute choke not having sufficient rating for the total current required by the rig. The RCA choke is 10 henries with no DC flowing and is rated at 1 ampere and the UTC I substituted is only rated at 350 ma. It runs warm even at 320 ma so it, I am sure, is the problem. The inductance of a choke will drop dramatically if the DC current exceeds the manufacturer's rating. The remaining 120 cps hum is now at -45 dB, which is at least acceptable until I get the replacement choke.

Thanks to another Ham buddy, I was able to obtain an exact replacement filter choke. After installing the replacement choke, I started in again to make a proof of performance. After some preliminary measurements, equipment "calibration" and checking, I determined that there were several more problems. First, after checking the DC and AC modulator feedback voltages as documented in the RCA manual, the repairs done by a previous engineer resulted in a reversal of the modulator filament center tap leads from the cathode circuits of the two 4-400 modulator tubes. Second, the two precision 3.16-ohm modulator cathode resistors used to set the modulator bias were both a lot out of tolerance so they had to be replaced. Finally, one of the two RF 4-400 tubes was "soft" resulting in excessive second harmonic distortion on the modulated AM signal. After the above repairs and that tube was replaced, the measurements on the RF output through the Harris AM-80 into the HP 334 distortion analyzer showed a rig that was pretty much "in spec".

After the repairs to the modulator

and replacing the one bad RF final, the frequency response was re-checked from 50 cps to 10 kcs and found to be good. At 50 cps, the response is down about 1.0 dB from 400 cps. At 10 kcs, the response is down about 2.4 dB.

The distortion now measured about 1.3% at 400 cps at 95% modulation, down from about 5% before. At 50 cps, the harmonic distortion measured 4.5% and at 10 kcs the distortion measured 0.9%. At the critical 2 to 5 kcs range, the distortion was below 1 %. After adjusting the "night" hum pot, the total hum and noise was 54 dB below 100% modulation. All proof of performance measurements were made into a dummy load with the transmitter operating at 480 watts output in "night" mode.

Finally, a most important measurement on an AM transmitter is "carrier shift". Carrier shift is sometimes not checked in amateur circles but is always measured commercially. Carrier shift is simply a measurement of carrier power output without and with modulation. This is easily checked on a Bird or other carrier indicating wattmeter, which, as stock, measures only carrier power. Correct carrier shift measurements assume that your modulator does NOT allow asymmetrical modulation, that positive and negative swings are equal. If you use asymmetrical modulation, than you will have carrier shift and resultant distortion! To make the measurement, read the carrier power with no modulation and again with 95% modulation using a steady low distortion tone at 400 cps. A "good" transmitter will show no more than about 3-5% shift in carrier power output with modulation. An excessive negative shift usually means you have "soft" final(s) or insufficient grid drive to the finals or both. The BTA-1R1 on 1945 kcs into the dummy load measured -2.2% during this proof.

All and all this restoration was a fun project.

Digression On Audio Bandwidth

With all the recent discussion in amateur circles on occupied bandwidth and, at the time of this writing, a pending Request for Rulemaking (RM) and possible FCC Docket forthcoming defining occupied bandwidths for SSB and AM, I thought it time to reason through the process. Observing male speech with an audio octave based spectrum analyzer on local "talk" AM broadcast stations on a receiver with at least 8 kcs of confirmed RF/IF/af bandwidth shows that the audio energy above about 5 kcs to be very low compared to, say 400 cps. By low, I mean at 8 kcs the peak audio levels are 20 or more dB below the peaks at 250-500 cps. The Ham band on-air "problem" really is one of occupied RF bandwidth. Attempting to pass audio frequencies above the modulator circuit design bandpass or utilizing heavy audio processing be it AM or SSB always will result in excessive occupied bandwidth. Ringing of the audio circuit filters, overdriving of audio amplifiers, harmonic distortion and/or intermodulation distortion, can cause this excessive bandwidth. Further, as shown above in my testing of the RCA BTA-1R1, soft final tubes can easily result in excessive distortion and, hence, RF bandwidth.

On the standard broadcast AM band in the United States, the channel spacing is 10 kcs. However, the transmitted audio bandwidth currently permitted by the FCC Part 73 broadcast AM rules is approximately 9 kcs. As a result, audio frequencies on between 5 and 9 kcs from two stations on adjacent channels overlap each other. When transmitting music this overlap can and does cause considerable interstation interference. However, when both stations are transmitting speech, the interstation interference is usually negligible. The fact that interference is minimal is due to the actual audio bandwidth of typical speech and the low distortion of

typical professional broadcast transmitters as shown by this vintage RCA unit. AM stations in the United States are required by FCC Rules to annually make a measurement of occupied RF bandwidth utilizing a spectrum analyzer set for long term integration and taking the measurement for a 10 minute period. During this ten-minute measurement, the transmitted RF output RF spectrum must be contained within an emission "mask" which is specified in the FCC Broadcast Rules by reference to an industry standard.

The problem of adjacent channel interference on the amateur bands is caused, not so much by the bandwidth of human speech, but rather, poor adjustment and/or maintenance of the transmitters and/or limitations on transmitter system AF bandwidth causing excessive distortion, or the use of heavy speech processing on SSB or AM systems not designed for such processing which pretty much guarantees excessive occupied bandwidth. It should be noted that typical high level plate modulated transmitters do not respond well to heavy audio processing. Heavy audio processing into most modulator circuits generates considerable intermodulation distortion primarily due to limitations on the modulation transformer itself. However, modern Class D or E modulators to not suffer from this problem, but these rigs are rare in amateur communications. I have personally measured some of the Class D/E broadcast rigs and harmonic and intermodulation distortion often is well below 1%. One percent distortion corresponds to audio harmonics and subsequent RF spurs being 40 dB down from the fundamental audio tone or 46 dB below carrier (40 plus 6 because each sideband is 6 dB below the carrier at 100% modulation).

The only practical way to reliably determine the occupied RF bandwidth of an SSB or AM transmitter is with a spectrum analyzer display of the transmitted signal with an analyzer with at least 40 dB of on screen dynamic range. Many years ago, when the east coast AT&T HF transmitting station was operating from Lawrenceville, NJ where I lived at the time, I talked with one of the engineers on duty. He indicated that intermodulation distortion on these independent double sideband reduced carrier transmitters, which operated with a total of 16 kcs RF bandwidth, was checked regularly and the PA tubes were changed when the 5th order distortion started to rise. High levels of third and fifth order distortion products can result in out of band radiation. Anyone can look at the ARRL new equipment reports published in QST to see that, with SSB rigs, 3rd order and 5th order intermodulation distortion will result in an occupied bandwidth considerably wider than the nominal 2.8 kcs. If the transmitter or linear amplifier are mis-adjusted, have weak final tubes, or are over driven by processing, these products rise quickly resulting in the excessive bandwidth. This is not a new problem, it has been known in commercial and some amateur circles for years. Solid-state linear amplifiers for SSB frequently have poorer intermodulation performance than tube type amplifiers. An exception is modern the HEPFET as used in Class D/E rigs.

Dedication

The restoration of this rig is dedicated to the memory of Bill Zehring (K3HFP) former Chief Engineer of WLBR AM/FM Radio and one of my early mentors when I was in junior high school and where I first saw and got to tune a broadcast AM transmitter, the RCA BTA-1R!

ER

The Collins 20V-2 Story-
How I Got My 20V-2 AM Broadcast Transmitter

by Orlin D. Jenkins (OJ) KØOJ
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Illustrations courtesy Jay Miller (KK5IM)

In late September 2002, Jeff Garrett (KEØMT) took on the job as Chief Engineer of Radio KFKA 1310 in Greeley, Colorado. He contacted me to see if I would like to become his assistant and help out, as he lives some distance away. I agreed, and on his next trip up to my area we went to the transmitter shack to do some work. On the way there he told me that he, as part of his contract, had acquired a Collins 20V-2 that the new owner didn't need because KFKA is a 5KW station.

He was very excited about getting a broadcast transmitter. The 20V-2 was not being used as they have a new Nautel ND-5 as the main transmitter and a Gates BC-5P2 as the backup.

When we arrived the first thing Jeff did was to light up the Collins and stand there and look at it for a while, as did I. He left it lit up the whole time we were doing our work on some new wiring, and made some tuning checks on the Gates. Later visits the same thing would happen, and as he worked he would stop a while and admire the Collins and continue with his tasks as I would do also.

A few weeks later he emailed me to ask if I would like to have a broadcast transmitter. I hemmed and haw'd a bit before I wrote back and said, "You bet I would!" I wondered where I would put one, but finally decided the garage would be the only place for now.

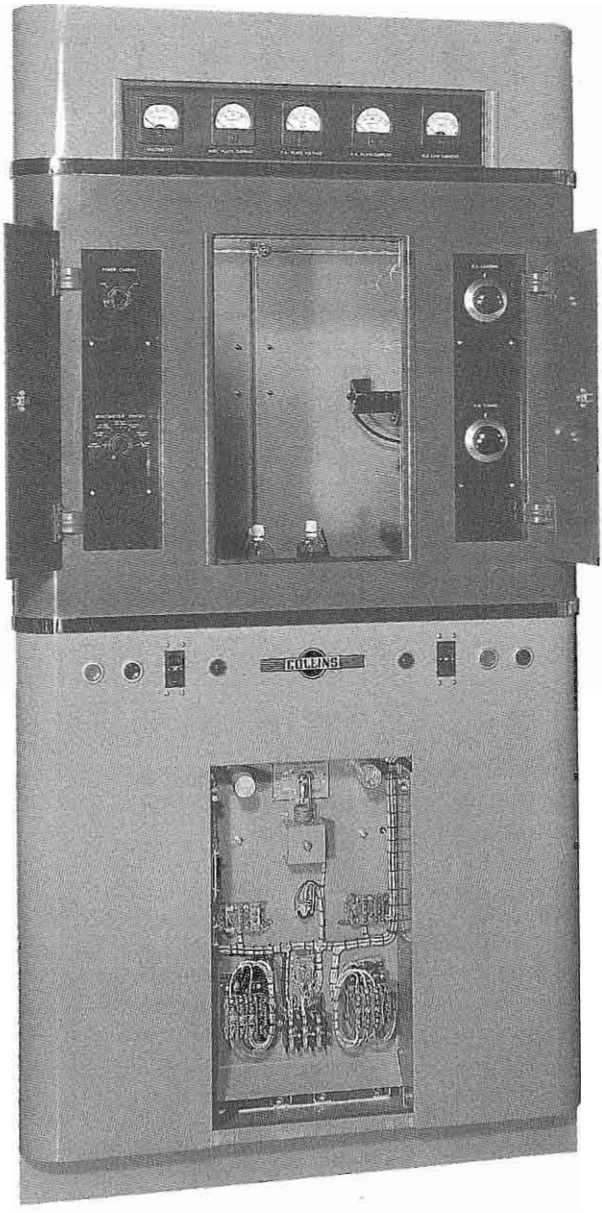
Jeff wrote back and said that he came across a Bauer 1KW, but didn't know the model number. He had not seen it, so our guess was a model 707. Later, Jeff went to see the Bauer and found that it was a 5KW. He wrote me to tell me about it and I had to tell him that a 5KW box would be to big for me. He felt bad about that but I assured him I wasn't mad and it was not a big deal.

A few days later we were going to the KFKA shack again when Jeff said, "You know, I already have a BC-610 and I really don't have a place to put the Collins, so how would you like to have it? I can't just give it to you, so do you have something you would trade for it?"

I thought for a minute and said "How about an R-388 with a Bud steel box and book?" He accepted. I knew how much Jeff loved that Collins so I said, "Do you have a speaker for it?"

He didn't, so I said, "Well, I'll throw in that Hallicrafters R-42 speaker that Horst Geipel (WAØNUH) restored for me". (Horst did a real fine job on that speaker, too!) After we got done with our work at the transmitter site we went back to my home. I gave the receiver to Jeff and the trade was done.

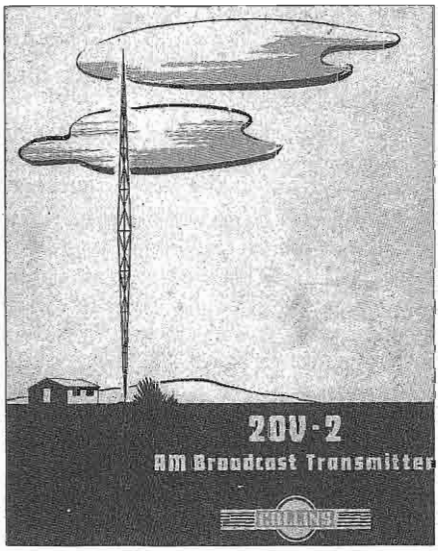
I went back later to remove the transformers and label the wire leads and take plenty of documentation pictures so I could put everything back where it belonged. Masking tape and a "Sharpie" marker sure helped out. I arranged with Jeff and some non-Ham



friends of mine to move the Collins to my garage, which was done in early December, 2002. The move went without a hitch. One of the guys who helped me move it went into the hospital the following Friday for a hernia operation. This was a scheduled operation, but I have fun kidding him about that.

We had some warm days so I put the transformers back in. The tape labels and pictures sure came in handy for that job. I did some dusting, put the tubes back in, and closed it up for the winter as there is no heat in my unattached garage. Before it went into the garage it was tipped over on its side and onto the flatbed trailer that we used to move it from the site, so that we could put some casters on the bottom. I got the casters from Mike Hall (WØCMH). Mike said they had been used to hold up some big IBM mainframe computer.

A few days ago Richard Heidbrink (KCØLFU), who is a Master Electrician, got 220 VAC in the garage. Then, Chuck Mishler (W3PRR) came down from Mitchell, Nebraska for a visit. After lunch, Chuck and I fired it up, but didn't find any high voltage. After trying some rewiring of the remote control relays we still had no HV, so Chuck went into the back and asked if I had rewired the iron correctly. I thought I had, but I went in the house and got the pictures and let him look them over. It turned out that I had left out one wire; it was hanging behind a big capacitor out of view, and



The cover of the 20V-2 owner's manual shows typical industrial art of the post-war period.

I had put another one on the wrong capacitor. The shorting interlocks couldn't discharge the power supply, and Chuck got a tingle out of a cap as he discharged it with a nut driver and a bang. Boy did that picture come in handy! He hooked up the wires where they were supposed to go, checked the rest, and this time up came the HV. We had hooked it up to the "ohmspun" dummy load earlier. We ran the transmitter for an hour with no audio, took some more pictures, and called it a day. Saturday we went to Longmont, Colorado to a Hamfest, and Sunday Andy Loomis (KEØUL) helped us hook up a broadcast receiver for an audio source, and we fired it up again. After setting the volume on the receiver so the modulator plate current was hitting 400 mils, we let it run for 2.5 hours. The PA plate was 500 mils and the plate voltage was 2900. Chuck moved his Dodge Durango real close to the garage so we could listen to "KØOJ Country" in his car. The audio wasn't real good as we were using 8-ohm audio into a 150-ohm load but it served its purpose to proof Art, for Art Collins, as I call my new transmitter.

The RF line current meter stuck at 3.6 amps so I may have to pull it to see if that it really is stuck. It should be close to 4.5 amps. The meter looks like it got hot at some time past.

My plans are to have Art running on 3880 for the Electric Radio Heavy Metal Rally 2003, but we all know about plans. I plan to remote it from my upstairs Ham shack. I'll have to get the stuff for remote operation, and my "plus 10 DB" audio going too. I have the remote circuitry drawings that Jack Quinn (KØHEH) gave me, so I have some building to do. This is as far as I have gotten so far, but I still have the rest of the summer and fall to go.

A great big thanks go to Jeff (KEØMT), Chuck (W3PRR), who I almost killed, Jack (KØHEH), Ken Sasso, who bought KFKA and gave Jeff the chief engineer contract, Mike (WØCMH) for the big casters, Richard (KCØLFU) for the 220 wiring and moving help, Josh Heidbrink (KCØLFV), Dennis Firkins and Dean Gardener for moving help.

[Editor's note: From Broadcasting Magazine for May 14, 1962 and from Farm Broadcasting, The First Sixty Years (Baker, 1981), ER has obtained some of the history of Radio KFKA. This story goes way back to the early years of radio broadcasting in the United States.

KFKA was the first commercial broadcast station in Colorado, being licensed in May 1921. This makes it one of the first stations to be licensed in the United States. In surrounding states, KDFN (now KTWO) began broadcasting at Casper in 1930 as Wyoming's first station, and in New Mexico, KOB began its broadcast schedule from Albuquerque in 1922.

Professor Charles Valentine and Mr.

H. E. Green, an accountant from Denver, Colorado, started KFKA at Colorado State Teachers College in Greeley, Colorado to serve the farm and ranch communities of Northern Colorado.

Before radio, farmers got their weather information by telephone. In 1904, 60,000 farm families in Ohio got weather forecasts that way. By 1926 more than 5 million families across nation got weather information by telephone.

Weather was considered an "agricultural property" because the Weather Bureau was part of the United States Department of Agriculture (USDA). Farmers, more than any other group, could gain or lose by changes in the weather. When radio engineers had learned to make the radiotelephone reproduce the human voice the weather forecasters, and then other agricultural people, began to use the radio to talk to farmers. The USDA began with wireless telegraphy in 1900 when the Weather Bureau hired a man away from Thomas Edison's lab and gave him $3,000 to set up two wireless telegraphy stations on the North Carolina coast.

The first regularly scheduled farm weather report on voice radio was on 9XM at the University of Wisconsin, beginning in 1921. Also in 1921, KDKA in Pittsburgh began carrying "Market Reports" by USDA's market reporter in Pittsburgh, and thus became the second station to begin regular broadcasts of farm information.

Two days after KDKA Pittsburgh began its market news broadcasts, Mr. Green began making three trips per week on the Union Pacific local train between Greeley and Denver, Colorado so he could report current Denver livestock prices to ranchers. The station has reported prices and other farm information ever since, although it is now officially an all-talk format.

About 1926, Valentine and Green organized the Mid-Western Radio Corp. and assumed full operation of the station. Mr. Green became full owner upon Prof. Valentine's death in 1929, and the Green family still controlled the station until the mid-1960s.

KFKA was originally on an assigned wavelength of 341 meters, which later became known as 880 kc. In 1928, the Federal Radio Commission completed the National Frequency Allocation Plan, and KFKA was required to time-share 880 kc with KPOF in Denver. The time-share allocation continued until 1940, when KPOF moved to 910 kc.

In 1949 KFKA obtained a 1 kW license and changed frequency to 1310 kc. The owners had already contacted their Collins sales representative in Cedar Rapids, Iowa to arrange for the purchase of a new Collins 20V-2. This transmitter is now proudly owned by KØOJ, and thanks to OJ's efforts, the KFKA 20V-2 will remain on the air from Greeley.]

ER

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Radio's Golden Age-
Episode 25, Part 2

Bruce Vaughan, NR5Q
504 Maple Drive,
Springdale, AR 72764

Episode 25
Two longs and a Short—Part Two

Discarded wall 'phones provided boys of my generation with hours of enjoyment. The receiver from an old telephone could be used on crystal radio sets—or so we thought. The prize from junked 'phones was the dynamo. A favorite form of entertainment was running a wire from the dynamo to a pan filled with water, out near the chicken coop. We would then wait for a chicken to come by for a drink. When the poor unsuspecting chicken lowered his beak into the water we would give the dynamo a crank or two, and laugh loudly as the chicken jumped high in the air. I suppose it was cruel, but we were consistent. We would not do anything to an animal, or bird, that we would not do to our fellow man.

I attended the Huntsville State Vocational School back in the mid-thirties. Manual training students in the school's wood shop built sturdy unfinished pine tables in the general science classroom and in the study hall. The tops were attached to the tables with common, 8-penny nails—no effort was made to make the tables look pretty. Under the tabletop the nails were bent over and then hammered flat to keep someone from getting a nasty scratch.

One day after classes, James Deere and I slipped back into the schoolhouse. In the general science room, the eight-foot long tables were placed end to end. James and I crawled under the tables and, with bare copper wire, hooked up every nail on a row of three tables. We connected a wire to a telephone dynamo—property of the science lab—on a wall shelf on the back wall of the room. Anyone sitting in one of the chairs by the wall shelf could reach the dynamo with ease.

The next morning, James made sure his chair was within easy reach of the dynamo. During class, James waited until several bare arms and hands were resting on the table top. While the teacher, Murphy Mears, was drawing a picture on the blackboard explaining how electric motors worked, James gave the dynamo a few vigorous cranks. Pandemonium broke loose! Books and papers were tossed in the air—girls screamed, boys used language frowned upon in polite society, and those at other tables looked on in amazement. There was more than enough confusion for James to move the dynamo well away from his chair.

Well, as we expected, they found the wiring—and I'm sure our teacher had a strong suspicion who was involved in the dastardly deed—but we never confessed until now.

****

I must have been about five years old at the time. Dad was running 'the store' at Habberton, a 'cross roads' village with a population of less than 50 people. I remember our old wall telephone hanging by the front door. It was a party line system—no switchboard.

Well, one Saturday the store was full of customers—and loafers. I suspect there was more of the latter because the store made very little money. The tele-

phone began ringing, and ringing, and ringing, over and over. Dad recognized our ring—'two longs.' He put the scoop back in the lard stand, wiped his hands on his soiled apron, and walked from behind the counter to answer the phone.

"Bruce, has Henry got there yet?" asked the lady on the phone.

Dad glanced around the cluttered store. "No, Sally, I don't see him. Can I give him some word when he comes in?"

"Yes Bruce, if you don't mind, have him call home real quick. I need to talk to him."

Dad looked out of the dusty window, the one with the circus poster in it. He saw Henry coming around the corner. He was carrying a red rooster.

In the 1920's most country stores bought produce of any sort—eggs, poultry, milk and cream, fruit and vegetables—whatever the customers needed to exchange for groceries—even old roosters.

Dad kept a chicken coop on the front porch of the store. When customers arrived with chickens to sell they carried them by their legs. The legs were normally tied together with a strip of cloth torn from old clothing. A scale hung from a support over the coop. Dad would weigh the chickens, untie their legs, and drop them into the coop.

Jimmy Lewis, from Springdale, was the produce man for most of Springdale's trade area. He made his rounds every week in his Ford truck, picking up whatever the storekeepers had traded for since his previous trip.

"Just a minute, Sally," said Dad. "Here comes Henry now."

Dad went to the front door. "Henry, Sally is on the phone. Hurry up. She needs to talk to you."

Well, of course that kind of upset old Henry. Was Sally sick? Maybe one of the young-uns had cut his self with an ax. Maybe one of the family was copperhead bit. A lot of possibilities—most of them unpleasant—ran through the old farmer's head.

Henry hurried into the store. He laid his rooster on the floor, and reached for the phone. Before he could pick up the receiver, the rooster started flopping around raising quite a ruckus.

By now, all eyes in the store were on Henry and his rooster. Business came to a standstill.

Henry was both excited and confused. Here was Sally waiting on the telephone—with bad news probably—and here was his big old red rooster flapping his wings, and raising old Ned something terrible. He reached down and grabbed the rooster by the neck to stop all the flopping around. Then, in a hurry to find out what was going on at home, he held the rooster up to his ear and yelled into the mouthpiece. "Sally, fer God's sake whut's wrong?"

The whole store broke out laughing at the sight of Henry with the rooster up to his ear.

Well, it turned out Sally wanted Henry to bring home a spool of thread.

Henry was so upset with the embarrassing episode that he dropped the rooster on the porch, and stormed off down the road without buying a thing. He didn't even pause long enough to get paid for his rooster.

And so it went in rural areas throughout America—but what kind of progress was the telephone making in our cities and towns? I have always thought of telephone service as either party lines similar to those we had in Spring Valley and Habberton when I was a youngster, or as highly efficient systems provided by giant communications companies like Bell Telephone. However, there was something in between—small, privately owned telephone services. Throughout America, these smaller telephone companies served as a transition service—a stepping-stone if you will—between rural telephone systems and large, well-organized and well-financed companies.

According to stories in the Springdale News, the town's very first telephones were installed between two business

firms here in Springdale.

From the Springdale News
April 29, 1937

Up in Judge Millard Berry's house there is a piece of polished brown wood, hollowed here, curved there, fitted with a bit of fabric, a length of wire and brass button. It looks like the beginning of an electric table lamp, but it isn't. It is the beginning of a telephone system.

In the days before "Central" was summoned by the lifting of a receiver and any voice on the continent was at the bidding of Springdale, this queer contraption used to be Springdale's first telephone. There was another just like it, and a length of wire, a quarter of a mile long, ran from the one to the other. One hung on the wall of the Springdale Roller Mill and the other "uptown" at B.F. Deaver's store. When men at the mill felt the need of consultation with those at the store—which was often the case, since the mill accounts were handled by the store—they went to the instrument and tapped on it with a lead pencil: the sound of the pencil tapping set up vibrations which were amplified and transmitted through the vibrating brass button, along the copper wire; and the men at the store came right over and talked in the thing. The principle was much the same as that of the tin can telephone through which youngsters shout at each other from one yard to another, but Judge Berry says it worked.

That's what he says, and he was here and the news reporter wasn't. But we wonder if the millers didn't have to go out on the steps now and then and shout to the store, "Answer your acoustic phone" the way people have to do now and then on party lines. Anyway, the acoustic telephone introduced Springdale people to the convenience of talking to their neighbors without going to see them.

Well, mebbe.....

Now, I don't doubt the word of Judge Berry or of the Springdale News reporter who wrote the above feature. I do suspect, however, that our idea of telephone communication today is somewhat different than it was a century ago. I would think that the practical use of such a device would be limited to a distance much less than the quarter mile mentioned in the article.

The article states that the device amplified signals. I think this statement was made because the reporter writing had little understanding of simple electrical and mechanical principles. In any mechanical device it is impossible to get more from the machine than you put into it. There is no such thing as a perfect machine; therefore the total output of any mechanical gadget is always less than the energy put in. Otherwise, we would have perpetual motion machines doing all our work and there would be no energy shortage.

I have no doubt the thing worked as Judge Berry said, but I would bet my self-dialing telephone that it took a great amount of yelling on the sending end, and some very careful listening on the receiving end to hear anything at all. As described, this telephone depended upon sound vibrations, a mechanical source of energy, traveling along a wire stretched between the stores. Such an arrangement would be subject to the wire vibrating of its own accord due to winds, temperature changes, and such things as tree branches touching the taut wire. Over very short distances, such a telephone might work, though rather poorly. As the distance increases, the weight of the wire increases. This weight damps the mechanical vibrations, much like putting your finger against a vibrating guitar string.

I would also suspect that this might not have been the first acoustic telephone in Springdale. With the invention of the telegraph a vast audience was created for books and magazines pertaining to communications, electric-

ity, and inventing. This led to a proliferation of magazines especially for young people. This was a time when young boys dreamed of becoming another Thomas Edison or F.B. Morse. I would think that somewhere in our fair city tin can telephones were probably built, and used with limited success, by numerous readers of such material.

For accuracy then, I prefer to say that the first business telephones in Springdale were installed between the Springdale Roller Mill and B.F. Deaver's store, and that the acoustic phones worked well enough to create a desire among Springdale's citizens for better telephone communication.

The century from 1850 to 1950 saw more changes in technology and science than in all recorded history. It was a marvelous time—and a time of marvel. Our world changed quickly and dramatically. Our country moved from horse drawn vehicles to supersonic jet airplanes, from flickering kerosene lamps to lights that virtually turned night into day. The pony express, once considered a rapid means of communication was replaced by microwave communication. Medicine advanced from the common use of such treatments as leaches and sulphur into the era of heart transplants and a whole plethora of new miracle drugs. Changes came so fast the average individual could keep up only with great difficulty. Lifestyles changed—our standard of living took such a leap forward that every generation thought of the previous generation as hopelessly 'old fashioned' and 'out of date.'

Oh yes, we gained much—but there was a terrible price to pay. The tradeoff was dear; progress carried a price tag some of us think excessive. We lost our simple, uncomplicated, unhurried lifestyle. We lost some security, and unfortunately we lost some honesty. We lost respect for ourselves, and for others, we lost some patriotism, and yes, we lost some of our religion. The ultimate result was tragic; we as a nation lost our innocence. And, if at times it seems we are on a road to oblivion, rejoice in the fact that we can get there in a hurry on our decaying interstate highway system, at legal speeds of 75 miles per hour. And we can go in comfort—in a car on which we only owe 54 more $396.00 payments—plus one final payment of only $11, 516.13.

By the turn of the century over half of the U.S. population still lived in rural areas. Electric lights, Mr. Edison's amazing invention, was available to only a small segment of our people. Many of our citizens of 1900 were unaware of the 'horseless buggy' and the 'aeroplane.' Then, almost overnight it seemed, the airplane and the automobile became a reality. Small towns installed their own electric generating plants. Kerosene and natural gas streetlights were replaced by electric lights—far brighter than those used originally.

In homes of working men and women—families with average incomes—talking machines, electric lights, and telephones became commonplace.

Tycoons of business were quick to seize upon these new opportunities. Slowly at first, then with increasing speed, large corporations criss-crossed our land with telegraph and telephone lines much like the railroads had done a few years before.

Talk of 'wireless' transmission of messages without telegraph lines had been around since the invention of the telegraph. Most people discounted such nonsense. When the first transatlantic wireless message was successfully completed, Thomas Edison took a full-page ad in the New York newspapers branding the whole episode as a hoax. The educated, as well as those less knowledgeable, were skeptical.

But our young people believed! In cluttered bedrooms, dusty attics, and makeshift workshops across this land, a sizable group of young people were

busy building wireless sets and communicating with other experimenters near and far. These young experimenters formed a strong nucleus of well-trained communications engineers for our emerging technology. It is little wonder that the pioneers of radio, aeronautics, and the automobile were all youngsters who had first embraced these new scientific marvels as a hobby before making it their lifelong work.

From the Springdale News
April 29, 1937
W5EP IS FIRST SHORT WAVE HERE

Springdale's first short-wave station was constructed by Arlo Eggensperger, who was a licensed operator in 1929, with the call letters W5EP. As a 15-year old boy he made his first receiving set out of an oatmeal box and improved it until he had 'logged' 115 stations in the United States, Cuba, Canada, and Mexico. With a common type tube for his transmitter and a 2-tube short wave receiver he received his first answer from 9DGW of Garfield, Iowa. Increasing the power to 10 watts, he was able to reach any part of the United States and also got OH6CH of Honolulu, Hawaii. Again increasing power to 50 watts, he was receiving and sending 35 words a minute in international code to such far away places as Australia and New Zealand. Arlo's radio contacts enabled him to get a position with the American Telephone and Telegraph Company, at Fargo, North Dakota, where he now has his short wave station. Arlo is the brother of Omar and Kermit Eggensperger of the Springdale News staff.

Our nation's best and brightest people were attracted to professions newly opened in transportation, communications, and medicine.

Perhaps one reason so many people were eager to enter into previously unknown business enterprises was that everyone shared an equal opportunity. The playing field was flat, empty, and totally level. The future was limited only by an entrepreneur's imagination and ability.

Today, three short blocks north of the Shiloh museum on Main—just across Huntsville Street—is a beautiful bed and breakfast. The graceful old home is showcased by its sitting; ten landscaped acres. Some trees, still standing, once shaded gala lawn parties for the family of one of Springdale's most prominent citizens. The house is little changed from a century ago. It is obvious that the original owners of this property were people who loved their home and its surroundings. This was the home of Judge Millard Berry, the gentleman mentioned earlier as the "Father" of Springdale's telephone system.

Judge Berry's abstract office was located one block south of the Shiloh Museum, in the rear of the Bank of Springdale building. In my book 'Emma, We Love You,' the building is designated as the Southwestern Gas and Electric Company building.

It seems that the Judge got tired of running back and forth between his home and office and decided to try out one of the new 'talking telephones.' In 1896 he installed the very first electric telephones in Springdale.

The Golden Anniversary Edition of 'The Springdale News' tells the story far better than I can. The following is taken (almost verbatim) from that edition.

The Springdale News, Golden Anniversary Edition
April 29, 1937—page no. 17

The city wouldn't have had electric telephone service as early as it did if Judge Berry hadn't lived so far from his abstract office. He got tired of walking home on errands and, in the spring of 1896, bought two telephones from the Dunlap Construction Company at Springfield, Missouri. He put one in his home, and the other in *the* Berry abstract office.

Judge Berry had no original intentions of cutting the town in on his new convenience, and he maintains that it was not civic pride but a yen for his own personal comfort that led him to install these first telephones. But people kept dropping into the office and being fascinated by the strange product of science that their abstracter handled so casually. They wanted to talk in it too, but there was no point in that for the line ran only to the Berry home, so they wanted one of their own.

It was not long before Judge Berry installed a five-drop switchboard in his office, and no doubt regretted it almost at once, for he had to be the operator when he was at his office. When he was away from the office, there was no operator. But the little switchboard formed a connecting link between the first fortunate businesses of the town.

Even five telephones didn't seem to suffice. After a few weeks the little switchboard was traded in on a larger one with 25 drops, and Charles Sanders was employed as operator. Then a 50-drop switchboard replaced the smaller one, and Judge Berry had the telephone situation pretty well in hand.

At that time he was operating an abstract office in Fayetteville as well as in Springdale, and driving from one town to the other soon became nearly as tiresome as running back and forth between home and the office. There was a Fayetteville Telephone Exchange in that town, with the switchboard in the old First National Bank building, so the Berry telephone lines began to edge down the highway toward Fayetteville. The posts got as far as the city limits and then Fayetteville interests protested against the new line coming in. Permission to take the telephone line into Fayetteville was granted after a session with the city council, and the Fayetteville Telephone Exchange connected Judge Berry's line to their switchboard, thus giving Springdale telephone connections to Fayetteville. The Springdale switchboard was now outgrowing the abstract office so a new switchboard was moved upstairs just over the office. The year was 1899 and Fred Horton was the operator. J.N. Hulsey and Henry Cowan were linemen.

In the meantime, business interests made it advisable to establish connections with other nearby towns. Judge Berry ran a line to Rogers where he put in a telephone exchange, later extending the line to Bentonville. From Rogers, he ran a line to Seligman, Missouri and the home folks began to realize just how big the world was. After the Rogers service was established, Judge Berry rebuilt the line to furnish better service.

East to Huntsville by way of Sonora, Spring Valley, and Hindsville the local telephone lines ran. The North Arkansas Telephone Company was formed with Judge Berry as president, James W. Dupree as vice president, J.P. Deaver as secretary/treasurer, G.G. Dodson and S.H. Slaughter. The company had a capital stock of $25,000.00.

The telephone system, as operated by the new company, made use of fully metallic copper wire, with the phones good for a 500-mile circuit. James Dupree managed the local service and found it necessary to insert the following notice in the Springdale News:

Proper use of your telephone....

Ask central the time of the trains and if they are on time.

Don't use your telephone during a thunderstorm.

Don't use your phone longer than you need to. Somebody else may want to use the line.

Always 'ring-off' when you get through talking.

From Fayetteville, the North Arkansas Telephone Company ran a line to Alma, where it connected with the Bell Telephone System. In this manner, Springdale was supplied with telephone service to Fort Smith and points

beyond.

The Bell Telephone Company bought out the North Arkansas Company in 1915 and has since operated the Springdale telephone system.

****

Well then, if Southwestern Bell took over the system in 1915, it would seem everyone in Northwest Arkansas had long distance telephone service available. This was hardly the case. There was the problem of upgrading all the small local telephone systems. Telephones, even with new copper lines, still needed repeaters throughout the system. This was possible but not as easy as it would seem. Such repeaters would have to be battery powered, or supplied with it's own generator. This was almost 25 years before our rural areas were supplied with electricity.

When we moved to Huntsville in 1932, a locally owned generating plant supplied electric power. Mr. Harrington, with the help of two sons, ran the power plant. Power for the generator was supplied by a one-cylinder diesel engine. The first thing I noticed when we moved there was the constant poom, poom, poom, poom, of the large Fairbanks-Morse engine, a sound heard throughout the town during times when we had electric current. Yes, they turned the power off at night. From 11:00 PM until 6:00AM the city was without power. Every family still had two or more kerosene lamps ready to use when the power cut off.

The Huntsville telephone system depended upon batteries for much of its system. The best I remember is that we had pretty good long distance service. During those depression years it was only used when absolutely necessary. A long distance call usually meant bad news. I don't think I remember of my family ever receiving any good news by long distance. The mail was fast enough for good news.

There is little doubt that Springdale would have had a telephone system without Judge Berry's help. However, Judge Berry's progressive vision brought this new invention to our city, and to our area, at an early date. Such people as Judge Berry leave their mark on a town in many ways. Some of our residents may not be aware that the beautiful old Central School building, currently under restoration, sits on land donated to the city by Judge Berry.

During World War Two, Judge Berry's grandson, Raphael, was among a group of young men who stormed the beach of a small, little known, highly strategic, island in the south pacific. Raphael was among the first to die on the beaches in of Hollandia.

In the early 1950's a small group of people in Springdale decided we needed a Catholic Church. The obstacles were many. Mrs. Braun, Judge Berry's daughter, granted the group permission to use a small house located on the west side of the old Berry estate as a Catholic Mission. With a lot of work, and practically no money, a meeting place was constructed.

Years passed, the group grew larger, and it became obvious a much larger church was needed, and well within their grasp. Twenty acres was purchased on highway 68 West—which is now 412. A beautiful new church was constructed. It seemed fitting that the new church should be named St. Raphael.

Yes, Judge Berry's legacy is with us every day. It is difficult to make a telephone call without thinking of the original five-line Berry telephone service.

ER

VINTAGE NETS

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

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

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

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

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

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

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

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

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

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

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

DX-60 Net: This net meets on 3880 Kc at 0800 AM, Eastern Time on Sundays. Net control is Jim (N8LUV), with alternates. The net is all about entry-level AM rigs like the Heath DX-60.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Vintage SSB Net: Sunday 2100Z 14.293 & 0300Z Wednesday. Net control Lynn (K5LYN) and Andy (WBØSNF)

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

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

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

CLASSIFIEDS

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

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

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

FOR SALE: Hallicrafters SX-110, National "Super Sixty", National grey speaker, Battery Stuff: Kellog Pwr Sply 505, Kellog 401 tubes, Crosley RFL 75, 3 headphones. Old telegraph key, sounder, repeater. Bill Coolahan, 1450 Miami Dr. N.E. Cedar Rapids IA 52402-2933. 1-319-393-8075

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

FOR SALE: National FRR-24, BC-639 rcvr, 640 xmtr. Fbridges@citcom.net. F. Bridges, 104 Maple St. Brevard, NC 28712, 828-885-2470

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

NOTICE: NCX-1000 IF cans now available. George, 413-527-4304

FOR SALE: Hallicrafters SX 115, $795 + ship. Ed Sauer, 787 N.Peterman Rd.,Greenwood, IN 46142, (317) 881-1483.

FOR SALE: NCX-3 w/PS-$125, Simpson 260-$20, Heath GR-64 receiver- $40. Wanted: Manuals for Hickok 533A,752A tube testers. Carter 434-979-7383. CElliott14@aol.com.

FOR SALE: Collins R-392 receiver w/ speaker and original manual, .5 to 30 mc. Clean, working. Stuart T. Carter, II. W4NHC, 680 Fernwood Drive, Melbourne FL 32904-1995, 321-727-3015

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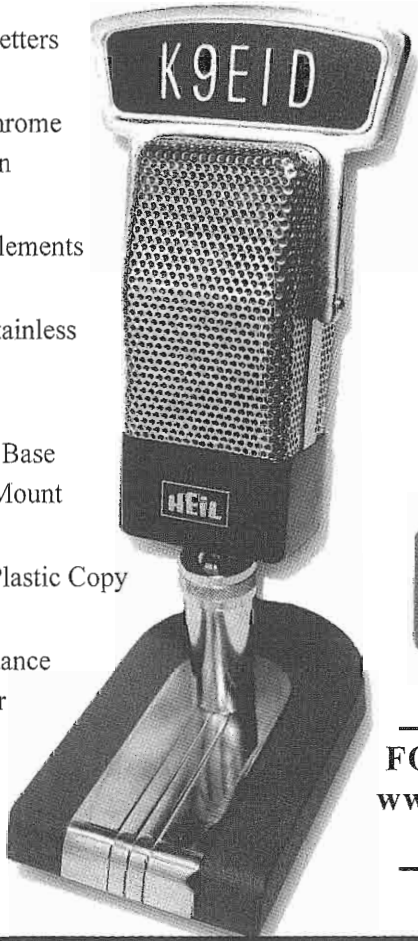

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FOR SALE: Collins Manuals: KWM-2, 312B-4, 51R-3 Supplement, AN/ARN-14 Operating Instructions. Transformer: TF-1A 02YY, 310V, 275V. Mike Grimes, K5MLG; 3805 Appomattox Cir; Plano, Texas, 75023, (972) 867-6373. Email: grimesm@flash.net

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

FOR SALE: Tube Collectors RCA 6181 1KW UHF tetrode and RCA 5820 image orthicon. Norman Hall, W6JOD, 661-399-4101, w6jod@aol.com

FOR SALE: SX-101 and HT-32. $150. Pick-up only. 307-325-9081 k7du@vcn.com

FOR SALE: Hallicrafters: HT-32A excellent condition with manual $300.00. Bob, W1RMB (M.A.) work #. (508) 261-8231.

FOR SALE: ART-13 transmitter, fair condx, appears complete, $75 plus shipping. Jim Feasel, W8HPL, 13549 Morse Rd. SW, Pataskala, OH 43062, 740-927-2592

FOR SALE: Complete set of Ham Radio Magazine. First to last. 267 issues, $100. Pickup only in Berkeley, CA. John Gibson, 510-849-1051, gibsonj@mindspring.com

FOR SALE/TRADE: WWII BC-312, BC-348Q. Nice HW-12A. B&W LPA-1 2KW G-G amp w/ps, matches B&W 5100B. Sam KF4TXQ PO Box 161 Dadeville, AL 36853-0161 stimber@lakemartin.net 256-825-7305

FOR SALE: Heath GD1-B, V7-A, QF-1, 10-103, also other Heath manuals. Call, email for details. Jim, K7BTB, 928-635-2117, jeldgl@safeaccess.com

FOR SALE: Lafayette HE45A(2) $45 ea, B&W coax switch model 375 $10, manual TR switch $7, TenTec Scout and 2 modules $325, TenTec model 1208 20 to 6 transverter $85, MFJ 949D antenna tuner $75. Jon Wood, WØUHL, 70 400 St. Chanute, KS 66720, 620-431-6554

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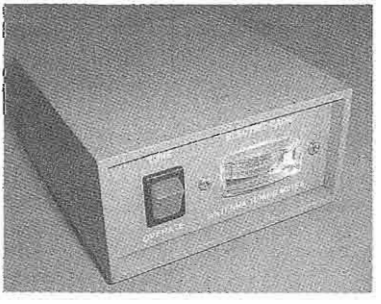

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FOR SALE: Hallicrafters Sky Challenger II, SX 18 with S Meter and a copy of the manual. Excellent condition. $250.00 plus shipping. Dan Killian, W4BN, 1140 Country Club Dr., Lancaster, PA 17601. W4BN@aol.com

FOR SALE: GRC-9, 2 pwr splys, handcrank gen, cable, some assc's, manual. $100. Pick-up only. 307 325 9081 k7du@vcn.com.

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FOR SALE: Military manuals, in excellent condition. $15 ea shipped lower US: Navships 91906: AN/URR35, AN/GRC10. TM-11297: VRC19. TO-08-10-139: BC375E. TO-08-10-105: SCR522. TM-11-600: SCR508, 528, AN/VRC5. TM-11-620: SCR608A, SCR628A. TM-11-300: SCR211/BC221*. TM-11-605: SCR509, SCR510. TM-11-615: SCR609, SCR610. TM-11-1366: AN/MPG1, AN/FPG1. TM-11-303: 156. TM-11-2627: I177, IE36, BC1303. TM-11-235: SCR536*. TM-11-850: BC312, BC314, BC342. TM-11-242: SCR300, BC1000. TM-11-637: AN/VRC3, BC1000. Tube manuals: RC-14, RC-15, RC-16, RC-17, RCA TT3 TRANSMITTING MANUAL 1938. Richard Wurtzinger, 1140 S Taylor Ave, Oak Park, IL 60304, 708 3834579, richwurtz@.iuno.com

FOR SALE: NIB National MB-40L Low Power Multi-Band Tank w/1949 QST applications. 20W/10-80M. $45+UPS/OBO. Robert 303-988-2089 rgbdenver@att.net

FOR SALE: GR 1192 Frequency counter, manual copy, $50. GR 724-A Wavemeter, $46. Simpson 383-A Capacitor Analyzer, manual, $40. B&K 960 Transistor Radio Analyst, manual, $45. Sencore filament and fuse tester, $25. 7&9 pin tube pin straightener, $5. Ross Wollrab, 229 N. Oakcrest Ave, Decatur, IL 62522-1810. 217-428-7385 rewollrab@aol.com

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FOR SALE: Send #10 SASE for large list of accumulated tubes. WB5UIA, 903 Madison Ave., Minden LA, 71055-2923

FOR SALE: QSTs starting late 20's, request list, or specific issues. $1 per, 3 for $12, six for $5, etc. + postage, most clean. Charles Graham, K2GVE, 4 Fieldwood Drive, Bedford Hills, NY. 10507. 914-666-4523

FOR SALE: Motorola and GE tube FM gear for sale, ask W2OQI@optonline.net, 631-878-1591, 17 Inwood Rd, Center Moriches, NY 11934

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

FOR SALE: GE mobile xmtr 40-50 mhz. 6V dynamotor 60 watts. Pair 807's. Mel, WØMLT, 970-249-1544

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FOR SALE: Heath "Sixer", $35; Heath AM-2 SWR, $22; Heath HA-14 "Kilowatt Compact" w/HP-24 AC supply, $425. Richard Prester, 131 Ridge Road, West Milford, NJ 07480. 973-728-2454. rprester@warwick.net

FOR SALE: NOS Tungsol 26Z5W as used in the R390A, $16.00 each. Electron Tube Enterprises, Box 652, Springvale ME 04083. 207-490-5870

FOR SALE: RCA MK IV single sideband Navy shipboard transceiver, $200. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777, 989-595-6483

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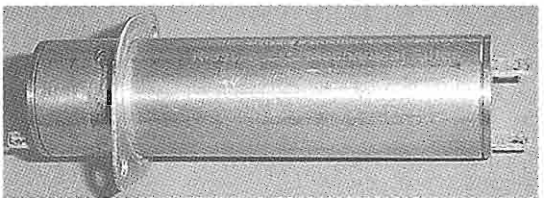
Collins Mechanical Filters



R390A

75A-4

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

FOR SALE: Communications Receivers, Military Communications and some test equipment. SASE, Don Jeffery, 131 North Ivy Ave., Monrovia CA, 91016, boallan@aol.com

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

FOR SALE: Send SASE for large list of excess parts. Publications, ham & test gear. K4AFW, 104 Glenwood Dr., Williamsburg, VA 23185

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

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

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

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

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

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WANTED: For NC-300, 4H4C regulator, VHF converters NC-300C1, NC300C2, and NC-300C6. Robert Johnson, W5KTN, 7230 Lehigh, Dallas, TX 75214

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

WANTED: Need schematic of info on Regency Weather Alert radio model C1WA. Don Kuhn, N8KPD, 740-383-5744

WANTED: Information on and schematic for Mason Engineering A2 radio and modules. Bill Wagner, 1510 NW 35th Terrace, Gainesville, FL 32605, 352-372-8332, bill@ece.ufl.edu

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WANTED: Cabinet for Drake TR-4. I restored the rig, works great, but now can't find a cabinet! Steve Johnston WD8DAS, 11723 W. Jenilyn Ct. Boise ID 83713. sbjohnston@aol.com

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

WANTED: Hallicrafters PS-500 A-AC pwr sply for SR-400 transceiver. Bob, KL7HDY, 9501 Brien St. Anchorage AK, 99576, 907-346-1044

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WANTED: Manuals: OE-4/GR, GRA-94, PRR-15, PPS-15B, RD-140/TNS, ASB-5, APA-11A, 8D-3 xcvr. William Van Lennep, POB 211, Pepperell, MA 01463. 978-433-6031

WANTED: HQ129X cabinet. Condition not important since I can strip and repaint if necessary. Joe Fell, W3GMS, e-mail joseph.fell@Unisys.com or phone 610-648-4425.

WANTED: James Millen coils 42080, 42040, 42015, and 43015. Info and photos of Navy "RG" receiver. Gary Carter WA4IAM, 1405 Sherwood Drive, Reidsville, NC 27320. Phone: 336-349-1991. Email: gcarter01@triad.rr.com.

WANTED: Manual for a Gates "PRODUCER" Mono Mixer board. Copy will do as well. A schematic copy will help also. Bob Lydon AB3L AB3L1@aol.com 412-429-8413

WANTED: R9 receiver by Harvey-Wells in good condx. Richard N. Pann, W1SVJ, 2447 Yates Dr., Augusta GA, 30906-2587. 706-798-7279. RPANN@COMCAST.NET

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

WANTED: Info/schematic on RCA Transcription Turntable Type 70-C-1 MI-4871-G.Denny Reeves, reeve06@texas.net, (512) 258-8473.

FOR SALE: Heathkit EK-2 AM/SW receiver, works, clean w/o manual or schematic. $30 includes USPS. Louis L. D'Antuono, 8802-Ridge Blvd, Brooklyn NY 11209. 718-748-9612, AFTER 6PM.Eastern Time

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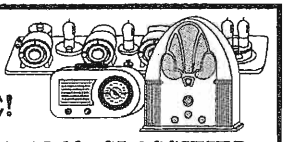

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WANTED: Waters Q-Multiplier for Collins KWM-2. Claude Fleureau, F6GGF, 14 Sentier-Du-Buvier, 92130 Issy-Les-Moulineaux, France

WANTED: Anyone interested in forming an email discussion group on OS-8/U oscilloscopes please email Mike at: mikehardie@shaw.ca

WANTED: Power transformer for Collins 310B3 exciter—will buy junk unit if needed. Brian Roberts K9VKY, 130 Tara Dr., Fombell, PA 16123 724-758-2688 k9vky@arrl.net

WANTED: Marantz first power amp, uses EL39 tubes. Condx unimportant. Or pay well for photo of same. For use in upcoming "History of Audio" book. Charles Graham, 914-666-4523

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

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

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

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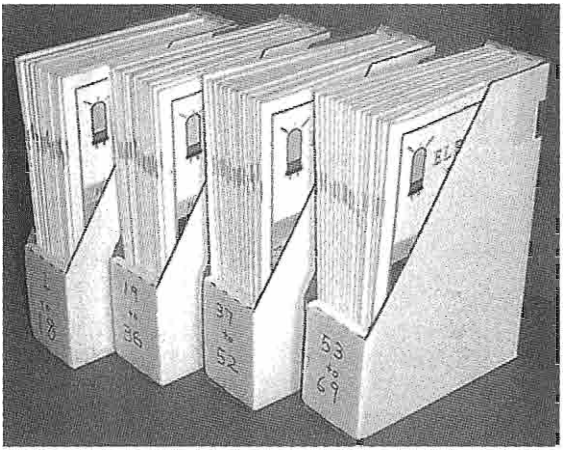

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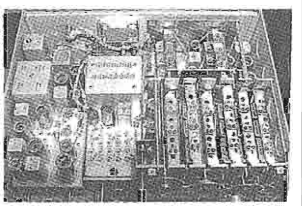

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WANTED: Old military radar displays, scopes, antennae, receivers, manuals, etc. Even half ton items! William Donzelli, 15 MacArthur Dr., Carmel, NY 10512. 847-225-2547, aw288@osfn.org

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

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

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

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

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

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

WANTED: QSL cards from old/pre WW II Ham DX countries; old regen kits. Hajime Suzuki, Nishikuniyoshi 1644-24, Ichihara-Shi, Chiba-Ken, 290-0231 Japan

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

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

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

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

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

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

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

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

WANTED: Long wire antennas AT1O1, AT1O2, GRC-9; Bendix ATD tuning unit Type CRR 47211, 9050 to 15800 kcs; Gas engine generator UPG-12 (GRC-109) KA1ZQR, 348 N. Main St., Stonington, CT 06378.

WANTED: Manual (copy OK) for Tapetone Skysweep 345 Receiver; correspondence w/other Skysweep owners. Geoff Fors, POB 342, Monterey CA 93942 wb6nvh@mbay.net

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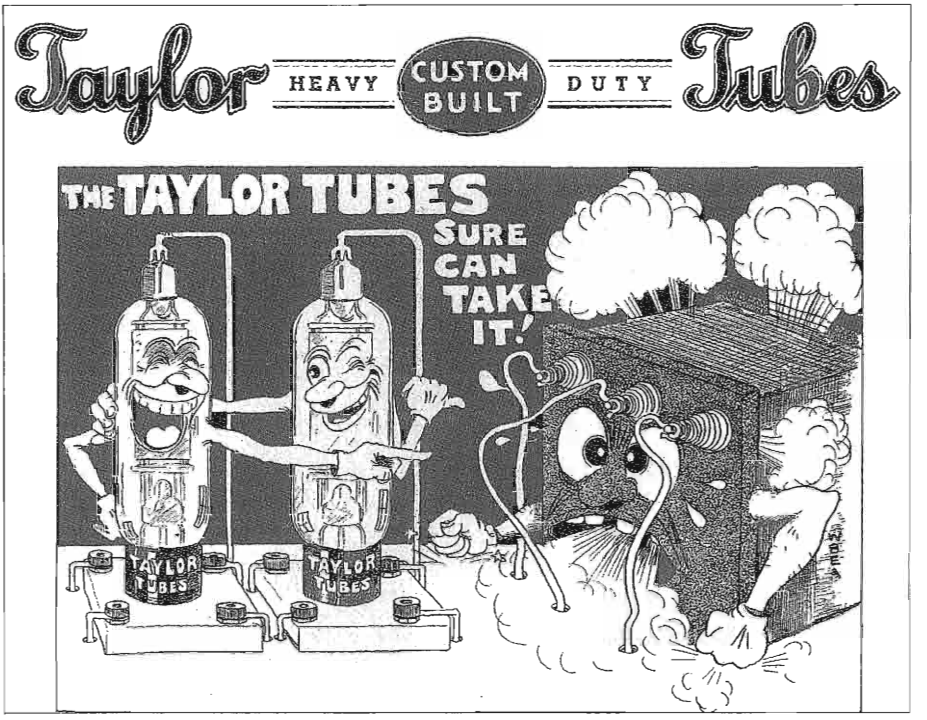

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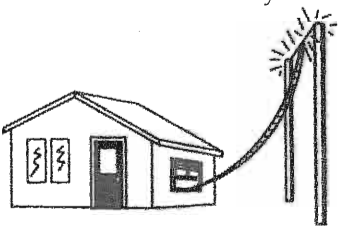

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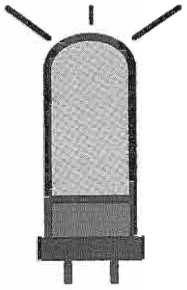

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