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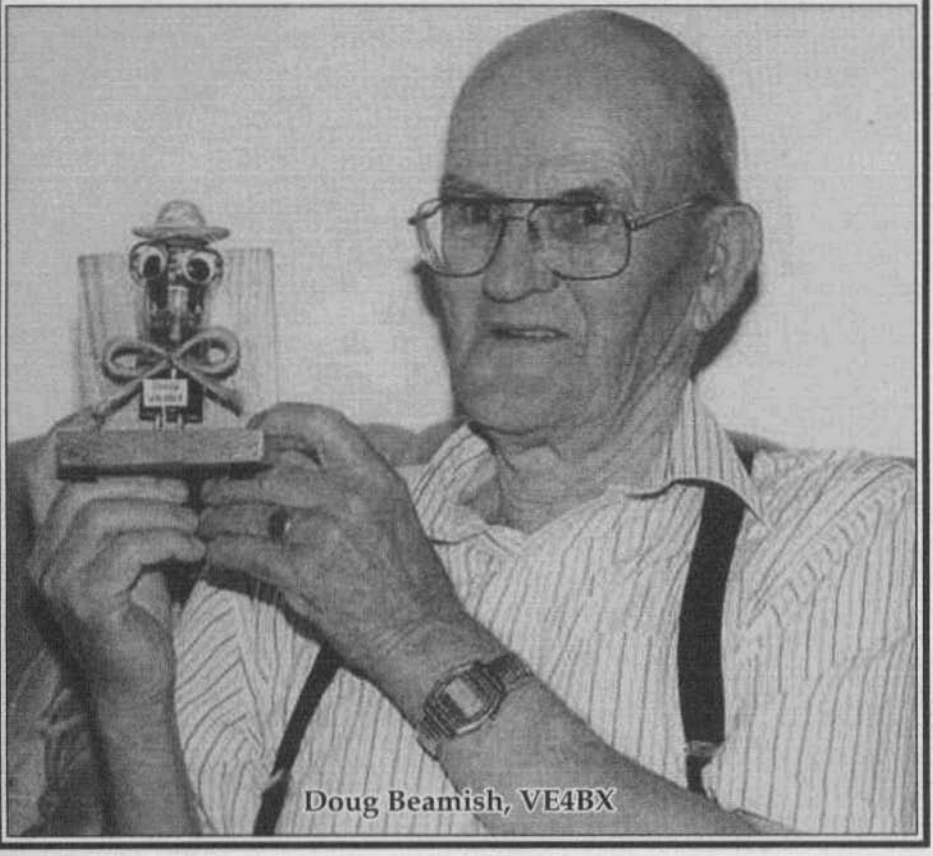
ELECTRIC RADIO

celebrating a bygone era

Number 148 September 2001



Doug Beamish, VE4BX

ELECTRIC RADIO

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Electric Radio is published primarily for those who appreciate vintage gear and those who are interested in the history of radio. It is hoped that the magazine will provide inspiration and encouragement to collectors, restorers and builders.

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

Regular contributors include:

Bill Breshears, WC3K; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Bob Grinder, K7AK; Jim Hanlon, W8KGI; Brian Harris, WA5UEK; Tom Marcellino, W3BYM; Ray Osterwald, NØDMS; Chuck Teeters, W4MEW; Bruce Vaughan, NR5Q.

Editor's Comments

AM Expeditions

In this issue on page 2 there's an interesting article that describes an AM expedition to a historic lighthouse in Chesapeake Bay. It isn't the first expedition this group has undertaken and I'm sure it won't be the last. We should all be inspired to do something similar. Not only did the participants have a great time but the fun was extended to all those other AM'ers who worked the special event station. And of course the mainstream hams listened in and learned what AM operation is all about. Some of them even fired up their plastic transceivers on AM for the first time. All in all the concept of putting a special event station together is a a big-time winner.

For the last couple of years Dale Gagnon, KW1I, the president of AMI, (with sponsorship from ER) has had an AM station on-the-air at the Dayton Hamvention. This special event station has been very effective in showcasing AM operation and has probably resulted in many converts to our niche of the ham radio hobby.

I suggest that other groups (formal or informal) consider putting a special event station on the air. I know from my experience participating in VFD the last few years that going into the field with boatanchors is hard work but I also know that it's rewarding. Going out to Utah for VFD has become an annual'rite of spring' for Shirley and me. I wish I could sell the idea to more of my fellow AM'ers. It might be that if we could get more people putting AM expeditions/special event stations together that it would bring more participation to VFD.

If anybody decides to launch a special event station let me know your plans and I'll help publicize the event and publish a report here in ER. N6CSW

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Cover: Doug Beamish, VE4BX on the occassion of his 80th birthday celebration. He's hold a #80 tube which was presented to him by his friends as a gift. *Photo by Ron Samchuk, VE4SR.*

The AM Expedition to Thomas Point Light

old radios, old lighthouse bring new station on the air

by "The Gang at K3L"
K3L@amfone.net

(Annapolis, Md.) — Every so often a radio event comes along that captures the imagination of participants far more vividly than expected. And so it was with National Lighthouse Weekend, Aug. 3-5, 2001, and nine members of the AM Community who teamed up to establish a vintage station at a historic site in the Chesapeake Bay.

Late last year, some of us were feeling we had missed an opportunity to stage a celebration of 100 years since Reginald Fesseden sent the first AM fone signals from a site at the southern end of the Chesapeake. We managed to squeeze a little visibility for of that milestone during the 160 meter Heavy Metal Rally, which took place the same date, Dec. 23, as Fesseden's experiment a century before.

Yet, since the centennial of AM continues through December, 2001, we still were trying to come up with another, specific way to mark the event. National Lighthouse Weekend surfaced as an ideal way to celebrate.

After months of negotiations with the Coast Guard for access, finally we got word we would be allowed to establish a vintage, AM-only, shortwave station at Thomas Point Lighthouse, near Annapolis, which was first illuminated in 1875, just 25 years before the first AM signals in Fesseden's experiment at Cobb Island, Maryland.

Officials were enamored of the idea of using vintage radio on a historic lighthouse to help draw attention to the need to preserve lighthouses and to honor the development of radio and its role improving maritime safety. The Coast Guard even arranged for the media to come visit the lighthouse and our station to help generate coverage.

The challenge was that the lighthouse had not been manned for nearly 30 years, and had been automated 15 years ago with weather telemetry, beacon and foghorn running on a system of solar panels. No shore power was available, and the outhouse plumbing—a direct drop into the Bay—had long been rendered illegal.

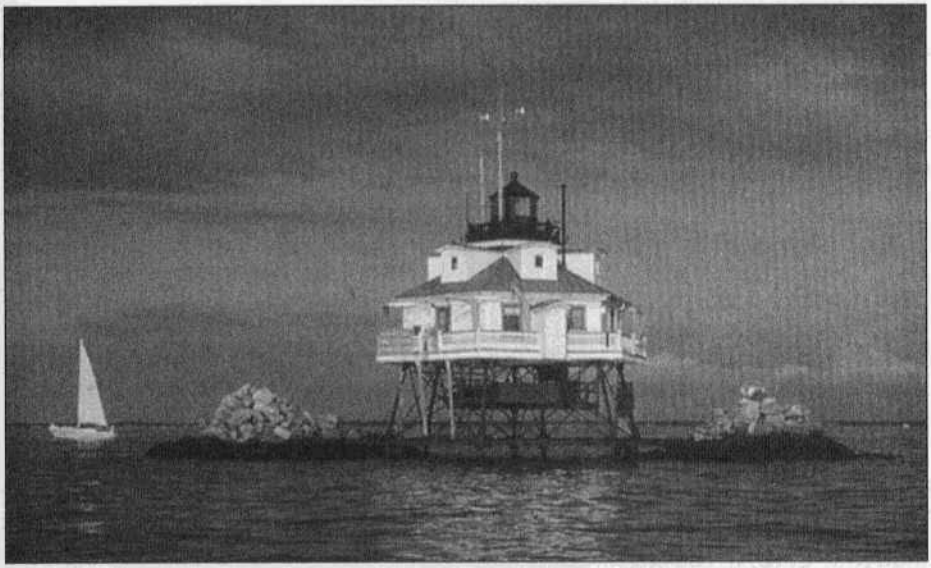
Station Details

The lighthouse is more than a mile from land, a wooden cottage with an iron framework perched on a "shoal" that extends into the Bay. This shoal creates a hazard for cargo ships in transit with the Port of Baltimore. Our little runabout, a 19-foot, "bowrider" powerboat, draws just two feet of water so it can easily navigate to the site where waters are about 7 feet deep.

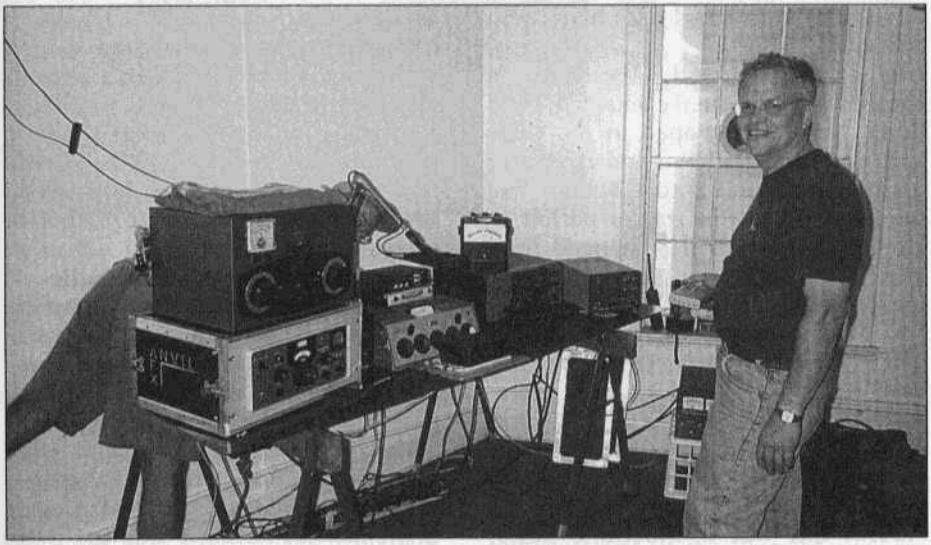
Once at the lower landing deck at the site, there are two metal rung, hand-over-hand ladders to navigate, prompting us to very carefully consider how we would move a generator and our "heavy metal" radios into position. It also proved difficult to make certain the fiberglass gunwales of our boat didn't lose a conflict with the rough iron substructure at the waterline as the wind and waves moved by.

Eventually, we landed a 4000 watt generator on the lower deck, and successfully brought through the hatch a Johnson Ranger and a Collins 51S1-F in a ruggedized transport case. We also brought a Heath amplifier (single 3-500Z), a Gates mixing console/EQ, monitor scope, Hammarlund HQ-100A, hookup cables, a microwave oven, our coffeemaker, lighting, provisions, sleeping bags, and camping toilet.

We calculated some months ago that a 60-foot inverted vee, fed with open wire line, would span the distance nicely



Thomas Point Lighthouse as we approached by boat. *Photo by Paul Courson, WA3VJB*



Joe Fell, WA3GMS, prepares to throw the switches to put K3L on the air. *Photo by Dave Wenger, K3ZRF*

between the two icebreaking rockpiles to either side of the lighthouse. It was suspended from the flagstaff next to the beacon about 50 feet above the waterline. We anchored the ends with jugs full of water, tied with rope to the wires, and placed by hand on the piles of rocks.

Activating The Station

It was an absolutely exhilarating feeling to be on this wonderful old structure in the first place. As far as we have been able to determine, civilians have never been allowed to stay on board for any length of time. There definitely has never been any

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The Astatic D-104 Microphone

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My first encounter with the Astatic D-104 microphone dates from the late 1940's, before I was licensed, when I became fascinated with ham radio. My 'elmer' would control his big, open rack, black wrinkle finished, rig with a chrome, wire mesh protected, (as if a caged beast was inside) D-104. When he pressed that push-to-talk bar, huge, oversized contactors and antenna transfer relays would energize with a loud KER-CHUNK causing meters, blue rectifiers, and red plates to came alive. Awesome. I wanted to do that! I suppose it was love at first sight, for ham radio as well as D-104s.

The D-104 and its unique configuration is pretty much a Ham thing. It was developed in the early 1930's by hams for hams and except for a little excursion into CB land has remained so to this day, a period of almost 70 years. It has changed little and is still popular and relatively inexpensive.

C. M. Chorpening, W8WR/W8MMJ, and F. H. Woodworth, W8AHW, both avid AM'ers looked for an improvement to the carbon mics of 1930, and built a few condenser microphones, (Hmmmm, are they called capacitor mics today?), before producing the crystal mic out of Rochelle Salts, (Sodium Potassium Tartrate). They incorporated in 1933 and went on to produce crystal; microphones, phonograph pickups and recording heads. Their legacy is still doing business as the Astatic Corporation.

The familiar D-104 'Chrome Lollypop' graces many shack pictures and old advertisements of other ham gear. This mic together with the hand key profile is almost a trademark of ham radio, and the mic is certainly a good candidate for a symbol to represent AM phone operations.

The Astatic D-104 microphone remains one of my favorite and is the microphone of choice for many AM/Boatanchor operators. Besides being a good performer, it has a significant mystique associated with its looks. It projects a very manly image and feels solid of heft and fits in the hand, as a fine target pistol would, unlike those wimpy little flexible shaft Q-Tip things or liver colored transceiver squeeze mics that make you look like you are covering a sneeze. I won't comment on those ice cream cone karioke things, but Elvis wouldn't have used one. The old military T-17 carbon mic is a close second favorite for form, but that is another story.

Today's Hams Want Better Audio

Today AM'ers, and SSB operators as well, seem to be on a quest for better sounding audio. It has almost become a sub branch of the hobby. Everyone has their opinion about the best mic, equalizer, processing, etc. and often there are conflicting views. I also have a fairly large pile of 'Stuff Tried'. During this experimentation I was using my old faithful D-104 as a standard of quality for comparison with the configuration of the day. I reasoned, this is silly, using this $35, swap meet, mic as the type of on air sound I like, why not put some effort into finding how to make its performance better?

The remainder of this article covers three main topics;

From the late '40's until the present time the D-104 has been the most popular microphone amongst hams.

*My findings and observations on getting the most performance out of the D-104.

*A description of a simple modification to extend bass response that almost provides an "Equalizer in the mic base".

*The final section is composed of reference notes and repair information.

The D-104 Sound

The key to the D-104 sound is clearly seen by observing the response curve of Figure. 1. The rising characteristics from about 500 Hz with a big peak at 3 kHz and rapid decrease thereafter. The response at the low end, as discussed below, depends on the crystal element load impedance.

Good Bass Response Requires High Load Impedance

Through the years many have experienced poor results when trying to use the D-104 to drive low impedance inputs, in particular transceiver inputs which are around 600 ohm impedance. This lack of performance for this task is common knowledge. In fact Astatic's amplified mic base was developed to address that need in the CB market. Numerous circuits have been published for active impedance transformation using MFETs etc. Many of them use a 100 K ohm resistor in the input. This leads one to believe 100 K ohms is a good value to use, and indeed it is, if you are not concerned about lows below about 500 Hz . The Astatic stock amplified CB mic has a measured cut off of about 300 Hz .

A search of literature regarding the proper load impedance for the crystal cartridge is summarized by the following:

A quote from, W. F. Soules, W8HCW, Electro-Voice Inc., (QST, January, 1958, pg. 30); "With a crystal microphone, the bass response is governed by the value of the grid resistor in the first stage. An input resistor of 100K will limit or "rolloff" at about 500 cycles, 500K at about 250 cycles, and a 1 megohm will extend the response to about 100 cycles.".

Interestingly, here is a comparison of typical catalog specifications but with the lapse of 41 intervening years.

Harvey Radio, 1959; Imp = 1 to 5 meg ohms Response = 30-7,000 cps rising 500-4,000 cps

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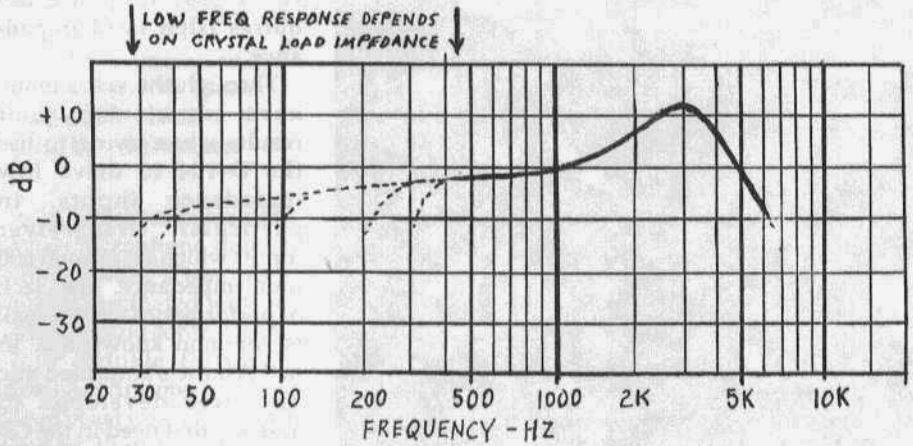

Figure 1. D-104 crystal element audio response. Showing typical shape and how low end is affected by load resistances between 4 meg ohms and 100 k ohms.

Amateur Electronic Supply, Summer, 2000; Imp = High Z Response = 300-7500 Hz rising 500-4,000 Hz

I conducted my own rough experiments using an audio signal generator into a quality response headset taped to the D-104 head and observing the output. (An amplifier with 6 meg ohm input was used to amplify the element output.) With the limitations of setup well in mind, it confirmed the response curve was as above except my highs were almost gone above 5 kHz. In addition the low end response was very much a function of crystal cartridge shunt resistance value. It is a surprisingly striking and significant effect. However the mid and high frequency response was minimally affected for load variations above about 50 k ohms.

There have been a few who knew the truth all along. Tim "Tim Tron" Smith, WA1HLR, east coast AM guru, has for years preached the virtue of using bare D-104 crystal elements into mic input amps in Boatanchors with 5 Meg ohm or greater grid input resistors.

Practical Implementation of a High Input Impedance

Five Meg ohm inputs do indeed produce great sounding audio with plenty of lows and a nice AM signal. I routinely incorporated that in my transmitter audio circuits. I also found that this as well as extending the modulator chain to include lower frequency response, greatly increased my hum problems. Design, wiring and layout problems appear that the old Boatanchors avoided by limiting low end response to about 300 Hz. These hum problems sometimes require an inordinate amount of work to resolve. In addition, with that high an input impedance, the 60 Hz environment in my basement shack is high enough to cause a problem with just 4 feet of shielded mic cable on the floor. The simple, straight forward, solution is to put the high impedance load together with a pre amp right inside the shielded mic element enclosure and bring out the signal at more forgiving low impedance, an old but graceful remedy.

The idea dawned to install a 3.3 meg ohm resistor in series between mic element and the stock D-104 preamp. The amp will compensate for loss of gain and produce a low impedance output. The high impedance load on the crystal element will enable response to 30 Hz on the low end with minimal effect on mid or high end audio. Now, if

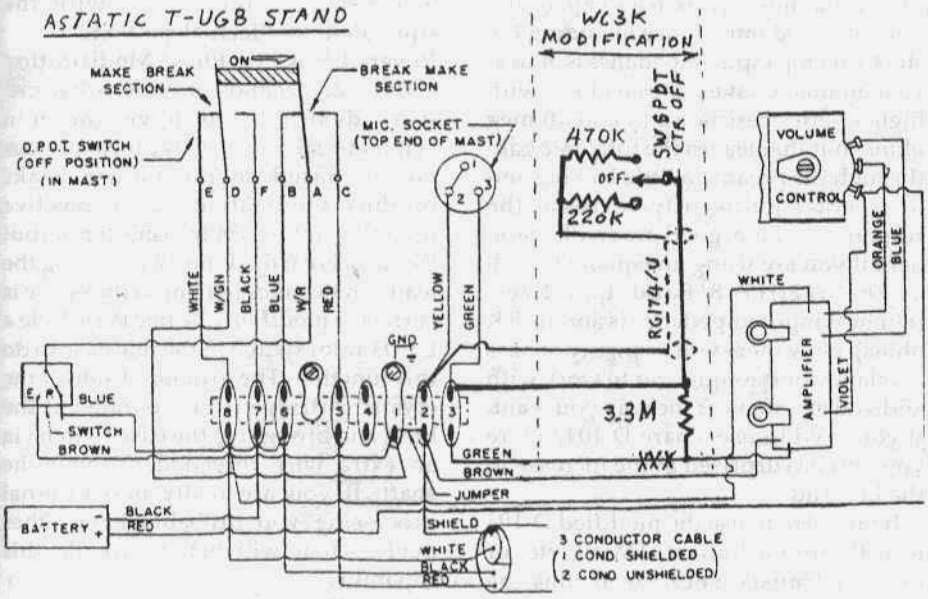

Figure 2. Schematic of Astatic T-UG8 mic stand with the simple WC3K modification to allow selection of three bass responses.

an additional resistor is placed to shunt the crystal element, the low end response becomes a function of the shunt resistor's value. (higher resistance, more lows.) This allows one to conveniently set low frequency response by changing the value of one resistance element; a convenient equalizer in the base of the D-104.

The WC3K D-104 Bass Response Modification Details

This modification is very simple and allows a clear demonstration of the effects of crystal cartridge load impedance on the low frequency response. I have modified several, each with slight differences, and have arrived at this configuration as the most usable. It costs about $5 for parts that are available at your local Radio Shack.

Obtain a D-104 with a T-UG stand, the 'T' means it has a transistor preamp, the 'G' means it has a 'grip' push-to-talk (PTT). (If you are shopping for one at the hamfest, it has the adjustment slot of the nylon gain pot visible through the 1/2 inch hole in the bottom plate.) You can put a superior JFET preamp (See ER, Dec. 2000, pg 35, for W6VMI's circuit for a good start.) and a 9 volt battery in the non amplified model, G or UG, with a little more work. In any case the preamp is needed to act as a high to low impedance transformation device and to provide some gain.

The modification adds 3.3 meg ohms (three, Radio Shack, 10 meg ohm, 1/4 watt, resistors in parallel) in series between the crystal cartridge and the pre amp. This is physically done by removing the bottom plate of the D-104 stand (3 screws). Viewing the bottom with the mic cord in the down position, a green wire will be seen connected between the right-most terminal (#3) of the 8 terminal strip and the lower right corner of the preamp circuit board. Open this connection and solder the resistors in its place. With this simple action, the crystal cartridge will now

continued next page

provide almost all its bass capability. The total load impedance including the stock preamp input impedance is almost 4 megohms. I have experimented with higher series resistance (5 and 10 meg ohms) but that leaves the total mic gain through the preamp a little lacking and does not significantly increase the response to be a good trade-off. Stop here if you are using an equalizer such as the W2IHY 8 Band Equalizer, (Highest input impedance is about 25 K ohms). Now there will be plenty of bass available for the equalizer to work with and you can shape it the way you want. If you tried to use a bare D-104 before you will be surprised at the increase in the low end.

If you plan to use the modified D-104 directly into a Valiant, DX-60, etc. or even a transceiver, there may be conditions when this mod provides too much bass. The further modification as shown by the schematic of Figure 2 allows three choices. The single pole, two position/center off, mini toggle switch selects either no shunt or one of two values of shunting resistance (470K and 220K ohms, 1/4 watt). I chose these by experiment to suit the sound I liked at 6 kHz and 4 kHz monitor receiver IF bandwidths respectively. The switch mounts neatly and out of the way on the lip of the mic base about 3/4 inch to the right of the cable exit hole. Use a piece of shielded wire or RG 174U mini coax to bring the connection to the switch. Resistors mount by their leads to the switch and shield. You might want to experiment with other resistor values. I made one configuration using a mini 1 meg ohm pot and switch. The infinite range of values and choices resulted in personal frustration and I didn't consider it convenient. Though one may enjoy driving your buddies crazy playing the ' Now how's this sound? - Now how's this sound?— — — Now how's this sound? ' game. He, He, He. About as much fun as I have during Sweepstakes Contest and with the equivalent intellectual content.

Reversible Audio Phase Modification

If you are techno-compulsive like me, it is desirable to have the non symmetrical speech wave form of your voice phased so the higher peaks produce modulation in the positive direction at the AM transmitter output RF. This is easily done by reversing the leads on the mic element so the phase is correct. I modified one mic to include a DPDT mini switch in the mic base to do this function. The grounded side of the crystal cartridge is ungrounded at the head and brought to the base switch via an extra wire threaded through the shaft. If you are really into external processing you probably have other devices that will better provide this capability.

Sundry D-104 Information

The following are observations and sundry bits of information from my D-104 notes that may prove useful.

The D-104 Microphone has remained pretty much the way it originally was, however the ceramic cartridge was added as an option to the basic crystal cartridge, as a more environmentally robust element. There have also been improvements to the enclosure techniques/materials for the crystal itself. As previously stated I prefer the crystal for the way you can shape its bass response. The elements are housed in the 'head' that can be plugged onto a number of base support configurations. The most commonly available stands have a bar on the stem that when depressed/gripped activate a push to talk switch closure and also ungrounds the element output. These stands are the G and UG (G = Grip) which delivers the bare element output to the connector and requires a high impedance load; and the T-UG (T = Transistor) which includes a little two transistor pre amp and 9 volt battery in the base and provides an amplified signal that will op-

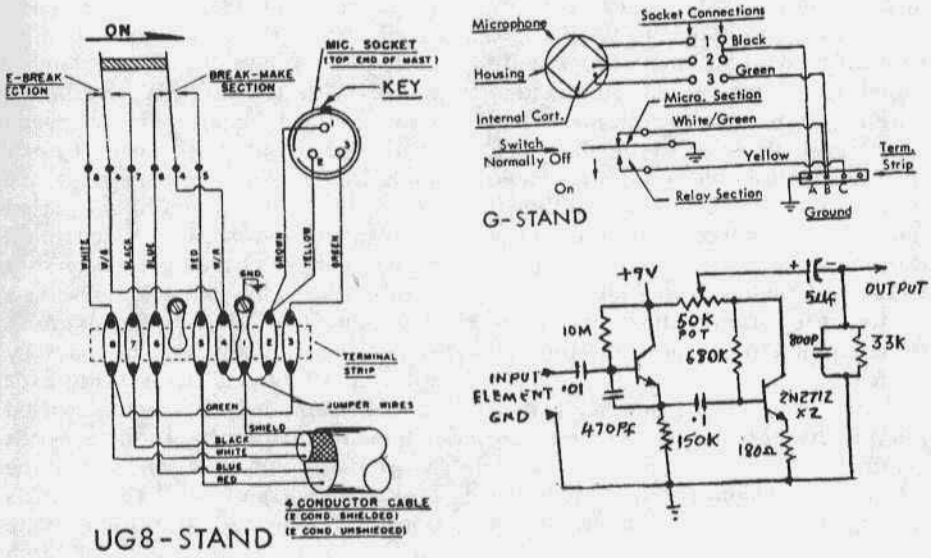

Figure 3. Schematics showing the differences in the Astatic G and UG8 mic stands. The schematic of the amplifier used in the T (amplified) models is also shown.

erate into high or low impedances. The 'U' = an E-R contact capability, I think it is for 'Universal'.

The Mysterious E R Switch

A slide switch in the base of 'U' mic stands has two positions labeled E and R. (No Barry, I don't think it stands for Electric Radio.) This has been a mystery in current times. I can't remember my source, but this is the story that makes sense if you trace the schematic. During the '70s the Japanese CB circuits switched from a relay to electronic PTT as a way to eliminate complexity, the need for, and cost of the relay, thus:

'R' = Relay operation is performed by grounding the red mic cable wire during PTT.

'E' = Electronic switching operation is performed by closing the mic cable black wire to the red wire during PTT. Normally leave the switch in the R position for Boatanchor operation. However if you also add a ground jumper to the black lead it will prevent accidentally leaving the ER switch in an unusable position.

Schematics are provided by Astatic in the base of their mics but are often missing on swap meet purchases. Figure 2 provides the schematic for the most complex base, model T-UG8, and Figure 3 shows those for the UG and G model bases as well as the little amplifier used on the T models.

Repairing Used D-104 Microphones

The most likely problem encountered with the D-104 (other than a weak 9 volt battery) is failure of either the cable or the push-to-talk (PTT) bar switch. There may be no audio and/or the PTT doesn't work.

Mic Cord Repairs

Mic cords are often the cause of a lack of output. My experience has been that it is always at the point where the cord enters the stand base, in spite of the spring designed to help this problem. If you can live with a cord shortened by 6 inches or so it is a simple matter just to cut it off and rewire it. There is an advantage in saving the old cord since it is often of more softly springy material

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and sometimes still longer than the readily available Radio Shack #278-356, $3, curly cord replacement. Proper wire for mic cables has a separately shielded wire for the mic audio and one or two other conductors for the push to talk relay circuit. It should be soft and pliable yet durable to withstand the handling it will receive. It is becoming increasingly difficult to find.

D-104 PTT Switch Adjustments

The mic stand shaft must be disassembled to gain access to the PTT switch:

* First remove the mic head, then remove the PTT clip off the top of the shaft.

* Remove the one screw at the top of the mast that holds the mic head connector.

* Remove the two screws at the base of the shaft that hold the PTT lever bar and remove the bar.

* Remove the two screws midway up the shaft that were under the lever bar. These free the PTT switch inside the shaft.

* Remove the last screw at the base of the shaft. Lift the shaft barrel straight up to free the PTT switch and mic head plug. These will be held suspended by the wiring. When making repairs try to minimize disturbing this alignment.

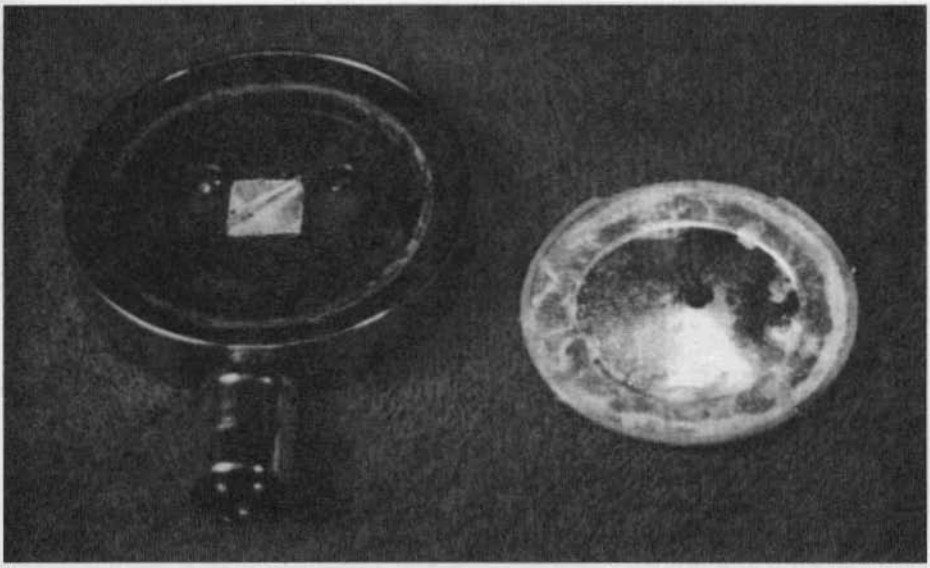
Reassemble in reverse order. The only tricky part is realignment of the PTT switch and mic plug screw holes. A round toothpick used through the screw holes helps reposition everything.

Once exposed, the action of the leaf spring contacts is easily understood, and access to the contacts is good. Sometimes a simple cleaning is all that is required. First give the contacts a light burnishing with a dry strip of note paper pulled through each set of contacts while holding the contacts closed. Usually the black crud quits leaving a mark on the paper after about three passes. Repeat the operation with a new paper strip which has been freshly dampened with Deoxit contact cleaner.

Sometimes the leaf springs require physical adjustment as the spring relaxes with use. While it can be done with small needle nose pliers a special tool will make it much easier. I use a soldering tool that works as well as the old Western Electric tool I misplaced years ago. One end has a 1/8 inch round steel rod on which the tip has been split for about 1/2 inch so that it looks like a tiny tuning fork. The two prongs are 1/16 inch apart. One could be made by splitting a large nail with a thin hack saw or Dremel wheel. The tool is used by placing the prongs around a switch leaf and applying rotation force to the tool to move and reset the spring's position as needed. Control is quite good once you get the hang of it. From the schematic, note that one contact set is make-before-break and the other is break-before-make.

Repairing Crystal Cartridges

There is a lot of advice about the need to replace the crystal cartridge because of its fragility, sensitivity to environment, and aging effects. I am sure when compared to ceramic that is true, however my experience with over two dozen, swap meet specials of various age and condition (including one with a fire discolored base) has been that the crystal itself is usually very usable, some have a little more or less output. This is not a problem if you have the kind with the preamplifier in the base. (There are Hams that recommend scrapping the little pre amp, but I suspect they are just suffering from "CB Envy".) All but four are working after repairs including the 'Unkie Bill Cure' that follows. Note that there is an advantage to trying to save and use the older crystal cartridges. (The oldest mics have little aluminum trade marks rather than decals.) I think they seem to have a little more low end response than today's fresh from the box elements, but that observation may



The photos of the inside of an old D-104 head show the elegant simplicity of the crystal cartridge. The square in the middle is the Rochelle salt crystal block with sandwiched electrodes. It is supported by spots of adhesives on the mounting disk at two diagonal corners. The remaining diagonal corners are attached to a metal "inverted T stirrup" with a post at the center for attachment to the center of the acoustic diaphram. The "wax like" adhesive can be seen around the small hole at the center of the thin aluminum diaphram.

be just my perception and preference for old things. (Like my hat, truck and XYL.) However the published specs have changed a little over the years.

Unkie Bill's Cure

If the mic output is hooked to the most sensitive setting of your scope or audio amp and shouting into it produces a detectable output no matter how limited the audio response, it is probably fixable. If it is dead-dead-dead after inspection of the remaining circuit path, the crystal is probably defunct.

Remove the mic head by unscrewing the large knurled nut and unplugging from the stand. Remove the four screws holding the front (screen) side to the back side, and carefully remove the front. There is a black fabric circle backed by a 'fiberglass looking' blanket that may stick to the element, just carefully remove it. This gives access to a large but fragile aluminum diaphragm that is attached to a small metal stake at the center. This stake couples the acoustic vibrations from the diaphragm to the crystal. The coupling adhesive is a small bead of wax material. Close inspection with a magnifier will sometimes reveal that the wax is broken loose at the stake and is the problem. Mechanical and/or thermal conditions are a likely cause.

This wax can be rebonded by carefully melting with a pencil type soldering iron. A 15 watt Radio Shack iron works. Place the iron in contact with the tip end of the 'metal stake' for a short second and remove it. You want it hot enough to just liquefy the wax at the break point. I now use a home light dimmer to control the iron temperature. Start cool and move up in temperature. If you over melt and lose or vaporize the wax., use a match head size pellet of bees wax, or if you have a friend that

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A One-Tube Wonder
The Twinplex

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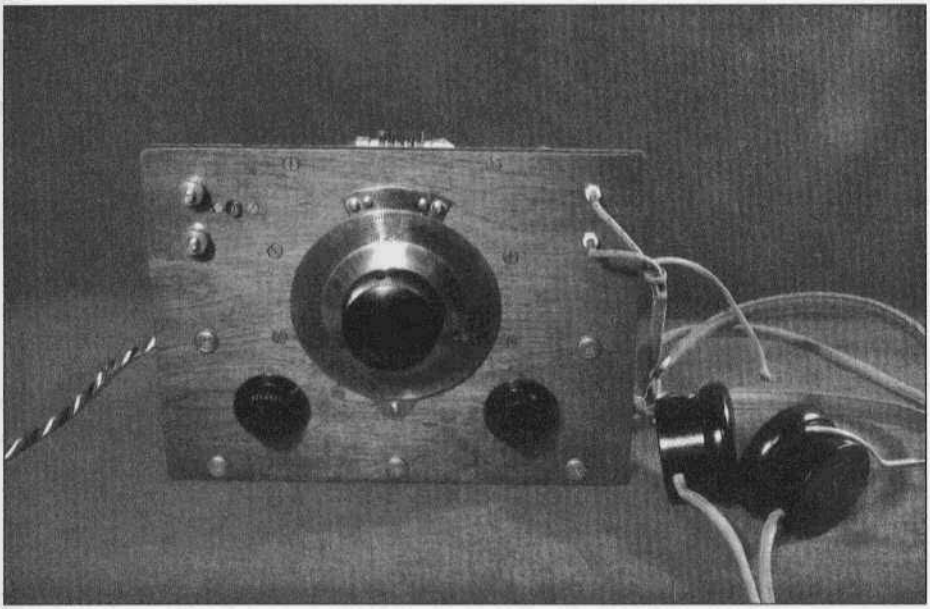
I was content after building my vintage 2-tube Doerle "Globe Circler" regenerative receiver (see "Regenerative Fever", ER#42, Oct.'92, pgs. 20-25). With the exception of the plexiglass used for the construction, the balance of the components, including the Silvertone 230's dated 12/7/33, were faithful to the 1930's design. In addition, the primary reason for building it, the fact that I had wanted to build a similar set in 6th grade, had been satisfied. I had no intention of building another regenerative receiver. Not until I met Bruce Vaughan, NR5Q.

This year, 2001, my interests have focused on crystal sets, and still another project I was never able to build as a 6th grader, a 1-transistor CK722 solar radio. I was searching for components for both when I ran across two crystal sets on eBay listed by NR5Q. I knew that Bruce, NR5Q, was a regular contributor to ER because I had read many of his articles. I emailed Bruce about his crystal sets on eBay and I eventually won both auctions. When the sets arrived, I was really impressed by Bruce's workmanship, especially his use of wood and woodworking skills. His iron pyrites detector assembly in the second set was "gorgeous". Bruce and I continued to correspond after the auctions and we eventually sent each other some 35mm photos of our projects. Bruce integrates wood into his projects, be they transmitter or receiver, that gives them a warm, personal feel. Bruce and I entered amateur radio about 20 years apart, and our building style is very reminiscent of the years we started, 1938 vs 1959. During the second week of July, Bruce emailed me photos of his Twinplex 1-tube regenerative receiver using a 19 twin-triode tube. I was instantly "hooked"...

The 19 Twinplex is covered in exquisite detail in "How to Build the Twinplex Regenerative Receiver" by T.J. Lindsay and available from Antique Electronics Supply or Lindsay Publications Inc. for $7.95 plus S/H. If you are considering building the Twinplex, I would highly recommend Lindsay's book. Additional information can be obtained by entering "twinplex", "doerle", and "regenerative radio" into your internet search engine. I'm not sure why the Twinplex is so appealing to me, but here was a radio I had to build. Maybe Lindsay says it best on the rear cover of his book: "I have to be honest. I wanted to build the Doerle 19 Twinplex I had seen so many times advertised in 1930's magazines simply because of its appearance."

The "original" Twinplex appeared in the Oct.'33 issue of "Short Wave Craft" magazine and used a single 53 twin-triode that replaced the more common dual-30 circuit, similar to my plexiglass radio. Based on the Oct.'33 article, the Twinplex One Tube "Double-Action" Receiver was offered assembled ($9.50, less 53 tube) or in kit form ($8.50) in the "Radio and Short Wave Treatise", Catalog No. 27, 1934, from the Radio Trading Co., NY. The 53 was probably pretty brutal on battery supplies with its 2.0A filament current requirement. Lindsay's book indicates that later in '34, the Radio Trading Co. was offering the Doerle Twinplex using the new 19 tube for $4.91 in kit form, less the 19 tube. The "new" Twinplex was built on an L-shaped "unimount" panel. According to Lindsay, "the original Gernsback Twinplex circuit....appeared in a 1934 issue of Short Wave Craft magazine". Another catalog of the mid-



Front view of the Twinplex. The front panel and baseboard were built by Bruce Vaughan, NR5Q. The headphones are Baldwins which are highly sought after by builders of crystal sets and regens because of their sensitivity and good audio quality.

30's was selling the Doerle Twinplex kit, including coils, for $3.00, and an additional $0.50 for the 19 tube. The evidence suggests that even though the 19 twin-triode was released prior to the 53, it was the 53 that made it into the first "Twinplex".

According to "70 Years of Radio Tubes and Valves" by John W. Stokes, the type 19 was released (by Sylvania) early in 1933, and appeared in "New Tube Announcements", Radio Craft, Jan.'33, pg. 398. The 19, "the first of the so-called 'twin-triodes'...was..."intended for Class B output stage use". The 19 tube is available in both ST12 and T9 outlines. The octal equivalent of the 19 is the 1J6G with an ST12 outline and 1J6GT with a T9 outline. The 1J6G/GT's filament current of 0.24A is a bit lower than the 19's 0.26A, but are otherwise identical. My 19's came from Antique Electronics Supply, appear to be NOS, and were made in Canada (manufacturer unknown).

In my emails with Bruce, I must have told him that I was a real "novice" working with wood. Before I knew it, Bruce was building a baseboard and front panel for me, using a thin steel sub-panel behind the 1/4" wood front panel. When you look at the photos of my Twinplex, keep in mind that the baseboard and front panel were built by Bruce Vaughan, NR5Q.

Here are a few comments about the construction and components of my Twinplex 19 regenerative receiver:

* The wood front panel is 9-1/2" x 7-1/4" x 1/4" thick. The matching sub-panel is made from 26GA steel. The baseboard is 8-3/8"W x 7-1/8"D x 3/4"T. The usable space between the 3/4" wide support brackets on the baseboard is 6-7/8"W x 7-1/8"D. The center drilled hole for the tuning shaft is 3-1/4" from the top of the panel. The front panel has three coats of stain "to get the desired look", "several swipes with Ultra-Clas-

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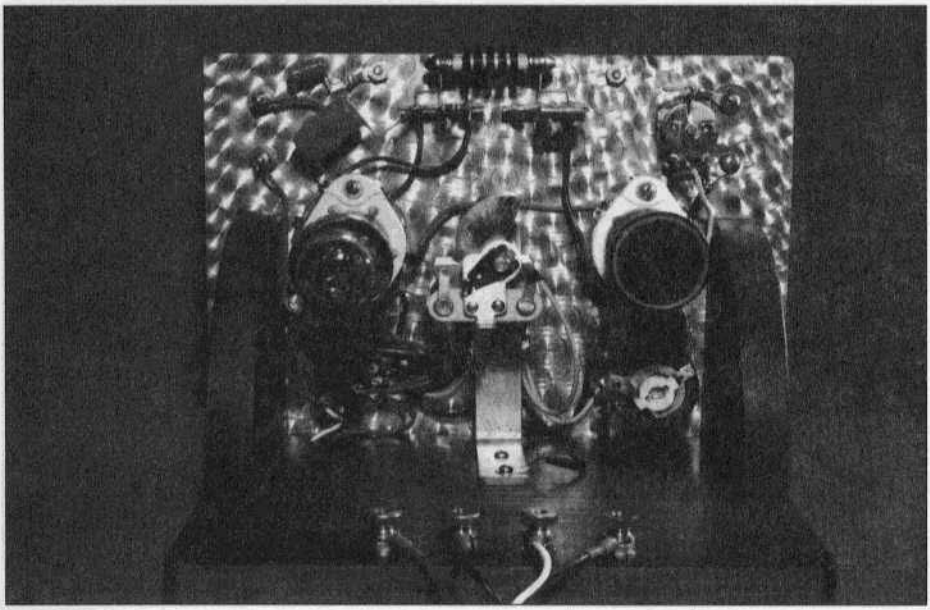


Rear view of the Twinplex. Note the simple uncluttered layout.

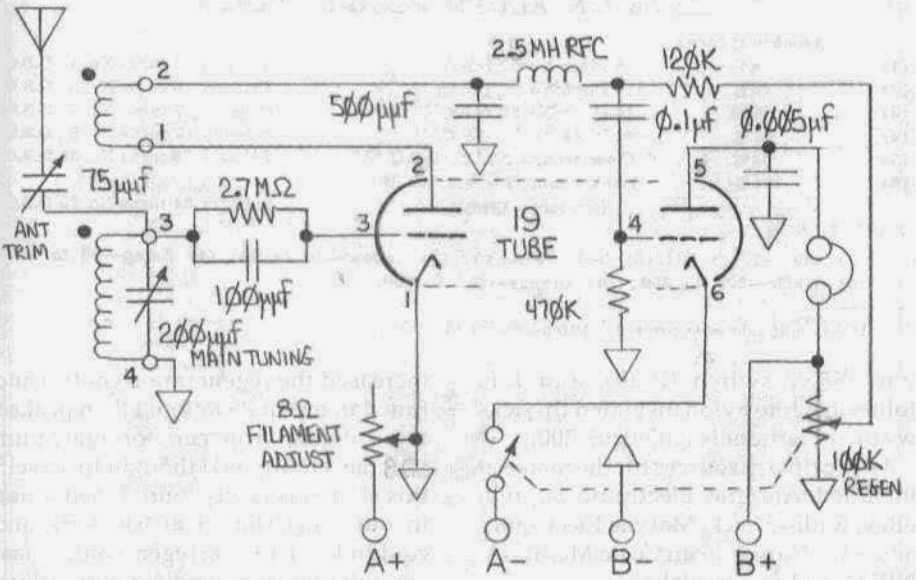
sic Toner to get the darkened corners and 'antique radio' look", followed by two coats of a polyurethane clear satin varnish.

* The wood front panel and steel sub-panel were drilled as a unit. I used a drill template to locate and center punch the holes on the sub-panel. Small pilot holes were drilled from the rear using the center punched sub-panel as a guide. All subsequent drilling was from the front using a drill press and slowly increasing the drill sizes until the two 3/8" holes were drilled for the filament rheostat and the 100K regeneration pot. Holes for the National dial and clearance hole for the 100K's bushing were enlarged using a T-handle reamer. Slowly going up in drill sizes and drilling from the front minimized, if not eliminated, chips and splinters in the veneer. Eight holes were countersunk. The countersunk holes and the exposed hole for the antenna trimmer capacitor were darkened with a black marking pen.

* Additional work on the sub-panel included using a 5/8" chassis punch for the clearance hole for the antenna hardware and increasing the size of the clearance hole for the antenna trimmer capacitor's shaft. Both sides of the sub-panel were deburred and cleaned before spraying with clear lacquer to minimize rusting. Before assembly, several holes were spot-faced to insure a good ground connection.

* The six 4-pin plug-in coil set was manufactured by Alden Mfg. Co. and is thoroughly covered in the "1934 Official Short Wave Radio Manual" and "Short Wave Coil Data Book", both Lindsay Publications reprints. It is the same set that I used with my plexiglass radio. The set is designed for use with a 140uuf tuning capacitor and covers the range of 10-500 meters. The orange and white coils used for the AM broadcast band measured 412 uHy and 115 uHy respectively.

* The NOS/NIB Hammarlund MC-200-M 200uuf main tuning capacitor came from my "junkbox". I wanted to optimize this receiver for the AM broad-



DOERLE 19 TWINPLEX SCHEMATIC
13AUG01 WA6VVL

cast band, so I increased the size of the tuning cap from the recommended 140uuf. Bruce fabricated the main tuning capacitor's mounting L-bracket.

* The National N vernier dial is 4" in dia., has a decimal vernier, and a planetary drive with a 5:1 ratio. It is secured to the front panel with three SS 4-40 screws and the dial fits a standard 1/4" shaft. The MC-200-M tuning cap is directly coupled to the dial without a coupler.

* The antenna trim cap is similar to a National PSL-75, but is made by Sickles. It is screwdriver adjustable.

* The 19 twin-triode has a 2.0 VDC 0.26A filament. Using two D-cells as a filament supply, a filament rheostat of 8-10 ohms is about optimum with the initial adjustment at midrange. The Ohmite 25W Model "H" is a bit overkill, but its 1-9/16" dia. was reasonable, it was available, and the price was right. At mid range, 4-5 ohms, the rheostat is dissipating only 0.27-0.34W, so there's a wide range of choices for the filament rheostat.

* The RFC is a National R-100 2.5 Mh.

* The 4-pin ceramic socket appears to be a dead-ringer for an E.F.Johnson 122-0224-001, but was made in China. The 6-pin ceramic socket is NOS. The ceramic sockets were selected primarily for "looks" and phenolic sockets would work equally well. Both ceramic sockets were installed on 1" aluminum spacers using 6-32 brass hardware. The screws were not tightened which allowed the sockets to "float". I was concerned that over-tightening would crack the ceramic.

* The antenna, ground, and battery terminals were constructed using 10-32 brass hardware, including the knurled nuts. Brass hardware was used throughout the construction of the Twinplex where possible.

* Among the miscellaneous items are terminal strips from Radio Shack (274-688B), Caltronics 100K linear taper pot

continued next page

DATA ON ALDEN PLUG-IN COILS

	Number of turns		
(1)	4¾	6 Pitch No. 22 D.S.C.	Primary 4 turns No. 31 D.S.C.
(2)	10¾	12 Pitch No. 22 D.S.C.	Primary 6 turns No. 31 D.S.C.
(3)	22¾	16 Pitch No. 22 D.S.C.	Primary 7 turns No. 31 D.S.C.
(4)	51¾	40 Pitch No. 22 D.S.C.	Primary 15 turns No. 31 D.S.C.
(5)	68¾	Close wound No. 28 D.S.C	Primary 28 turns No. 30 D.S.C.
(6)	131¾	Bank wound, 2 layers, No. 32 (Optional Litz)	Primary 32 turns No. 30 D.S.C.

WAVE BANDS:

(1) Blue—10 to 20; (2) Red—20 to 40; (3) Yellow—40 to 80; (4) Green—80 to 200; (5) White—200 to 350; (6) Orange—350 to 550.

D.S.C.—double silk covered. Pitch—turns per inch.

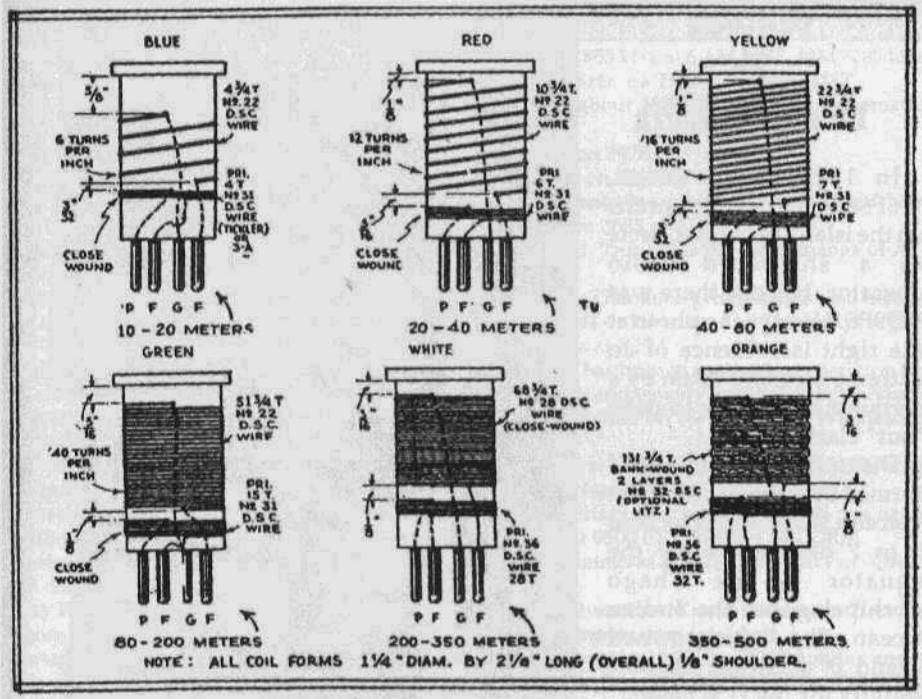
with SPST switch (P-29), and E.F. Johnson white nylon insulated tip jacks w/turret terminals (105-0201-200).

* My primary sources for the material included Antique Electronic Supply, eBay, Radio Shack, Marvac Electronics and ACE Hardware in Costa Mesa, CA, NR5Q, and my "junk box".

* The power supply was the same battery supply built for the plexiglass radio in '92—3V provided by two D-cells and 45V provided by five 9V batteries. Total supply current from the 45V batteries measured 1.6 mA. The filament draws approximately 260 mA.

So, after all this, how does the Twinplex perform? I admitted in ER#42 that I wasn't a "regen-guru". Well guess what? After ten additional years, I'm still not. My regen experience has been limited to my plexiglass radio ('92), a half a dozen Knight Kit Ocean Hoppers, and a couple of Knight Kit Space Spanners. As I was connecting the antenna, ground, and battery terminals, I was hoping my Twinplex was going to work at least as well as my plexiglass radio. I had assumed that by using an interstage transformer between the detector and audio stage my plexiglass radio would have an "edge" in performance. I was about to get a very big surprise. I plugged in my Baldwin Radio Type "C" headphones, turned on the filament switch (regeneration control fully CCW), and slowly adjusted the 19's filament for 2.0V. I slowly increased the regeneration control and tuned in my first station. I then peaked the antenna trim cap for maximum volume. Hmmmm, I thought to myself, this station is pretty loud. I then tuned in our local station at 640 KHz and couldn't get to the regen control fast enough to turn down the volume. Five minutes before, I had just gone through the same "drill" with the plexiglass radio, and there were NO stations that were "too loud". Something was clearly different about the Twinplex!!! After recovering from the "shock", I slowly tuned across the band. There were several very loud stations and many stations that produced very comfortable headphone volume. Where the plexiglass radio's regen control was "finicky", the Twinplex was just a joy to use. I was just dazzled that a 1-tube radio could perform this well. The performance of the Twinplex just "knocked my socks off"!!! The word "incredible" came to mind.

The plexiglass radio uses a fixed supply voltage on the detector tube and a variable cap (310uuf) in the feedback winding for the regeneration control. The Twinplex uses a fixed capacitor (500uuf) in the feedback winding and a variable supply voltage for the detector tube as the regeneration control. The differences in performance between the two regens are so remarkable that I am going to revisit the design of the plexiglass radio. Keep in mind that all



Plug-in coils to cover from 10 to 500 meters.

my comments are aimed at performance on the AM broadcast band. I have yet to try the Twinplex on the amateur bands. However, in light of my plexiglass radio's performance in a 40M QSO almost ten years ago, there's no doubt in my mind that I will experience the same increases of performance with the Twinplex on 80M and 40M. I will repeat the same caveat that was in ER#43 that the tuning rate using a 140uuf (and now a 200uuf) tuning capacitor is just too fast for 40M operation. These values represent more "general coverage" (SWL) coverage.

Building the Twinplex gave me a new respect for regenerative radios and provided me with a new "benchmark" for future projects. In addition, this radio was fun to build. I haven't had this much fun building a project in several years.

I would like to thank Bruce Vaughan, NR5Q, for his inspiration and help in making this project possible, and Philip Rheinschild, Jr. for taking the time to scan the Jan.'33 Radio Craft article. ER

Selected References:

1. "70 Years of Radio Tubes and Valves", John W. Stokes, copyright 1982 by The Vestal Press, Ltd.

2. "New Tube Announcements", Louis Martin, Radio Craft, Jan.'33, pgs. 398-399, 438-439.

3. "Radio and Short Wave Treatise", Catalog No. 27, 1934, Radio Trading Co., 100 Park Place, New York City, NY, Copyright 1933. The Twinplex utilizing the 53 twin-triode appears on pgs. 12 and 56. The schematic and assembly diagram in the Catalog are identical to the "The '53' 1-tube Twinplex" found in the "1934 Official Shortwave Radio Manual" below.

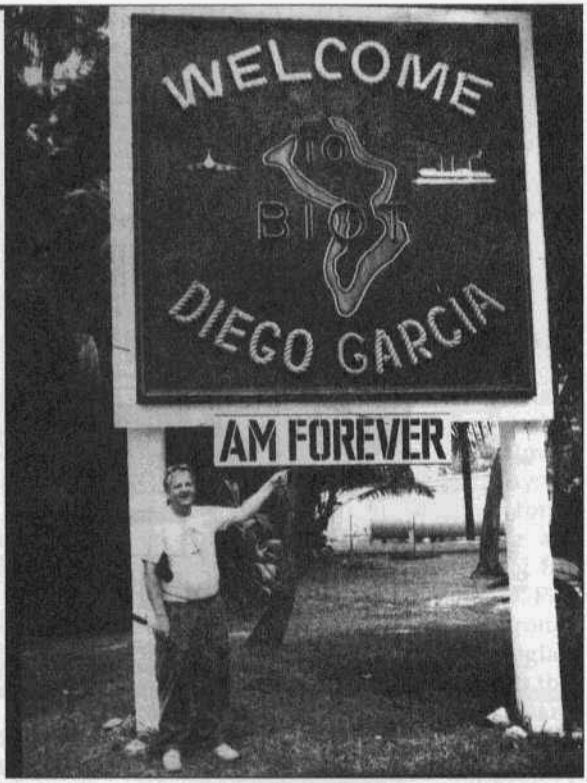
4. "How to Build the Twinplex Regenerative Receiver", T.J. Lindsay, copyright 1998, pgs. 7-40. Lindsay's

continued on page 42

W6PSS at Diego Garcia

In 1992 David Olsen, W6PSS, spent eight months on the island of Diego Garcia as a shipboard radio operator. His call there was VQ9PS. He says the photo at the right is evidence of an extreme measure taken by a certain AM operator to stake "our" claim abroad.

Diego Garcia is an island formed by a rim of an extinct volcano 30 miles long located 5 to 7 degrees below the equator in the Chago Archipelago of the Indian Ocean. The British owned island is a critical support activity for the U.S. Fleet.



David says, "This was a unique opportunity to be associated with probably one of the last remaining classic "old buzzard" shipboard radio shacks. Those months provided cherished memories of "radios that glow in the dark".

VINTAGE NETS

Arizona AM Nets: Sat & Sun, 160M 1885 kHz at sunrise,75M 3855 kHz at 6 AM MST, 40M 7293 kHz 10 AM MST; 6M 50.4 MHz on Sat. at 8 PM MST; 2M 144.45 MHz, on Tue. at 7:30 PM MST.
West Coast AM Net meets Wednesdays 9PM Pacific on or about 3870kc. Net control alternates between John, W6MIT and Ken, K6CJA.
California Early Bird Net: Saturday mornings at 8 AM PST on 3870.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3860 +/-
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net controls are Andy, WA4KCY and Sam, KF4TXQ. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours.
Colorado Morning Net: An informal group of AM'ers get together on 3875 Monday, Wednesday Friday, Saturday and Sunday mornings at 7AM MT.
DX-60 Net: This net meets on 3880 at 0800 AM, ET, Sundays. Net control is Jim, N8LUV, with alternates. This net is all about entry-level AM rigs like the Heath DX-60.
Eastcoast Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is Ted, W3PWW. Saturday mornings at 0500 ET on 3885 + or - QRM.
Westcoast Military Radio Collectors Net: Meets Saturday evenings at 2130 (PT) on 3980 + or - QRM. Net control is Dennis, W7QHO.
Gray Hair Net: The oldest (or one of the oldest - 44+ years) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:00 PM EST & 8:30 EDT. http://www.crompton.com/grayhair
Vintage SSB Net: Net control is Andy, WB0SNF. The Net meets on 14.293 at 1900Z Sunday and is followed by the New Heathkit Net at about 2030Z on the same freq. Net control is Don, WB6LRG.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet on Tues nights on 3805 at 2100 Eastern and on Thur nights on 3875. West Coast 75M net that takes place on 3895 at 2000 Pacific
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.
Collins Collector Association Monthly AM Night: The first Wed. of each month on 3885 kHz starting at 2000 CST (0200 UTC).
Drake Users Net: This group gets together on 3865 Tuesday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, W8NS; Rob, KE3EE and Huey, KD3UI.
Drake Technical Net: Sunday's on 7238 at 8PM Eastern time hosted by John, KB9AT
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. NC is Will, AA6DD.
Old Buzzards Net: Meets daily at 10 AM Local time on 3945. This is an informal net in the New England area . Net hosts are George, W1GAC and Paul, W1ECO.
Canadian Boatanchor Net: Meets Saturday afternoons, 3:00 PM EST on 3745.
Midwest Classic Radio Net: Sat. mornings on 3885 at 7:30AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics. NC is Rob, WA9ZTY.
Boatanchors CW Group: 3546.5, 7050, 7147, 10120, 14050. 80 on winter nights, 40 on summer nights, 30 and 20 meters daytime. Nightly "net" usually around 0200-0400 GMT. Listen for stations calling CQ BA, CQ GB.
Wireless Set No. 19 Net: Meets the second Sunday of every month on 7.175 +/- 25 kHz at 1800Z (3760 +/- 25 kHz alternate). Net control is Dave, VA3ORP.
Hallicrafters Collectors Assoc. Net: Sundays, 1730-1845 UTC on 14.293. Net control varies. Midwest net on Sat. on 7280 at 1700 UTC. Net control Jim, WB8DML. Pacific Northwest net on Sundays at 22.00 UTC on 7220. Net control is Dennis, VE7DH.
Nets that are underlined are new or have changed times or frequency since the last issue.

How to Repair a Transmitter

by Jim Hanlon, W8KGI
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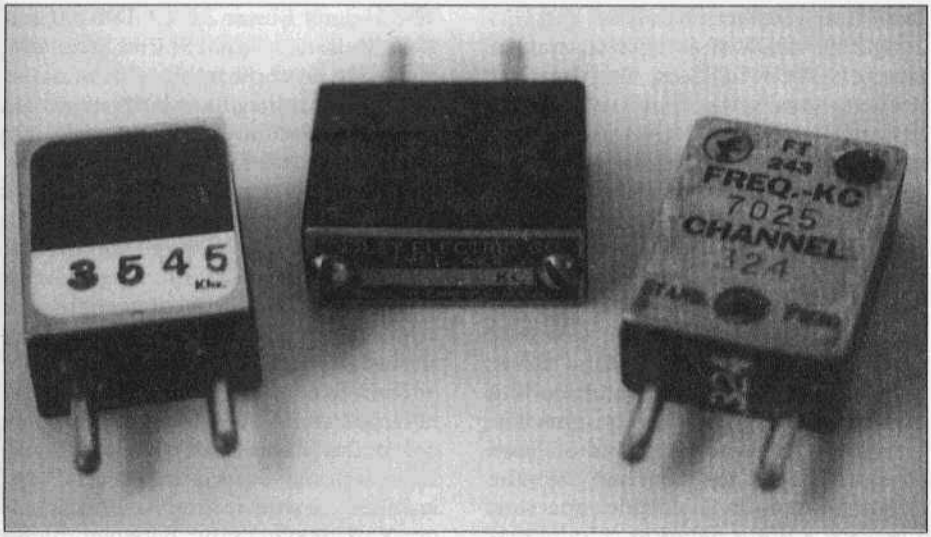
Part Two

Two Stage Transmitter

Your new transmitter might be a two-stage, oscillator-amplifier unit. They were very popular in the 40's through the 60's, and many manufacturers offered them to the new novice class licensees. Examples in my collection include the Heath DX-20, Globe Scout 680 and Globe Chief 90, Millen 90800, Lettine 240, and McMurdo Silver 701. EICO also offered their 723, and the Eldico TR-75-TV was popular especially in the western states. One of the most sought-after two-stage models is the Heath AT-1. All of these transmitters have a crystal oscillator and a power pentode amplifier, and they use either bandswitched or use plug-in coils to cover multiple bands. There are several VFO-controlled two-stage transmitters including the ARC-5 Command Set transmitters and the Meissner Signal Shifters. We will take them up a little later.

In a "rock-bound" two-stage transmitter, you will be tuning the oscillator plate tank to resonance at the crystal frequency or at one of its harmonics, and you will be tuning and loading the amplifier plate tank to the output frequency of the oscillator or perhaps to its second harmonic. Most rigs have a way to turn off the final while you are tuning up the oscillator, usually by cutting off the final tube's screen voltage or opening its cathode. For those that don't, you will want to tune up quickly so that you don't overload the final tube for very long. In those rigs that meter the oscillator plate current, you will tune the oscillator plate tank for a plate current dip. Some rigs meter the final grid current, allowing you to tune the oscillator plate tank for peak grid current; except that for a 6146 you do not want to exceed 3 mA grid current. You may purposely detune the oscillator to reduce 6146 grid current to a safe, 2 to 3 mA value. Some rigs meter the final cathode current, and again you would tune the oscillator plate tank for peak current. At least one rig, the Lettine 240, only meters final plate current. For that rig, I hit the key and quickly tune the oscillator tank for maximum amplifier plate current with the amplifier plate tank tuned off resonance. Then I resonate the final and go back again to the oscillator tuning, adjusting it for maximum final amplifier power output as indicated on my SWR/Power meter.

After you have tuned the oscillator, you will power up the final amplifier and tune and load it. If it uses a pi-match output tank, you will tune it as described for the one-stage transmitter. If it uses a parallel tuned tank with a magnetic coupling link coil, start with no load on the transmitter and tune the plate tank condenser for a dip in plate current, and then attach your load to the link terminals. Re-dip the plate current with the load attached. If the loaded plate current is not the value you desire, you will have to adjust the coupling. One way is to physically move the link nearer to or further away from the coil or to rotate it further into or out of the plane of the coil. If that is not possible or if it doesn't have the desired effect, you can add more turns to the link to increase loading or take turns off to decrease it. As suggested in the



Crystals. On the right is an original, WW II surplus crystal in an FT-243 holder. In the center is a Bliley crystal in an AX2 holder with the same pin spacing as an FT-243. On the left is a newly made crystal in an FT-243 holder.

Handbook, you can also vary loading with a variable capacitor in series with the link. I use a 250 pF variable in series with the link on my Globe King 275. I have to re-dip the final plate tank capacitor after adjusting the loading with the series capacitor since it reflects a reactance change as well back into the final tank.

The famous WW II surplus ARC-5 "Command Sets" use a variable frequency oscillator instead of a crystal oscillator, and they cover just one frequency range. Tuning up a Command Set is easy, since the VFO and the final are gang tuned and they track each other across the entire range. You just set the transmitter on frequency, adjust the loading by rotating the built-in variable-position link inside the final tank coil, and away you go. "On the Air With the Command Set Transmitters" in Electric Radio number 75, July 1995, gives all the details about how to put one of these guys on the air.

The Meissner Signal Shifters are a series of two-stage, VFO-controlled exciters originally intended to drive or replace the crystal oscillator in older rigs. The pre WW II versions use a 6F6 oscillator/doubler, a 6L6 second doubler, and plug-in coils; while the post war versions use a 6V6 oscillator/doubler, an 807 second doubler, and turret switched coils. They put out more than 5 watts, and they make quite respectable QRP transmitters. Several guys, myself included, run "barefoot" Signal Shifters on the AWA Old Time Equipment Contest. Like the Command Sets, the oscillator and amplifier in the Signal Shifters are gang tuned, so all you have to do is dial up the correct frequency, attach a load to the link, and away you go. For more information, see "The Meissner Signal Shifters" in Electric Radio number 72, April 1995.

Multi-Stage Transmitters

One step up from a two-stage transmitter is, of course, a three-stage one. These units add an intermediate buffer stage that is operated either as a straight through amplifier on the oscillator's output frequency or that multiplies that frequency. Typical rigs in this class include the Johnson Viking

continued next page

I and II, the Hallicrafters HT-9 and HT-20, the Heath DX-40 and DX-60, and the Harvey Wells TBS-50 Bandmaster series. As with the two-stage transmitter, you will need to tune the oscillator and buffer stages to the correct frequencies. Most rigs have a switched meter that allows you to monitor and dip the appropriate plate currents or peak the appropriate grid currents. The final amplifier on these rigs tunes up as the other finals with a pi-match or a parallel-tuned tank do. One thing should be mentioned about the loading capacitors on high-powered pi-matches. Some rigs use a combination of fixed capacitors that are switched into the circuit along with a variable capacitor. I make it a point never to change that fixed capacitor loading switch while the key is down and the transmitter is operating. That part might be able to survive being "hot switched," but if it doesn't I will have a heck of a time finding a replacement.

Higher end transmitters may also have their own, built-in VFO. Rigs like the Johnson Ranger and Valiant, the Heath DX-100 and Elmac AF-67 have a crystal oscillator stage as well which runs as a buffer amplifier or multiplier stage when the VFO is being used. These rigs usually run the VFO on 160 meters when the rig is switched to 160, 80 and perhaps 40 meters. They switch the VFO to 40 meters for operation on the higher frequency bands. VFOs, if you feed them the right B+ voltages and if they have good parts, will usually oscillate with no trouble. If yours doesn't oscillate, measure the plate and screen grid voltages and trouble shoot the tube and other parts until you find something wrong. Don't forget to check the tuning capacitor for shorting plates like you did with your receiver. If it oscillates, but the note is hummy or chirpy or the signal drifts a bit, try replacing the tube with a new one, even if it tests OK. I've found that to work wonders for the VFOs in my Elmac AF-67, DX-100 and 1941 Meissner Signal Shifter. You may also need to correct the calibration on your VFO. It may have both a variable slug in the oscillator coil and a variable padder capacitor in parallel with the main tuning capacitor. Adjust the padder for correct calibration at the high frequency end of the range and the coil slug at the bottom. You may need to bounce back and forth between the two adjustments several times, but they should converge on correct calibration.

The VFOs in the Viking Ranger, Valiant, 500 and Navigator and the external model 122 VFO for the Viking I and II deserve some special attention. There is an 18K, 2-watt carbon resistor, R3 on my Valiant schematic, between the B+ line and pin 1 of the OA2 voltage regulator tube. You will find it inside the VFO box. This resistor is notorious for decreasing in resistance as it ages and overheating. In the worst case it will start a fire and destroy the fiber boards in the VFO. REPLACE IT immediately with one or more resistors that are rated to dissipate at least 5 watts!

A few rigs, like the Collins 32V series and the Hammarlund 4-20, have a dedicated frequency multiplier for each band and use a VFO or crystal oscillator on 160 or 80 meters. The Collins rigs gang-tune the VFO and multiplier stages via a series of slug tuned coils. My advice is not to mess with the adjustment of those slugs if at all possible. The original, factory settings will be just fine for the life of the rig. The Hammarlund 4-20 uses gang tuned capacitors in the multiplier stages. Mine works just fine without any messing with the individual stage inductors after 50+ years of service.

Adding a VFO to a Crystal Controlled Rig

When the 1950's rock-bound Novice graduated to a General Glass ticket, he wanted the freedom of a VFO for his transmitter. Several manufacturers of-

fered add-on VFOs, among them Heath (VF-1 and HG-10), Knight, EICO, and Hallicrafters. Millen, Bud and Meissner also built VFOs in the 30's through the early 50's, and many Command Sets were drafted into VFO duty. All of the above VFOs come with one of two output coupling circuits, either a low impedance link or a high impedance capacitor coupling off the plate side of the VFO output tuned circuit, usually driving a short piece of coax.

The capacitor coupled VFOs are designed to plug into the crystal socket of a grid-plate crystal oscillator stage with the coax center lead connected to the crystal oscillator control grid (G1) and the shield to ground. I have several rigs running with this type of coupling, including a DX-20/Knight VFO, DX-40/HG-10, Harvey Wells TBS-50 D/Harvey Wells VFO, Globe Chief/Knight VFO, Globe Scout/Hallicrafters HA-5, and McMurdo Silver 701/T-195 vfo (ER # 128, December 1999). They all work fine with no sign of instability in the driven crystal oscillator stage, even the McMurdo Silver 701 that uses a tri-tet crystal oscillator. If you are not so lucky and your crystal oscillator stage wants to sing on its own when you are driving it with a VFO, bypass the crystal oscillator cathode to ground with a 0.01-microfarad disc ceramic capacitor. Harmonic crystal oscillators like the often-found Grid Plate circuit will usually settle down if you do this. You might even want to include a switch like the Harvey Wells TBS-50 has to switch the bypass cap in or out of the circuit. The only adjustment beyond tweaking the VFO calibration that you might need to make is to adjust the output tank of the VFO, usually a slug tuned coil, for maximum drive to your particular transmitter. One adjustment is usually sufficient for an entire band.

VFOs with a low impedance link output were designed to be connected to a similar coupling link on a coil that is part of the tuned circuit in the grid of the driven stage. My Meissner EX Signal Shifter does a great job of driving the link input to the 2E26 driver in my Globe King 275. Some of the VFOs with link output, specifically the Meissners, the Hallicrafters HT-18, and the Command Sets, have high enough power output so that the voltage developed across their links is sufficient to drive a grid-plate crystal oscillator directly. With these units, you just put a DC blocking capacitor in series with their links, an 0.01 microfarad disc ceramic will do just fine, and then attach their link output to the crystal socket of the driven stage. If your link coupled VFO doesn't have enough power output, however, like the Millen 90700 or 90711, you will need to provide link coupling to a parallel tuned circuit that plugs into the driven stage's crystal socket. Again, be sure to use a 0.01 mFd blocking capacitor in series with the lead that goes to the grid to avoid shorting out the normal grid leak bias. The tuned circuit should resonate at the output frequency of the VFO, and you can adjust it while monitoring the output of the driven stage (it will peak) or the plate current of the driven stage (it will be a minimum with the input circuit tuned for maximum drive).

It is a good idea if you can to run the VFO on a sub-harmonic of the rig's eventual output frequency. RF from the final amplifier or antenna that finds its way back into the VFO can cause it to chirp if it is on the same frequency. Also, watch the keying connection on your VFO to make sure it is compatible with the keying circuit in your rig. Most rigs use cathode keying, and it is easy to set up a VFO for cathode keying as well and to key the rig and the VFO together. But some rigs like the DX-60 use grid block keying and you need to configure the VFO accordingly. In particular, the Heath HG-10 can be set up for grid block keying compatible with the DX-

continued next page

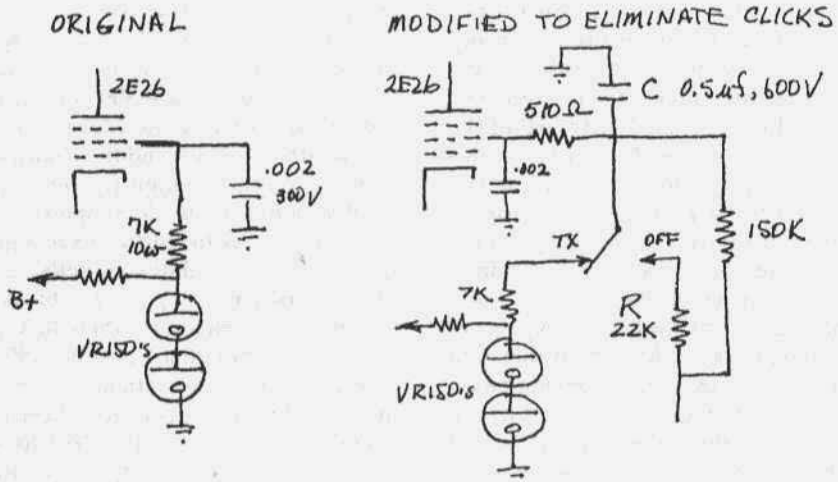


Figure 1.

60. You may just decide not to key the VFO at all but rather just to let it run continuously while you are keying the rest of the transmitter. You won't be able to run break-in, but it does avoid the problem of chirp that you sometimes get with a keyed VFO. Do not key only the VFO and let the rest of the rig run all of the time. Class C stages usually depend upon drive for their grid bias. At best they will run too much current and overheat with no drive. At worst they will oscillate on their own.

Key Clicks

Key clicks occur when the transmitter output is tuned on or off too abruptly. They will be radiated along with the rest of your signal, and they will often spread out several kcs to either side of your carrier frequency much like "splatter" on a distorting, over-driven linear amplifier. You can hear key clicks on your monitor receiver, but it can be difficult to separate them from a localized click caused by arcing at your key contacts. So you might want to ask a person you are talking to on the air to listen carefully for key clicks on and to either side of your signal. Most commercially built boatanchors will not have key clicks, but you may be lucky enough to acquire a rig infested with them. In my collection, my Globe King 275 had awesome clicks, and my Gonset G-66 was not far behind it.

Key clicks can be cured. It's probably best to start off by getting a look at them if you can. Set up your oscilloscope for a wave-envelope pattern as described in the ARRL Handbook and also below in the modulator section of this article. If your scope has a triggered time base, pick up the trigger signal from the key jack of your transmitter. Load your transmitter up into your dummy load and send a string of dots. Adjust the scope trigger, time base, or horizontal sweep frequency so that you can observe the leading edge of those dots. If you have clicks, you will probably see a sharp leading edge and perhaps even some spikes on turn-on. Your job will be to smooth off that turn-on so that it has something like a one millisecond long rise time.

Your ARRL Handbook has good advice on how to acquire the desired, click-free shape on your keyed waveform. If your rig uses cathode keying, you can try putting a small, power

A really neat QSL card put together by Don Grantham, W6BCN.

supply type filter choke in series with the keying line and a 0.5 to 4 microfarad capacitor across the key. AES offers a 1.5 Henry, 200 mA filter choke made by Hammond that will probably do the job. Together the choke and capacitor will shape both the turn-on and turn-off edges of your keying waveform.

If you are keying something other than a cathode, you may need to use a bit of ingenuity. As an example, figure 1, first reported in ER #91, November 1996, page 27, shows the keying circuit I applied to the screen grid of the 2E26 driver stage in my Globe King 275. The rig had originally been keyed only in the cathode of the crystal oscillator stage, and the 2E26 driver and V70D finals which are biased beyond cutoff by a fixed bias supply were left to turn on and off via the drive supplied to them. Each stage sharpened the keying waveform and that was responsible for my 6 kc wide clicks. My oscilloscope showed the output from the final to be quite sharp on both leading and trailing edges. My modification introduces shaped, grid-block keying to the 2E26 screen grid. The 0.5 mFd capacitor takes time to charge when it is switched from the -120 volts it is connected to at the output of the bias supply to the normal positive screen potential when the keying relay toggles, so it rounds off the leading edge of the keyed waveform. The 22K return resistor pulls the 0.5 mFd capacitor back to the bias potential with about a 10 millisecond time constant, nicely rounding the trailing edge. The keying relay is a Western Electric type 337A mercury wetted relay, so it doesn't introduce any bounce or chatter into the waveform. The drive to the final is shaped, and even though the final squares it off a bit the output is still much better rounded than it was. Goodbye key clicks. ER

Ed. Next month part 3.

Clatternet: 850 shift RTTY roundtable, on 10137 kcs USB Saturday, starts 0930-1000 Pacific time.

September AMI Update

by Dale Gagnon, AMI President

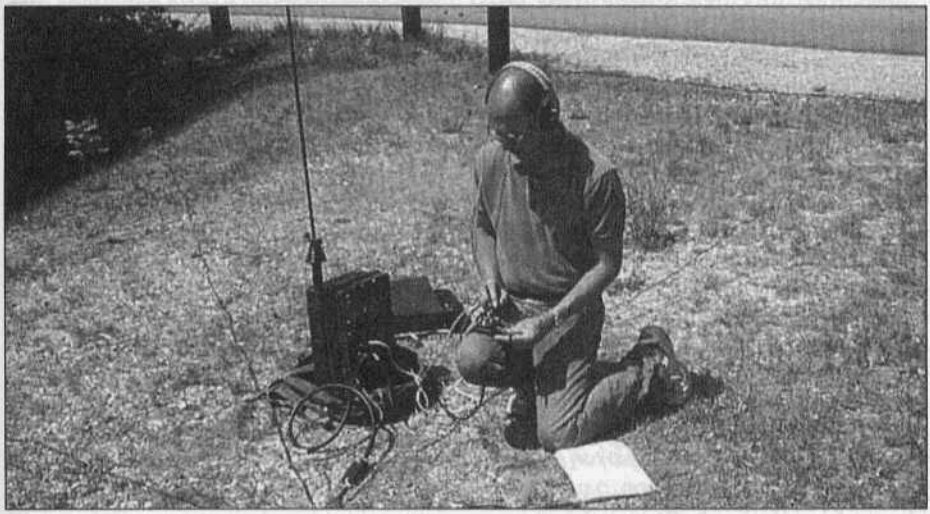
AM International Discovery Weekend This is the second year this event has been scheduled for later in the month of September (Sept. 28 – 30) to hopefully take advantage of lower noise on the 160 meter and 75 meter bands. This event is scheduled in the fall to encourage those AM operators who have taken the summer off to get their equipment ready to go for the fall and winter season. If enough AM enthusiasts get on over these three days the general amateur population will "discover" AM where they might have missed it before. This is good for us because it sets expectations with other hams about the frequencies we use and our operating procedures. The event begins anytime you get your filaments fired up on Friday evening and ends when you decide to quit Sunday evening. This is the AMI operating event with the complicated multilevel award structure. To earn the "Participant" award requires 20 or more AM contacts. These contacts can be made on 160, 75 and 40 meters. The "Participant Plus" award is achieved by making the 20 AM contacts on 160 – 40 meters and making at least one AM contact on 14.286 mHz. The coveted "Participant Primus" award is for 20 160-40 meter AM contacts, at least one 14.286 mHz AM contact and at least one AM contact on any higher band (15, 12, 10, 6 or 2 meters). Logs should be legible with date, time, call signs, signal reports, name, equipment in use and AMI number (if available). You do not need to be a member of AM International to participate. Mail logs to AMI, Box 1500, Merrimack, NH 03054. If you have lost your AMI number, e-mail degagnon@earthlink.net

Impressive 5x7 award certificates, suitable for framing, are sent out to worthy respondents.

Tactical Radio Deployment Exercise in New Hampshire

Every year at the end of July the Merrimack Valley Military Vehicle Club hosts a vehicle rally at a rustic site in Weare, New Hampshire. Over the past several years we have set up radio equipment there to check into the regular Saturday morning Old Military Radio Net on the east coast. This year we included an activity that would allow tactical HF radio owners to use their equipment in an environment that is similar to that for which it was designed. We developed sealed orders for five radio teams. We actually had two teams show up, but only had military transportation for one. So, we deployed one team composed of Pete, WB2JWU and Bud, WA2AUI. The equipment was a GRC-9 backpack HF transceiver, a PE-162 gasoline generator, a vertical antenna, a counterpoise and a host of accessories. Their orders, when opened, directed them to a location 2-3 miles away from the base station at the rally site. A 1953 M38A1 Willys Jeep was used to transport the team to a strategic site, a dam at a local reservoir. The team was directed to acquire intelligence – the name and location of the owner and operator of the dam. This was not a hard assignment. The intelligence the team was looking for was on a large sign facing where they set up their radio! Per the sealed instructions, one team member had to carefully structure the message with the vehicle driver first name, radio team member names, radio type used, the characters "TEAMMESSAGE" and the text of the intelligence acquired. All spaces had to be removed and the resulting string of characters had to be divided into five letter groups. When a reasonable amount of time had elapsed, the base station called the radio team and established contact and asked for the message to be sent twice. Signals were very good both ways and the

Bud, WA2AUI sending intelligence message to base, M38A1 jeep in the background.



Pete, WB2JWU establishing contact with the rally base station

message was copied easily. We were surprised to hear Chris, AJ1G in southern Connecticut call the radio team after the message exchange and easily establish contact with them. Amazingly, they were using low power, a short vertical in daytime conditions! The team was directed to return to the rally and we declared the deployment a success. The rally organizers were also pleased with the activity. They asked us to do more promotion to rally attendees next year, and to include a demonstration of tactical HF radio equipment. They also promised to allot appropriate military transportation so we can deploy all the teams that show up! ER

To Join AMI send $2 to:
Box 1500
Merrimack, NH 03054

Review
W2IHY 8 Band Audio Equalizer and Noise Gate

by Bill Breshears, WC3K
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When Barry asked me to write a review of the W2IHY Equalizer, I was pleased to do so. I had built the kit of the original W2IHY two band equalizer, and later upgraded to the 8 band unit when it first became available. The unit has been in use in my shack since 1999. I also have a little junk box with various commercial products I have tried but removed because of RF interference problems, interface difficulties or physical unwieldiness on the operating console. The W2IHY unit is the equalizer I am using today in my AM audio chain.

General Description

Physically the unit is 8" wide by 3" high by 7 1/4" deep, designed to sit on the operating table. It has a sloping top with good access to the main operating controls. Other 'one time' controls are readily accessible from the rear and bottom. Power (12 V nominal) is provided by a wall transformer.

The equalizer is of high quality, having 8 slide pots to give +/- 16 dB at 50, 100, 200, 400, 800, 1600, 2400, 3200 Hz centers. A separate switch allows bypassing the equalizer.

The noise gate section is a digital circuit with an adjustable threshold so that you can set it to respond to your voice level to permit audio to 'gate' to the output, but will not respond to ambient noise such as amplifier blowers etc.. It also has an adjustable 'decay' to allow it to be set for a smooth trailing edge of the gate. A separate switch allows bypassing the gate function.

An important feature of this unit is the accommodation of a wide range of microphones and different commercial transceiver mic inputs. Switches built into the design give it amazing flexibility.

The above is a very brief summary description. If you wish more detail, please refer to W2IHY's excellent web site. (W2IHY.com) the remainder of this article will address the review from an AM/Boatanchor lovers perspective.

Performance In The AM'ers Shack

The unit fits nicely in any shack, but it is obviously tailored to make life easy for owners of ICOM, Kenwood, and Yaesu, and at this job it is excellent. But it does have features that are useful in the AM/Boatanchor shack.

The equalizer itself performs well. Eight bands with centers from 50 to 3200 Hz is adequate for most AM'ers, although some sibilance radicals and cymbal players would argue for at least one more higher band. (How else can you occupy your 10 KHz of spectrum?) This is the first equalizer that shows no ill effects from radiating full legal limit AM phone RF despite my use of open feeders and an open tuner for the antenna. I have tried some commercial equalizers that needed more work than I wished to expend to make RFI safe at high power levels.

The noise gate works best when used during single sideband operations when break-in operation is most likely to be used. It truly is highly effective at

The W2IHY Audio Equalizer and Noise Gate is a well-built piece of equipment that can enhance of audio from both AM and SSB transmitters. Editor N6CSW has been using one of these units for several months and he says it's improved his audio.

reducing the effects of shack noises such as amp blowers etc.. AM operations are mostly key down 'Old Buzzards', and in this situation it is not possible to make the gating undetectable enough to escape the hypercritical ear of your audio curmudgeon ham friends.

The flexibility of the unit is the biggest asset to the AM ham shack. I often use mine at the test bench. The unit has amplifiers with gain controls that accommodate almost any audio input level and has a separate adjustment for the final output. It also has a separate little audio amp and control for a monitor headphone jack that is built in. The input allows configuring to accommodate almost any microphone including the dc voltage for electret mic elements. This makes comparing the audio sound of various microphones on the work bench easy. The highest input impedance of the unit is about 25 K ohms which is too low for a bare D-104 crystal cartridge, however the addition of a 3 meg ohm series resistor is simple enough, I added an RCA socket with that included. With that mod I regularly use the unit to test cartridges.

Julius D. Jones (W2IHY) is a pleasure to work with. He is concerned about his product and is very responsive to questions, even ones that weird AM'ers might ask. (It is amazing what a ham can do with the speech controlled gate, but that is a future article.) Julius gives excellent support for his equipment and uses quality parts and design techniques. He has written clear and well thought out kit instructions for the builder.

The price of the equalizer at $230 (kit $190) might seem a little stiff for us of the Hamfest, swap meet, "I'll give you five bucks for the Collins" crowd, However it is guaranteed to perform in your shack and is a product built by a ham for hams to match most of your radios with minimum hassle. I have appreciated the unit's flexibility as a useful addition to the shack workbench as well as a component of the station audio chain. ER

Radio Service in the Golden Age
1930's through the 50's

by Bruce Vaughan, NR5Q
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Episode 4

The First Two Years

I have those hard to find volt-and-a-half tubes," said a voice behind me. I was unaware of the well-dressed salesman's presence in the store. Today, one of our first warm spring days, was reason enough to have the front door open. My store, like most other stores in Springdale, was not air-conditioned.

Pushing aside the little Stewart Warner AC-DC set I was working on, I looked at him and asked, "What tubes are you talking about? They are all hard to find."

"You know...." he answered, battery-type tubes. "I have complete sets: 1A7, 1N5, 1H5, and 3Q5-the tube line-up used in thousands of farm-pack radios. The tubes are brand new, JAN (Joint Army-Navy) tubes, and I'm sellin' em' for only $8.00 a set."

I didn't want the salesman to know how inexperienced I was about radio repair. In April of 1946 I had been open for business less than two months-and most of my time was spent setting up shop and trying to get a business started. So far my actual repair business was limited to six or seven repair jobs a week. My income was derived from second hand radios; I'd fix up the radios, refurbish the cabinet if need be, and then resell them. Frankly, I had no idea whether the tubes he was selling were ones that I would need in the future. I bought four sets-just in case-and counted out 32 of my hard earned dollars.

Less than three months later, I regretted not floating a loan and buying one hundred sets of the tubes.

In 1946-47, Rural Electrification Authority power lines had yet to reach the majority of farm and rural area families in Northwest Arkansas. Construction of electric lines, started in 1939, stopped abruptly after Pearl Harbor. Literally hundreds of farm families owned battery-powered radios; almost all of which used tube types the salesman sold to me. It was several years after the war before the entire countryside was electrified. One of my best sellers in the late forties was the so-called '1,000-hour battery-pack.' This "battery-pack" contained both the filament and plate supply batteries—one and one-half volts for the filament, and ninety volts for the plate. On the battery topside was a female receptacle for a four-prong plug-the prongs or pins arranged in a "Keystone" pattern. The battery was rather large-about 16 inches long, by 8 inches high, by 5 inches deep. I would estimate the battery weighed in excess of 12 pounds. Though 1,000 hours of operating time was claimed by most manufacturers-Eveready claimed 1,300 hours-I know of no customer or repairman who kept a log to see if such claims were true.

Both the Burgess battery company, and Arkansas Radio, the Philco Distributor, offered regular service from company trucks at two week intervals. Battery cost was the same as other

wholesalers, but you saved the freight charges. Freight charges added up to a tidy sum, even in those days. My normal farm battery sales averaged about two-dozen units a month. In 1946, the retail selling price for 1000-hour batteries was $4.45. My cost was a little over three dollars. By 1949 the batteries were selling for $5.95, and by 1952 they were up to $7.50. By 1955 the sales of batteries and battery powered home radios became nonexistent. Now, REA reached even the most remote farms and villages.

Like other ex-servicemen I was accustomed to military schedules. It was not unusual to go to work long before daylight. Eight-hour days had very little meaning to members of the Armed Forces. As a new civilian I carried many on my work habits home with me. Many mornings I was at my workbench by 4:00 am-it was a good time to work. A cup of hot coffee nearby, the acrid smell of a 100-watt soldering iron wafting through the still air of the shop, and Glenn Miller or Tommy Dorsey music coming from a radio playing softly in the background created a comfortable environment. I felt cozy, secure, pleased with the world, and better able to concentrate on difficult repair jobs-and there were many I found difficult at the time. Soon the street noise would start, and the spell be broken, but for the present all was quiet and peaceful-it was a wonderful world-for some of us life don't get much better than this. I realized how good it was at the time, and value it even more so today.

On one such morning, unable to sleep, I opened the shop at 3:30 am. Crime in

continued next page

Springdale was next to nonexistent, so the thought of being in my store alone at that hour was not a cause for concern.

I glanced up from the 6-tube Arvin I was working on. A young man in Army uniform was standing in front of my store looking in the window. The front door was unlocked as usual-I motioned to the young man to come inside.

Curious as to why anyone would be on the street at this hour, I offered him a cup of coffee. Perhaps he would tell me why he was looking in my window at 4:00 am, three hours before most downtown stores opened.

"I just got off the bus from St. Louis," he said. "I've been riding all night. I was discharged at Jefferson Barracks yesterday. A hot cup of coffee would sure taste good."

"Hey, I've even got a sack of donuts back there by the coffee pot. If you're hungry feel free to help yourself. Where do you live?" I asked.

"My mom and Dad live over on Park Street-about five blocks from here," he replied. "I was walking by and noticed that little white RCA radio in your window. How much do you want for it?"

"That's a used one," I told the young soldier. "We still can't get new radios. I've checked it out and it plays like new. You can have it for 20 bucks-no tax."

"Okay, I'll take it," he said. "I wanted to bring Mom and Dad a little present. I didn't have much chance to buy them anything on the way home. If you are a Vet you know how it is."

This incident did not seem at all unusual then. Armed robbery was not a serious threat in Springdale-that came later. Until the early forties our lone underpaid patrol officer, Lee Shankles, had little trouble keeping the peace. His duties were largely confined to arresting disorderly drunks on Saturday afternoon, Saturday evening, and early Sunday morning.

Christmas of 1946 came: business was fair-and I received an unexpected present. Mr. Late gave me notice to vacate his building. I never fully understood why. He was very cordial and continued to give me terrific deals on cars and trucks, and I continued installing his car radios-for $7.50 each. I suspect that my business was growing faster than Mr. Late thought possible, and he did not want a thriving business in his 'Case Room.' He would have been perfectly happy if I had confined my use of the building to one small corner of the large room-room enough for one workbench-nothing more..

Cooper Jewelry, located in the old Arcade building was having a "close out" sale. Mr. Cooper told me he wanted to move his jewelry store back to his hometown of Ozark, Arkansas. I offered him a small amount for his investment in fixtures. He in turn, let me assume his somewhat loosely worded lease. I paid him $50.00 as I remember it. The only thing of value in the deal was a nice 'Regulator' wall clock. I still have the clock in my home. On January 15, 1947, he vacated the building.

I was glad to make the move. My former benevolent landlord had been very nice to me. He allowed me to occupy a nice business building practically free of charge, but like charity, benevolence can be terminated at any time-and it was. As long as I could pay the $40.00 per month rent, I was assured of a home for my business until the end of my lease.

The building itself was a result of a 'quick and dirty' remodeling job following the destruction by fire of our town's largest hotel. In the 1940's it was considered a nice building-today it would be known as an 'inner-city slum.' The owner took what remained standing after the fire and converted it into a two-story brick rental property. The upper floor was divided into two offices—then occupied by a Doctor, and a Dentist. Why did a Doctor and Dentist

occupy such modest offices? Because it was all they could afford. Dr. Smith charged $4.00 to clean teeth, $2.00 for a filling, and $5.00 for a tooth extraction.

His neighbor, Doctor Harrison, made house calls for $5.00 and charged up to $25.00 deliver a baby. However, both Doctors often allowed patients to 'charge' their services to an open account, which was about the same in our area as offering free service.

The lower floor was divided into two rooms. The front room, my 'showroom' was finished out quite nicely. The back room, where my shop was located was much larger and completely unfinished. The toilet was in a corner of the room-with no walls isolating it from the shop. Such openness contributed to a sociable environment, but some of my visitors and customers preferred a little more privacy, and a little less socializing, so I built plywood walls around the ancient fixtures. Heat for the entire building was a small, ornate, cast-iron gas stove that obviously dated back before the turn of the century. If I had kept it, it would fetch a big price on eBay today.

The stove kept my coffee warm, and I found ample room for my dartboard. At the time I was single—with few responsibilities, and had what might be described as a 'carefree' attitude. My shop became a gathering place for a number of young veterans, and more than a few young ladies who enjoyed the company of those who used the shop as a meeting place. Back to my move.....

My moving expense was small. Jimmy King, a wizened old man who picked up grocery money by doing odd jobs up and down the block, moved my stock in his wheelbarrow. It was his idea. He heard I was moving and came by to see me.

"I can move everything you have in this shop by myself, I'll move it in my wheelbarrow-and I won't break a tube," he said. "Well, maybe not the shelves, tables, and workbench. But I'll help, and I can get us some more help from one of the beer joints for a dollar or so." There were always a bunch of winos loafing on the street in my block willing to work for a pint of cheap grape wine.

My actual move in distance was small—from 220 to 206 East Emma, However, I was putting the liquor store and two beer joints between me and the railroad tracks-definitely a move uptown.

Now, on my side of the street, starting at the 'up-town' end of the block, was "Rowland's Department Store," a "Ben Franklin" store, the "Blue Castle" bar, "Bruce's" radio shop, "Citizens News Stand," "Springdale Liquor," the "Bon Ton Cleaners" The "Meadow Maid" ice cream store, "Medo Maid" Café, etc..... As you can see I was not in a bad neighborhood. Most of the businesses in the block were neat, clean, and well stocked. Later however, I was to find out it did have a risk I could not foresee, one that would change my life forever. ER

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A complete index of the entire 12 years of ER is available for viewing or downloading at the following website: http://www.qsl.net/n9oo

continued on page 40

Dial Lamp AGC

by Chuck Teeters, W4MEW
841 Wimbledon Drive
Augusta, GA 30909

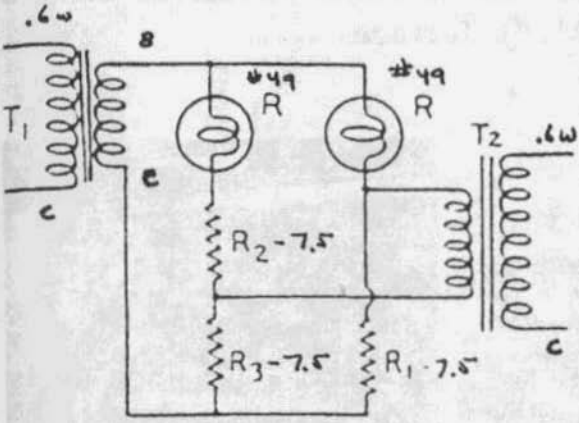
One of the nicest gadgets to come into a broadcast station in the fifties was the automatic gain controlled amplifier. The AGC amplifier eliminated the need for the studio engineer to "ride the gain". Prior to the introduction of the AGC amp it was necessary to adjust the level to keep the average modulation up with varying audio sources. The AGC amp had a response time about equal to the studio engineer. It was slower acting than the limiter amplifier used at the transmitter audio input. The limiter came into broadcasting in the thirties and by 1946 was a federal requirement to prevent overmodulation. The limiter worked on the peak level while the AGC amp worked on the average level. A check of RCA, Collins, Raytheon and Gates catalogs showed no AGC amps as late as 1949, but by 1956 Gates was listing two, and by 1961 they had 7 different models in their product line.

While the first AGC amps came along in the fifties, there were many homebrew gain control systems used in broadcast stations back into the thirties. One of the main sources of problems for the studio engineer was the remote feed. These were particularly troublesome as the remote announcer usually preformed his own engineering functions. Most were better announcers than engineers. Also the quality of some of the telephone lines was not good and losses could change in a matter of minutes. Even network feeds were apt to jump 5 or 10 dB particularly when the studio engineer was not watching the level. One of the most ingenious systems I ever saw was at WGES in Chicago. It had meter relays connected to read the audio level, which controlled motor driven attenuators in the audio line. The motors were geared down and provided the delay and inertia to make the system response ideal. It was a take off of a Western Electric telephone repeater gain regulator and worked exceptionally well.

The simplest system I found was an AGC system used at CJOR Vancouver, BC in 1936. It uses two transformers, two dial lamps, and three resistors. It was called a "A Differential Thermal Bridge Automatic Gain Control". It was written up by Wilbert Smith, who certainly wins the prize for a title more complicated than the circuit. The thermal elements he used are 2-volt 60 mA dial lamps. The resistance of the filament of a light bulb varies with temperature, which varies with the applied power. The cold resistance of a lamp is about one-tenth of the hot resistance. The low cold resistance leads to a high inrush of current, which is why bulbs like to quit with a flash when you first turn them on.

I wonder if Mr. Smith got his thermal filament idea from looking at broadcast receivers built by Midwest in Kansas City. In the thirties receiver tube count was an indication of quality. Midwest had very high tube counts, sometimes as high as 20, like some of the Caparharts and Scotts, but were very much cheaper. Midwest would use 8 each 45s in the output to run up the tube count. Two were conventional push-pull audio outputs, the other 6 had their filaments in series with the speaker voice coil. They advertised pull any tube and the radio goes dead, so all the tubes are working. Midwest explained it as using the resistance change of the filament to work as volume adjusters to prevent overloading the speaker. I wonder if Madman Muntz and his questionable quality TVs of the early fifties were products of the same fertile advertising minds.

The Smith system does work however as I have tried it. He used the lamps in a bridge so that most of the audio power



input is dissipated in the lamps. As the lamps light up with the higher levels of audio the increased resistance bring the bridge closer to a balanced condition, resulting in less output. As the bridge approaches a balanced condition the output remains relatively constant. The thermal inertia of the lamp filaments provides an attack time of about 100 ms and a release time of about 250 ms. The time delay is proportional to the max cuitcut through the lamps so if a slower response is desired, about half a second release, 150 mA bulbs can be used.

The system causes no audio distortion, does not change the ratio of high level to low level for short intervals, which preserves the character of the audio, and does not bring up background noise. However it is quite inefficient from a power transfer standpoint. The minimum loss at low level is 16 dB while at high input levels the loss increases to over 30 dB. It also takes a high level signal to drive it, about a quarter watt of audio, most of which is used to light the lamps. But input level changes of 30 dB are reduced to less than 10 dB at the output which is what an AGC amp is supposed to do.

The circuit diagram shows the simplicity of the circuit. All the parts are available at Radio Shack. The lamps are #49 (2 volt 60 mA), all resistors are 7.5 ohms, 1 watt (two 15 ohm 1/2 watt in parallel). Transformers T1 and T2 are Radio Shack Line transformers P/N 32-1031. The bridge is driven at 8 ohms by the input transformer T1. The primary of the transformer can be connected in the plate circuit of a 6J5 or equivalent triode. Connect B plus to the common and use the 0.6 watt tap for the plate which is 8000 ohms. For an exploration of this transformer see ER #139, page 20. If you want to use a 600 ohm input connect the line to the common and the 10 watt tap. The bridge output works well into 500 ohms, so use the common and 10 watt tap on T2. If you want to feed a hi-Z circuit connect up to the common and 0.6 watt tap. Use the common and 8 ohms for a speaker feed. If you are using junk box transformers, drive the input at 8 to 10 ohms and take the output at 200 ohms or higher. Too low an impedance across the bridge output will reduce the output. Mount the two lamps where you can see them as the brighter the lamps, the greater the gain reduction.

With used tube broadcast audio equipment selling for more than it cost new 60 years ago this simple circuit offers a cheap and simple way to add AGC to your transmitter audio chain. The RS input and output transformers allow lots of options in the installation. I have driven it with everything from the 600 ohm output of a 10 watt Hi-fi to the padded down audio from a Ranger modulator. I have used it on my receiver audio output and fed it into a small speaker. Small, self contained and requiring no power it is a handy little gadget to have around the shack. After getting blasted by every TV commercial I might reassign it to the living room, hooked to the audio output of my TV. **ER**

Build a Low-High Mic Interface

by Jay Miller, KK5IM
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Dallas, TX 75206
jay@kk5im.com
www.kk5im.com

Over the years I've had the good fortune to assemble a representative collection of commercial AM broadcast treasures— remote amplifiers, microphones, consoles and the like. What follows is a way (certainly not the only way) for you to put pieces in your collection to work in the shack instead of just creating a static display for worship and admiration!

Talking with several of my AM and broadcast buddies, we decided there were two options: go inside the transmitters and make circuit changes or build an outboard interface and go in through the mike jack. Since I did not want to modify my Collins 32V-3s, I chose the interface route.

Three problems present themselves to those wishing to couple broadcast mikes and remote amplifiers to ham transmitters. In the real radio world, we are talking about low-impedances (50 to 250 ohms) and balanced inputs. In the ham world, our vintage transmitters want to see a high impedance signal (on the order of 15K to 20K) and most all amateur sets are wired for an unbalanced mike (meaning one side with audio and the other at ground). Add to this a third problem and that is way too much gain from a remote amplifier when going in through the transmitter's mike jack!

Like many hams, I just love microphones. I will go out of my way to find them at hamfests or try and talk radio station engineers out of them in exchange for some work. I've missed a few with this approach, an RCA 44-BX in particular, but that is a story for another time.

The Low-High Mike Interface box sits on an operating table with my RCA KB-2C ribbon mike (with KGNC flag) and a Turner multi-impedance U9S at left. A Collins 212U-3 two-channel remote amplifier/mixer is above the 310C.

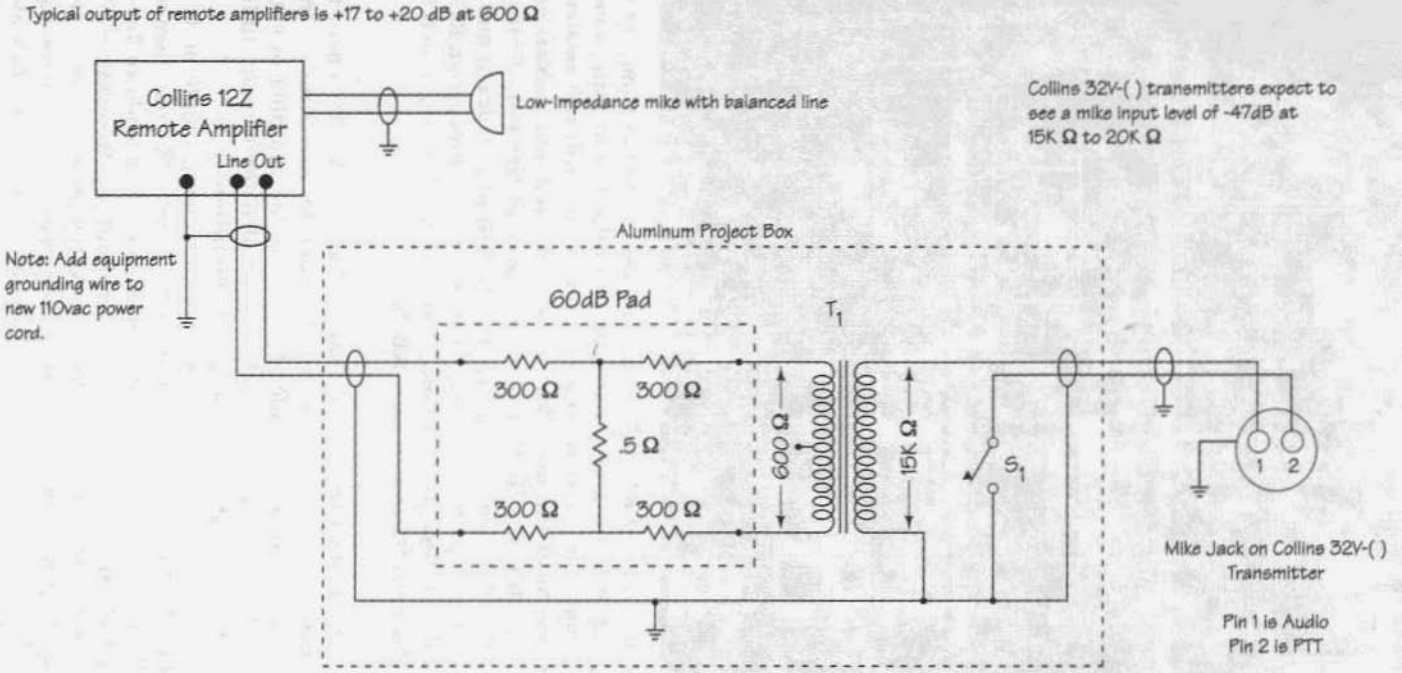
Most all vintage broadcast mikes (RCA, Shure, Turner, etc.) are low impedance creatures. Occasionally you'll find some wired with an internal switch for multi-impedances such as the Turner U9S or Shure 55 Unidynes. Typical mike impedances are 50, 150 and 250 ohms. And, the output is balanced.. two audio wires and a shield. These mikes usually generate a very low output signal and even if you cheat and ground one side of the element, chances are good that you won't get much audio into your ham transmitter. This is why the remote amplifiers are so cool! By using them you can adjust your

A partial view of the audio end of KK5IM's Dallas hamshack shows some of the commercial broadcast equipment in his collection. By building and using a low to high impedance interface box, all of this equipment can be used with amateur gear. On the top row (right of the humidor) are a Volksempfanger (Nazi era "Peoples Receiver"), a Collins 12Z four channel remote amplifier and a Collins 212H-1 remote. On the middle shelf are a Collins 310-B1(not broadcast) and a Collins 212U-3 two channel remote mixer/amplifier. On the bottom are an RCA BN-2A remote amp and a Collins 310C (not broadcast). The mikes are, from left, a Shure 55 Unidyne, Turner U9S and an RCA KB-2C.

gain with the stepped attenuators and watch the VU meter just like the pros do. And, you don't have to worry about rewiring the mikes to high impedances and eliminating the balanced inputs.

Most remote amplifiers came from the factory pre-wired for 50, 150 or 250 ohm inputs. Generally there are taps for changing the impedance so consult the manual for your particular unit (most mikes can be rewired the same way). Your best bet is to have everything the same and let the Low-High Interface Box handle the rest. A side benefit to using the remote amplifier is the monitor jack so you can plug in your headphones and listen to your audio going to the transmitter.

My favorite remote amplifier is a Collins (what else) 12Z, four channel amplifier/mixer. Thousands of these critters were built beginning in the late 1940s for AM stations around the country. Carried to Friday night football games, concerts, church services and news broadcasts, the 12Z was one of the

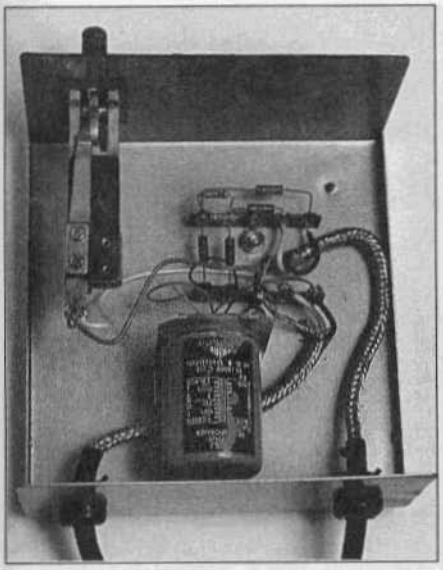


Use good quality 2 conductor shielded mike cable (Belden 8412) and one grounding point in Interface Box.

S_1 Push to Talk Switch

T_1 Audio Output Transformer
Primary: 600 Ω
Secondary: 15K Ω to 30K Ω
Triad A55J

Interface Box for Collins 12Z Remote Amplifier to Collins 32V-( ) Transmitter
KK5IM • August 2001
www.kk5im.com



All the components fit inside a metal project box. The most important construction point to keep in mind is maintaining a single point ground! The 'H' pad is built on a pair of tie strips. To key the transmitter, a key switch was salvaged from a studio console. A piece of aluminum was formed to mount the audio output transformer.

most popular rigs for remote broadcasting. Four mikes could be plugged in and mixed. The output was a twisted pair voice grade phone line (typically 600-ohms) which carried the remote signal back to the studio. On arrival, the signal was fed into a channel on the "big board" and then sent down the program line to the transmitter. Today this can all done digitally with cell phones, solid state mixers and a wonderful device called a Codec.

The typical output level for the remote amplifiers in my collection is on the order of +17 to +20dB at 600 ohms. This is WAY more than a 32V wants to see! A simple 60dB 'H' pad will drop the signal to a safe level and still provide a little head room for adjustment on the transmitter's mike gain control.

To change the 600-ohm output of the remote amplifier to high impedance, I found a suitable audio output transformer in my junk box. The primary was rated at 600-ohms and the secondary was tapped for 15K to 30K ohms. Perfect!

Five resistors make up the 'H' pad which gives 60 dB of signal "padding" and then into the mike jack of the transmitter. I used the best quality Belden shielded audio cable I could find to keep RF from the transmitter out of the line.

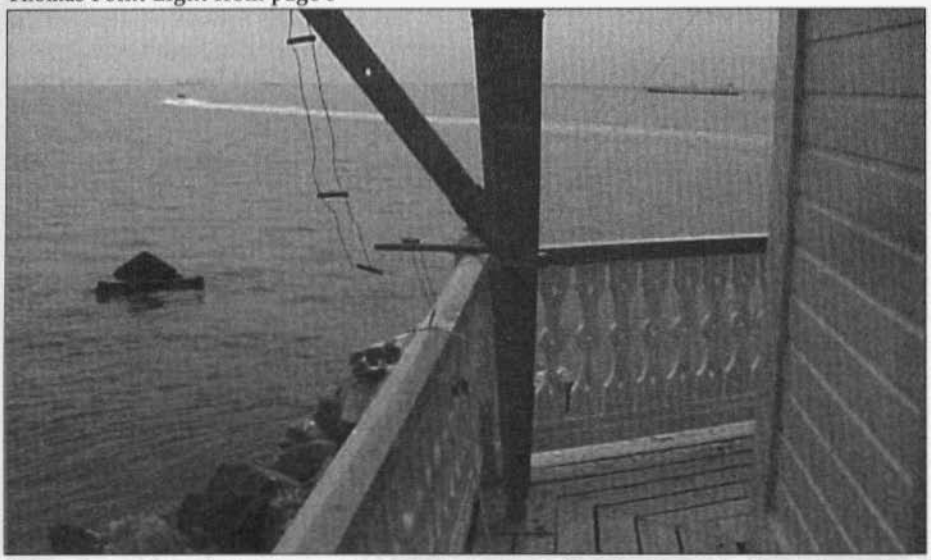
Radio engineers realize that hum is the enemy and one must be eternally vigilant in search of ground loops, floaters and multipath grounds. Beware! If you have hum, you most likely have a ground problem. I added an equipment grounding wire to the 12Z remote. To this point I grounded the shield of the output cable to the Interface Box. Inside the interface box, all the grounds terminate at one point. So far, I have no hum on my signal.

The interface box is wired to a 32V-3 with a simple Amphenol connector at the mike jack. I added a push-to-talk switch to my box which makes it easier to key my transmitter as the audio stuff is not right next to the rig. I suggest keeping this cable as short as practical however. The mike gain control on the transmitter was adjusted during on-air tests with the aid of a Heathkit SB-610 scope to watch the wave form— an invaluable piece of equipment.

This interface will also work with sideband transmitters. So if you have some juicy broadcast stuff and want to play with it rather than just admire it, cobble up a simple Low-High Mike Interface and put your collection back to work! **ER**

Thanks to J. B. Jenkins, W5EU; John King, K5CDV and Jack Sellmeyer, PE for their wise counsel and sage advice.

Thomas Point Light from page 3



With the center of the antenna at the top of the flagstaff, a calculated length of open wire feedline was draped outside the lighthouse perimeter before coming to the KW Matchbox at the operating position. ***Photo by Chris Courson, KC4CMR***

ham radio on board Thomas Point Lighthouse, vintage or otherwise. The organizers of National Lighthouse Weekend made it very clear to us that many people would eagerly be waiting to work this site for the first time.

We began our work on Thursday, as Dave Wenger, K3ZRF and Gary Burrows, N2INR arrived at the home of Paul Courson, WA3VJB. Paul's boat was our transportation, and the Thursday trip would allow us to see the logistics for our loading the next day. We took some initial materials, scouted out the territory, then returned to shore for a delicious meal of Maryland steamed crabs.

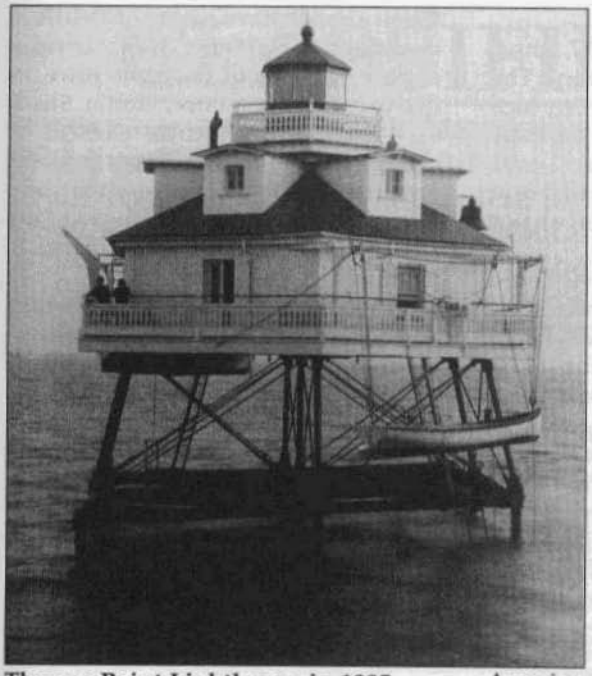
Friday we got serious. We hoisted the antenna after replacing the frayed, broken ropes on the flagstaff, and configured the open wire feedline around the perimeter of the lighthouse to ensure we had enough length to reach resonance into a Johnson KW Matchbox. As standoffs, we used the lighthouse's crane and winch assemblies that once held the lighthouse keeper's rowboat aloft.

We were joined by Tom Mackie, W2ILA, whose background as a professional in the maritime industry came in very handy helping figure out how to convey a 150 pound generator from boat to lighthouse. His harness and knot-making skills, combined with brawn from Joe Fell, WA3GMS and Dave/ZRF who grabbed the harness from the second level, allowed a successful move in choppy waters.

We powered up the machine and electrified the station, very quickly finding resonance on 75 and 40 meters. What little RF got into the audio gear was then eliminated by fashioning a common-point ground system for the components, tied to generator ground. The machine itself was grounded to the metal frame of the lighthouse in the brackish waters of the Bay.

On the air!

Operating under the special event call sign K3L, we began working stations at home within the AM Community, and later moved to frequencies where the National Lighthouse Weekend participants had gathered. Everywhere



Thomas Point Lighthouse in 1885.

we went, we got very favorable signal reports and excellent audio reports from the Ranger, which Gary had modified toward broadcast quality audio.

The Collins 51S1-F is not known for superb audio, especially when compared with the diode output of the usual R-390 or R-390A we have taken on other AM Expeditions. But with a perceived bandwidth of perhaps 10 kc, and with the receiver's 600 ohm audio output driving a powered Fostex hi-fi speaker, the radio room in the lighthouse was filled with the wonderful sounds of quality reception.

Throughout the night, each of us took turns at the mic. Saturday, we were joined by Bill Cross, W3TN, whose idea it was to link National Lighthouse Weekend with an AM operating event. Bill is quite the contester, and from his expertise we tallied some 200 stations worked into Sunday.

Norm Chipps, N3RZU, and Chris Courson, KC4CMR, also took part. On Sunday, Norm watched as we coordinated the dismantling of the station and the loading of all that stuff back onto the boat. "You guys looked like an ant farm," he told Gary/INR, describing how each of us had a task and efficiently went and did it.

Chris, who works with the Coast Guard auxiliary near his home along the James River in Virginia, struck up a friendship with our escort, Lt. Rick Wester, and helped field the media interviews and photographers as they came through the site.

Website and Follow Up

Through the good graces of Brian Sherrod, W5AMI, the head of AM North America, we were given some internet web space where we posted photos and text as the planning and operation began. That website, www.amfone.net/K3L/ had drawn more than a thousand visitors in the days after the event.

Jim Weidner, K2JXW, wrote a letter of appreciation that drove home the point we had really accomplished something on behalf of the event he founded, National Lighthouse Weekend. We worked seven other lighthouses during our operating time, and continue to receive QSL requests and comments from those who heard or worked us.

We look forward to next year, as the Radio Boys again stage an AM Expedition somewhere, somehow. Stay tuned! **ER**

Website references:

http://www.cr.nps.gov/maritime/light/thomaspt.htm

http://www.cheslights.org/thomas-news.htm

http://www.waterw.com/~weidner/arlhs/page2a.html

The Twinplex from page 17

Twinplex uses the 19 tube.

5. "The Hammarlund 1937 Short Wave Manual", Third Edition, The Hammarlund Manufacturing Co., Inc., copyright 1935, reprinted by Lindsay Publications, Inc. "The Dragnet (2-tube S.W. Set)", pgs. 10-11. Also available at www.qsl.net/w5hro/contents/s.w.manual/

6. "1934 Official Short Wave Radio Manual - Complete Experimenter's Set-Building and Servicing Guide", Hugo Gernsback Editor, copyright 1934, reprinted by Lindsay Publications, Inc. The front cover shows the same 19 Twinplex w/unimount construction that was available as a kit in 1934 but it is not covered in the book's contents. "The '53' 1-tube Twinplex", pgs. 49-51.

7. "Regeneration Fever", David Ishmael, WA6VVL, Electric Radio, Oct.'92, issue #42, pgs. 20-24, and "6AG7/6L6 25W CW Transmitter, 30-30 Postscripts", David Ishmael, WA6VVL, Electric Radio, Nov.'92, issue #43, pgs. 20-22.

The D-104 from page 11

does lost wax casting get a bit of harder model wax. Works nifty keen. A very satisfying repair that prompts me to cry out: "It's Alive, It's Alive!", in the fashion of Dr. Frankenstein.

I have repaired large dings in the fragile aluminum diaphragm, however if it is reworked very much the low frequency audio response suffers. You do it like audio body repair, poke a small hole and pull the big dings out with a tool you make from a paper clip. Small holes are not detectable by my ear.

If the above measures don't work, it is a relatively simple task to replace the entire cartridge with a new one, either ceramic or crystal. They are available from a number of dealers for around $30. The cartridge has two solder lugs in back on which to tack the two wires. If you already have plenty of D-104s in the shack, consider a Heil cartridge available for about the same price, or the excellent response, Radio Shack #270-092C, $2, condenser element, it needs a voltage source but is straightforward to implement. In either case you will retain the classic looks of the D-104 with little additional expense.

Refinishing The Painted Base

Damaged paint on the base is common and can be fixed by repainting, however my favorite method is to remove all the paint with sandpaper then polish the base pot metal with successive grades of auto rubbing compound until a high gloss, mirror finish silver look is achieved. It must be covered with brass lacquer or it requires a polishing every few months. Looks grand.

Conclusion

The D-104, at almost 70 years old, is still going strong. When operated into a proper high impedance it is still hard to beat for the audio quality that most AM'ers like. Performance, repairability, and economy, all packaged in a compact form that enhances the look of the AM Boatanchor shack. Used correctly it will remain the mic of preference for many of us. You and your listeners will like it even better with the described modifications. ER

TUBE COLLECTORS GROUP FORMED: The new tube collectors association is now in operation. This is a non-profit, non-commercial organization of collectors & history enthusiasts focusing on all phases & vintages of tube design. The founding president of the group is Al Jones, W1ITX, who is known for his award winning tube collection. For more details & complimentary copy of the association's bulletin contact Al Jones, CA, (707) 464-6470, Ludwell Sibley, OR, (541) 855-5207, or mail request to POB 1181, Medford, OR 97501.

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

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, W9LWW, 336 Sliders Knob Ave., Franklin, TN 37067

FOR SALE: Beach landing case, heavy duty, for Marine Corps model MAW VHF Packset, good condx. - $40 plus shpg. Dave Parker, WB9WHG, POB 307, Iron Ridge, WI 53035. (920) 625-3919, dparker@mconnect.net

FOR SALE: Johnson KW Matchbox w/meter - $300; Johnson 122 VFO - $90; Lafayette HA-90 VFO - $90. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (973) 728-2454. rprester@warwick.net

FOR SALE: Countermeasures rcv'g set, AN/WRR-10 50-10750 MHz, 9 bands, simultaneous display of freq, spectrum & modulation info on dual displays, manual, 1200 lbs - $4500. Carl Bloom, CA. (714) 639-1679 or 3778111@mcimail.com.

FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3ICH, 13192 Pinnacle Lane, Leesburg, VA 20176. (540) 822-5643

FOR SALE: Hallicrafters, RME, Gonset, others. Also some military, test equipment,VHF/RF amps, more. LASE, Don Jeffrey, POB 1164, Monrovia, CA 91017.

FOR SALE: New Collins winged lapel pin, still have meatball version, either type - $5.95 + 75¢ s/h. W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029. (760) 747-8710

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

FOR SALE: Mohawk/Apache drum dial reproductions. email for details. Ron, AB5WG, ab5wg@mylinuxisp.com; (281) 491-7823

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

FOR SALE: Naval rcvr's RAK, RAL, RAO, RBA, RBB, RBC, RBL, RBM, some checked, pwr splys available - $75 to $450, depending type condx. Carl Bloom, CA. (714) 639-1679 or 3778111@mcimail.com

FOR SALE: OEM Heath belts - $2.50 each shpd; or 10+ for $2 each shpd. Send check or money order. Roberta Hummel, 202 Midvale Dr., Marshall, WI 53559

FOR SALE: Manuals for old ham gear of the '30s to the '70s. Check WEB Catalog www.hi-manuals.com

FOR SALE: NOS TCS baseplates still in factory shipping wrap - 2/$15 plus shpg. Carl, KN6AL, POB 3531, Laramie, WY 82071. (307) 742-0711 kn6al@uwyo.edu

FOR SALE: 2001 COLLINS CALENDAR now shipping. 15-months, all color! $14.95 postpaid USA and Canada. Trinity Graphics, 5402 1/2 Morningside, Dallas, TX 75206. www.kk5im.com

FOR SALE/TRADE: Misc. parts, tubes, for tube gear. Sandy Blaize W5TVW, 40460 Edgar Traylor Rd., Hammond, LA 70403. ebjr@i-55.com

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

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

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

FOR SALE: Strong steatite antenna insulators. Lengths from two to fifteen inches. SASE for list. John Etter, W2ER, 16 Fairline Dr., East Quogue, NY 11942. (516) 653-5350

FOR SALE: Kenwood R1000, very nice - $250; Mirage D1010 450 linear, bargain, no book - $200; Johnson lowpass - $20; D104 w/G stand - $35. Jack, W9FQK, AZ, (521) 634-2028.

FOR SALE: Older type electronic parts & hardware; free vintage flyer. Mail order since 1954. Bigelow Electronics, POB 125, Bluffton, OH 45817

FOR SALE: VM parts, new boxed electron tubes, new Heathkit parts, new panel meters. Norm, 1440 Milton St., Benton Harbor, MI 49022

FOR SALE: Books, all electronics related; 300 titles; SASE. Paul Washa, 4916 Three Points Blvd, Mound, MN 55364. wwtok@email.msn.com

FOR SALE: Build your own "Midget" bug replication by K6YQX, ca 1918, featured by K4TWJ in CQ Magazine, May, '98. 10 detailed blueprints. FAX (507) 345-8626 or e-mail<bugs@mnic.net>

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

FOR SALE: Tubes. We specialize in early receiving & collector tubes & tube related books. Send for free catalog or see www. fathauer.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281. (480) 968-7686, tubes@qwest.net

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FOR SALE: Tubes, NIB or tested good, priced low. SASE for list. WA7HDL, 167 Hwy 93 S, Salmon, ID 83467

FOR SALE: Hallicrafters SR160 xcvr w/mobile pwr spy - $250 + shpg. Gene Tabor, KB7QG, 7780 N Hwy 38, Honeyville, UT 84314. (435) 279-8188

FOR SALE: Stancor A-3893 60W poly-pedance modulation xfmr - $75 ppd. Joel Ekstrom, W1UGX, POB 391, Cabin John, MD 20818. (301) 469-6562

WANTED: SW3 #33A and #35 coils. I will trade my extra coils SW3 coils. Hank Bredehorst, 2440 Adrian St., Newbury Park, CA 91320. (805) 498-8907

WANTED: Parts for a TMC GPT-750 xmtr. I need the AM modulator deck and other parts to restore this unit. John, KF2JQ (716) 873-0524 jprusso@acsu.buffalo.edu

WANTED: Long wire ants AT101, AT102, GRC-9; DY88/105; PP327GRC9; counterpoise CP12 & 13 GRC9; BC348 pwr conn PLQ102/103. KA1ZQR, 348 N. Main St., Stonington, CT 06378.

WANTED: Globe King 500 B/C; Viking Valiant I/II; Viking 500; Heathkit Mohawk. Frank, (916) 635-4994, frankdellechaie@sprintmail.com

WANTED: National SW-3 model1, version 3. Uses 32-32 30 tubes. Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: Collins 32V & Collins 75A series; Globe Scout; National SW54. KBØW, CA, (916) 635-4994. frankdellechaie@sprintmail.com

WANTED: National Company emblems, escutcheons, logos from equipment. Also WW II rcvr's manufactured by National. Don Barsema, 1458 Byron SE, Grand Rapids, MI 49506. (616) 451-9874, dbarsema@prodigy.net

WANTED: 1950's Popular Electronics; 1961-65 Heathkit catalogs & Radio-TV Experimenter. John Curtis, WØCAR, 3146 S. Franklin St., Englewood, CO 80110. (303) 781-8027, wøcar@arrl.net

WANTED: GP-7 xmtr in any condx, w/without tuning units or tubes. Ted Bracco, WØNZW, 203 E. Main St. #730, Teutopolis, IL 62467. (217) 857-6404 x306, braccot@hotmail.com

WANTED: SCR602 components, BC-1083, BC-1084 displays, any APS-4 components. Carl Bloom, CA, (714) 639-1679 or 3778111@mcimail.com

WANTED: Atronics Code Reader schematic/manual. George Marts, W9TDH, 5022 Pennsylvania, St. Louis, MO 63111. (314) 353-7669

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

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

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

WANTED: Hallicrafters SX88 or SX115. Larry Redmond, 413 Bedfort Dr., Duluth, GA 30096. (770) 495-7196

WANTED: Back issues of QRP or RADIO AGE magazines. Gary Fender, W5UUO, 450 Cunningham Rd., Celina, TN, 38551. (931) 243-5323, gdfender@multipro.com

WANTED: Antique tubes. Paying $40 ea for good used type 201 tubes (not A). Buy list & new 2000-2001 catalog of collector tubes available. See www.fathauer.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281. (480) 968-7686, tubes@qwest.net

WANTED: To recover one of my own early QSL cards from the 50s. Any ole tymer have an Iowa KNØCER or KØCER card in your archives? Tnx. 73. w5usm@aol.com

WANTED: Navy radio model MBM made by Jefferson Travis Co WW II; also PPN-1 ant & battery box & bag. Steve Bartkowski, 4923 W. 28 St., Cicero, IL 60804. (708) 863-3090

WANTED: Manual for AN/PRC-1 suitcase spy radio, copy OK. Walt Tukkanen, POB 254, Koza, Okinawa, Japan 904-0021. billtukkanen@yahoo.com

WANTED: Info on Volna or Volya Russian shortwave military rcvr, circa WW II. Louis L. D'Antuono, 8802 Ridge Blvd., Brooklyn, NY 11209. (718) 748-9612 after 6 pm.

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Looking for the following for a restoration project: round & square cameras, #AXT, CRV, ATH; transmitters, #AXT-6, 7, ART-26, 28; dynamotor CRV-21; test set, I-232, 231, 206, TS-93, CRV-60058.

Maurice Schechter, 590 Willis Ave., Willis Park, NY 11596
516-294-4416, mauricsch@cs.com

FOR SALE: Hallicrafter's manuals, copies starting at $5, some Johnson, WRL, others. SASE for list. DSM Diversified, 909 Walnut St., Erie, PA 16502.

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

WANTED: Orig Heath manuals for ham & test equip. Please state condx & price. Warren, K1BOX, POB 1051, Spruce Pine, NC 28777. (828) 688-1922

WANTED: 125 Amp, (50 mV full scale) panel meter for PP-1104/C, 14/28 V pwr sply. Don, WA2ELD, KY, (859) 254-1886, wa2eld@myexcel.com

WANTED: Globe King 500/A/B/C xmtr. Will pick up anywhere near Chicago. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (630) 852-4704. JandRJor@interaccess.com

WANTED: Bendix radio rcvr RA-1B; Belguim set RST-101. George Rancourt, K1ANX, MA, (413) 527-4304 or k1anx@mindspring.com

WANTED: WW-2 Japanese military radio and radar of any kind. Yokohama WW-2 Japanese Military Radio Museum, Takashi Doi, 1-21-4, Minamidai, Seyaku, Yokohama 246 Japan. Fax 011-8145-301-8069, takadoi@carrot.ocn.ne.jp

WANTED: Stancor/Chicago PCC200, PCO/PS0150, RC8150; Triad A-9-J, A-10-J, A-11-J, A-12-J. **FOR SALE:** Books, send SASE. Richard Robinson, POB 1425, Wallingford, CT 06492. (203) 949-0871, richmix@erols.com

WANTED: RBB/RBC rcvrs, pwr splys, cables & RAK/RAL equip. Andy Miller, KD6TKX, CA, (831) 484-2389, amillertkx@aol.com

WANTED: Mics: Astatic JT 30/40; UT-48; Shure CR80/81/41; 707A; Turner VT-73; CD/BD; parts for same. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225. tomsmics@flexcomp.com

WANTED: Desperate for museum display: lge AC cooled or water cooled xmtg tubes. Certain types including RCA, 898, 862, 893A or R & 5831s; other manufacturers such as Federal Telephone & Radio F 124R. Name your price. Tommy Bolack, 3901 Bloomfield Hwy, Farmingon, NM 87401. (505) 325-4275

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: WWII BC-610-E series or earlier xmtr; BC-739 interphone control box. BC-652 rcvr. Steve Finelli, N3NNG, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211, navrad@enter.net

WANTED: Plug-in coils 4, 5, 6-pin types; Hammarlund, Millen amphenol, used or new. Henry Mohr, W3NCX, 1005 W. Wyoming St., Allentown, PA 18103

WANTED: Replacement power transformer for Heathkit DX-35. Ron Faulkner, W6TUR, 7188 Ruane St., San Diego, CA 92119. (619) 303-1307

WANTED: Kleinschmidt teleprinter models: 311, 321, (AN/FGC-40, AN/GGC-16, AN/UGC-39...) Tom Kleinschmidt, 506 N. Maple St., Prospect Hts., IL 60070-1321. (847) 255-8128

WANTED: Military survival communications equip: radios, beacons, manuals, books, historical info/photos. Daniel Cahn, 3444 Greenwood Ave., Los Angeles, CA 90066. (310) 398-7159. danielc411@aol.com

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

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WANTED: Drake 1A rcvr; 399C1 Collins VFO; JRC 505 twins. K5YY, AR, (501) 756-5010. k5yy@arrl.net

WANTED: Collins 310B3, basket case OK - welcomed; & Chicago 500W CMS-2, high-level modulation xfmr; Taylor T21. Jerry, W8EGD, CO, (303) 979-2323.

WANTED: Clean Mackay 3010C & Kenwood R599D w/all filters & manual. Ric, C6ANI, POB N4106, Nassau NP, Bahamas

WANTED: National SW3, complete tube shield. State price & condition. Roger, K1TG, rwkuchera@snet.net

WANTED: Collins 70K-2 PTOs working or not; IN82A diodes; Bretting 14/14AX manual. Clark, WØBT, KS, (785) 286-2132

WANTED: National NTE. I love National. Sylvia, N1VJ, 33 Lawton Foster Rd., Hopkinton, RI 02833. (401) 377-4912

WANTED: Collins 30K1 xmtr; also need orig manuals & literature for 75A1, 32V1, 30K1. Paul Kluwe, W8ZO, POB 84, Manchester, MI 48158. (734) 428-2000

WANTED: Hammarlund HQ-180; Scott Special Communications rcvr; RCA Channalist. EA4JL, phone Kurt Keller, CT, (203) 431-9740 or k2112@earthlink.net

WANTED: Collins - Amateur catalogs, sales literature, manuals, promotional items & Signals. Richard Coyne, POB 2000-200, Mission Viejo, CA 92690

WANTED: Junker SX-42 or front panal. **FOR SALE:** Surplus Conversion Manual 3, 1956 ARRL Handbook - $25 ea. Gary, (952) 496-3794, k7adf@aol.com

CDs From the ER Bookstore

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RCA HB-3 Tube Handbook - $ 75.
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WANTED: National HRO black wrinkle spkrs, oak coil boxes, coils; Western Electric horns, spkrs, amps, mics. Barry Nadel, POB 29303, San Francisco, CA 94129. bnadel@ccnet.com

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

WANTED: New or used unmodified BC459A, BC696, T18/ARC/5, T19/ARC/5, CBY52232. Louis Lytch, K2DET, 117-33 230th St., Cambria Heights, Jamaica, NY 11411-1806. (718) 528-5065

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

WANTED: Collecting military electronics including radio, radar, RDF and test, manuals & literature. William Van Lennep, POB 211, Pepperell, MA 01463. (978) 433-6031

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: Postcards of old wireless stations; QSL cards showing pre-WWII ham shacks/equip. George, W2KRM, NY, (631) 360-9011, george2f@aol.com

WANTED: Copy of 1934 Short Wave Craft article on 19 Twinplex. Dave, WA6VVL,2222 Sycamore Ave.,Tustin CA 92789. daveishmael@home.com

WANTED: 500 cycle mech filter for 75-A3 receiver, good condx. Dave Parker, WB9WHG, POB 307, Iron Ridge, WI 53035. (920) 625-3919, dparker@nconnect.net

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 820, Hot Springs, AR 71902. (501) 318-1844, Fx 623-8783, james.true@ibm.net

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: Electric Radio; Antique Radio Classifieds; Old Timers Bulletin. Alan Mark, POB 372, Pembroke, MA 02359

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WANTED: Panel meter for the Johnson Challenger CW xmtr. Pete Cullum, KØWRX, 1332 Harlem Blvd, Rockford, IL 61103. (815) 965-6677. PLCullum18236@aol.com

WANTED: HR0-7 band plug-in E and F. DJ, (805) 683-2876, K6RCL@home.com

WANTED: Old Army Navy radar equipment, any condx, any size. Bigger is better! William Donzelli, 15 MacArthur Dr., Carmel, NY 10512. (845) 225-2547, aw288@osfn.org

WANTED: Hallicrafters HA-2 transverter with or without power supply. Tom Hoitenga, K8NGV, 3170 Kennesaw View Dr., Marietta, GA 30064. hoitenga@atl.bellsouth.net

WANTED: Complete working PRC-1099. Knob and friction drive for Heathkit SB series fiducial. Brian Roberts, K9VKY, 130 Tara Dr., Fombell, PA 16123. (724)758-2688. k9vky@stargate.net

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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. rwdowns_wa5cab@compuserve.com

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WANTED: In any condition ELF 7200B three-axis display and/or any associated documentation, John Bowers, ka0seri@arrl.net

WANTED: EICO 722 VFO. Any condition. Bob Mattson, 16 Carly Dr., Highland NY 12528. (845) 691-6247, w2ami@arrl.net

WANTED: HRO-5 "silver front" G Coil 180-430 Kc. Also PP-327 AC power supply for GRC-9. Tony, k4kyo@arrl.net or (703) 522-1568

WANTED: Convert Gates BC-1H to ham bands. Please e-mail if you can give me advice. Thanks, Wes, (870) 773-7424, k5apl@cs.com

WANTED: JW Miller IF trans 912-C-3 or 612-C2. Harry Weber, 4845 W. 107th St., Oak Lawn, IL 60453

WANTED: Clegg Venus xcvr w/pwr sply spkr unit or either unit separately. Jeff, WA8IKW, OH, (937) 667-9399.

NOTICE: The Electronics Collector has ceased publication; last issue (August) available $2 pp. Write TEC, Box 43, Live Oak, FL 32064-0043

ELECTRIC RADIO STORE

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