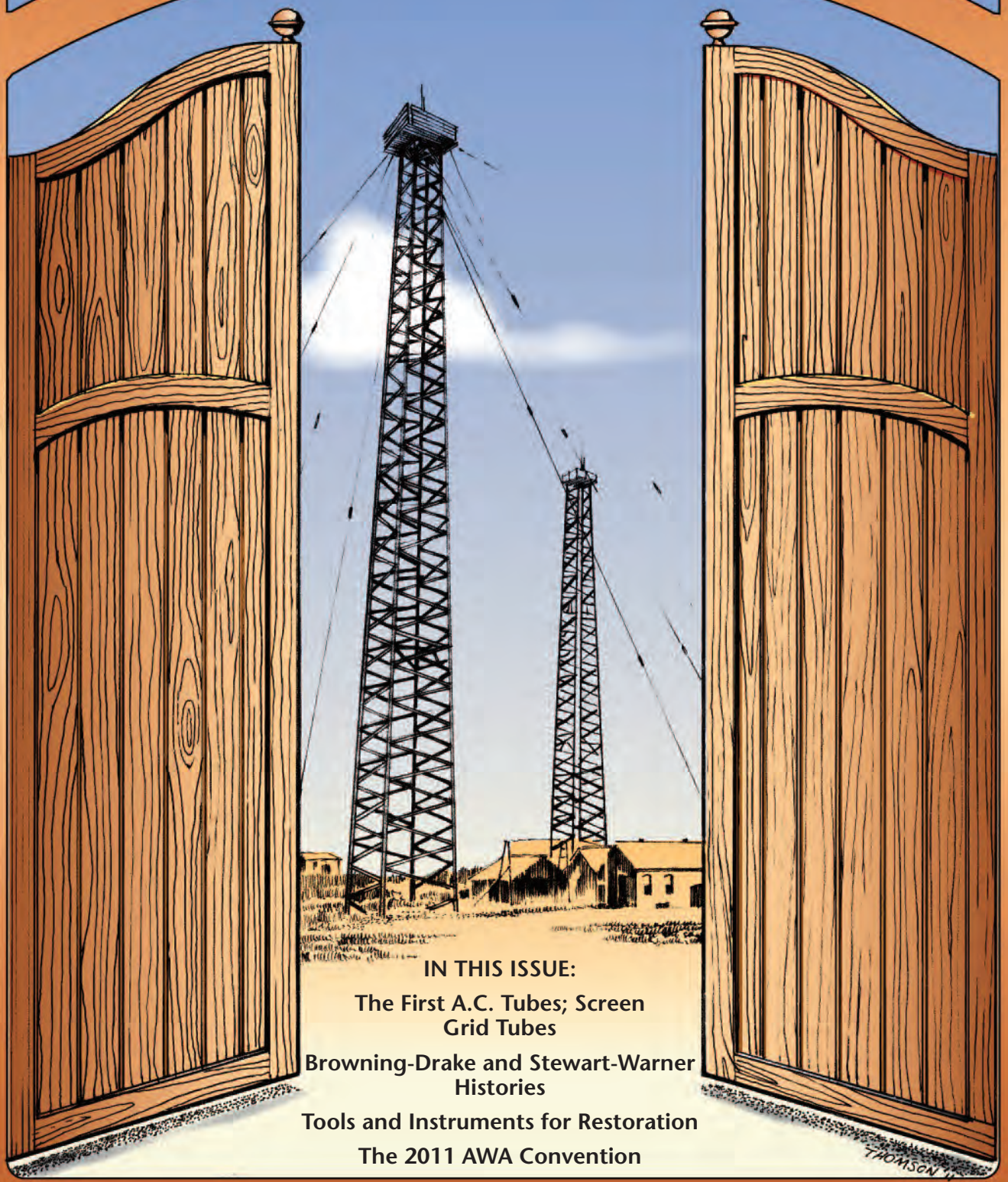
THE A.W.A. GATEWAY

Volume 1, Number 2, June 2011



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Your Entry to the Fascinating World of Vintage Communications

The *AWA Gateway* is an electronic publication of The Antique Wireless Association, downloadable without charge from the AWA website www.antiquewireless.org, to stimulate interest in vintage communications history, equipment restoration and collecting.

WEBSITES

Website: www.antiquewireless.org

Special Convention website: www.awaconference.com

Special Development website: www.antiquewirelessmuseum.com

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Marconi at his St. Johns receiving station. Courtesy David Read.

ABOUT OUR COVER

The scene that is partially revealed behind the gateway is the Marconi transmitter complex at Poldhu, southwest Cornwall, England, that sent the first transatlantic radio signal. The three dots, representing the Morse letter "s," were received by Marconi at St. John's-Newfoundland on December 12, 1901. Shown are two of the four sturdy towers that replaced the two antenna masts used in the original test.

The *AWA Gateway* cover was created by Will Thomson of Armadillo Arts, Iowa City, Iowa.

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Welcome to The AWA Gateway!

From The Editor

Hello and welcome to the second issue of *The AWA Gateway*, a free electronic publication of The Antique Wireless Association. I hope you enjoy going through it as much as we did putting it together! If you are just beginning to get involved in antique radio collecting and/or restoration—or if you are thinking about becoming involved—this new quarterly publication is especially for you.

In addition to its other features, this issue continues new installments of the three series we began last time: "The Receiving Tube Story," "Company Chronicles" and "Play it Again." Right now, much of the *Gateway* material is being contributed by your Editor, having appeared in a former publication some years ago. However, we would like for *The AWA Gateway* to become a vehicle for member contributions, just as is our sister print publication *The AWA Journal*.

Click on our web site http://www.antiquewireless.org/ to find out more about *The AWA Journal* and The Antique Wireless Association. Once on the site, click on "Join the AWA" to either access a printed application or join the Association via your PayPal account.

We'd like to know what you think of *The AWA Gateway* and hear about features you would like to see added. Be sure to contact me at mfellis@alum.mit.edu or tweet to @AWAGateway!—Marc Ellis, N9EWJ

From The Deputy Director

Hi everyone and welcome to the second issue of the *AWA Gateway*. It is Spring! Yea!! But, whoever is praying for rain, can please stop. I think I said the same thing about snow last issue.

I am sure you will enjoy this issue as much as the first. Please share both with your friends and especially with young people. Talk to them about the concepts and technologies of our hobby.

This week a group of 20 Girl Scouts visited our

Museum and they had a great time. They especially enjoyed using the wooden cabinet wall telephones, and when I explained that cell phones are telephones based on "radio" technology, a receiver and a transmitter, the flood of questions just kept coming.

Another staff member was busy upstairs demonstrating our thousand-watt spark transmitter to the amazement and enjoyment of others in the group. Even though he warned that it would be loud, they jumped anyway. It is always great to see the expression of fascination on the faces of young people as we introduce them to our working exhibits.

One of the goals of AWA is to interest and educate youngsters in the technologies that are used to communicate and entertain, ranging from the telegraph to the cellular telephone. Our new Museum, now in the planning and early construction stage, will have a 60 seat auditorium, allowing two classes of school children at once to view our educational presentations.

If the USA is to be a leader in technology, we must encourage our young folks to take an interest in the sciences.

Well, that is enough preaching. I want to update you on the development of our Museum. On April 21, we presented our plans for the new AWA Museum and Research Campus to the Town of East Bloomfield, N.Y. and received approval to move forward. That is a very important step. Although we do not expect major construction to begin right away, we have selected a general contractor and are now finalizing plans for the Museum building.

Our original Museum is still fully operational. But the Museum Annex—used primarily for storage and library research—is now empty. The artifacts and books have been moved to our new Museum campus across the road. Please look at our previous issue, Volume 1 No. 1, for a complete description of the new campus.

The keys to the Annex have been turned over to the Town of East Bloomfield. Since the building will be the headquarters of the summer recreation program, one of our antennas has been left up. We expect to provide demonstrations of Amateur Radio as part of the program—something that has pleased and excited the town officials.

We now have over 200 donations for the new Museum—totaling nearly $1.5 million. Some of the donations have notes and stories attached, and one especially comes to mind. A gentleman donated $2 with a note saying that he is 94 with no pension and has medical bills of $6,000 per month. The $2 was all he had yet he still wanted to support the AWA. I wrote back thanking him and told him that his generosity touched me so much that I made an additional donation in his name to the Development Fund.

Please consider joining us in sparking the Museum forward. Donations can be made through the Museum Development Fund website, www.antiquewirelessMuseum.org or by mailing your donation to AWA Development Fund, P.O. Box 421, Bloomfield, NY 14469. Every donation makes a difference. You can be part of the new campus development and I hope you will.

Bob Hobday

Deputy Director, Antique Wireless Asssociation

COMING SOON! THE 50TH AWA WORLD CONVENTION

If you are free to visit Rochester, NY on August 16-20, take advantage of the opportunity to spend five days totally immersed in radio lore, artifacts and equipment! You'll enjoy the fellowship with AWA members, learn from the forums and presentations, acquire or sell radio treasures.

Among the highlights of the event will be our round-the-clock flea market, forums and presentations covering a broad spectrum of the radio hobby, and expanded auction including items from several estates.

You'll enjoy spending time at the AWA museum and, also, viewing our Old Equipment Contest—where member displays in the various contest categories compete for top honors. This year, recognizing our convention's 50th anniversary theme, prize winning entries from previous years will also be competing.

Special event station W2A, sponsored by the Rochester DX Association, will be operating from the Flea Market.

There will also be many opportunities for purely social get-togethers. These include the International Dinner on Canandaigua Lake honoring our attendees from other countries, the Pizza Dance Party, Movie Night, Ladies' Luncheon and 50th Anniversary Banquet.

The Convention will be held at the Rochester Institute of Technology Inn and Conference Center in Rochester, NY. From Exit 46 of the New York Thruway (I-90), take I-390 North to NY253 West to NY15 South. Look for the RIT building about 0.7 miles on the right. For more information and to register on line visit www.awaconference.com. Contest and partial program listings are available at www.antiquewireless.org. Click on "AWA Convention Preview."

By Marc F. Ellis, N9EWJ

The Receiving Tube Story

Part 2: The First AC Tubes; Screen Grid Tubes

Last time we covered the development of all tubes commonly used in home battery receivers at the beginning of the broadcast era. Take a few minutes, now, and think about what those battery radio owners had to put up with. If the set was large enough to have good sensitivity and operate a speaker (such receivers would typically be "3-dialers" using five 0l-A tubes), energy to light the filaments came from a six-volt lead-acid storage battery of the type used in automobiles. Plate (and possibly grid bias) voltage came from two or more large dry batteries of the non-rechargeable type.

BATTERY RADIO AGGRAVATION

Consider the nuisance and expense of operating these radios. First of all, the typical coffin-shaped case of such sets was not designed to house the batteries. Unless the family purchased a piece of special furniture to accommodate the receiver and its accessories, battery location was a problem. Those energy sources, bristling with interconnecting wires and tied to the radio via a long umbilical, looked quite untidy under the radio table.

The plate and bias batteries (called the "B" and "C" batteries) had to be disconnected, discarded, and replaced when exhausted—an annoying and expensive recurring chore. But the filament storage battery (or "A" battery) was a special problem. It was definitely miscast in the living room because a few stray drops of acid from the battery could play hob with the living-room carpeting.

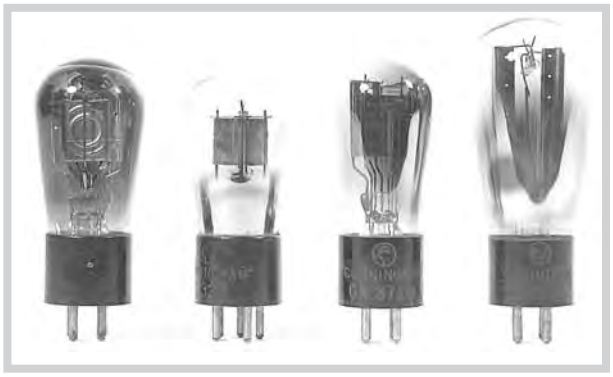
Moreover, when exhausted, it had to be disconnected and recharged. The hapless radio owner could either manhandle this 40- or 50-pound load down to the nearest service station and back or purchase a home battery charger. Of course the latter option placed another unit, with more interconnecting wires, under the radio table.

Folks tolerated those messy, inconvenient and expensive batteries at first. They were part of the mystique of owning a radio set at a time when listening to distant signals in one's living room was a thrilling and magical activity. But there was obviously going to be a great market for plug-in radios as soon as they could be invented.

BATTERY ELIMINATORS

Eventually "B" and "C" eliminators appeared on the market. These converted the 110-volt AC house current to the various direct current voltages needed for the set's "B" and "C" supply. Less common, more cumbersome and more costly were the "A" eliminators that replaced the storage battery, converting house current to six volts DC for lighting the tube filaments.

By purchasing these "eliminators," at some expense, the radio owner could free himself from dependence on batteries—but he still had a bunch of hardware and interconnecting wires under his radio table. Some time in the mid-



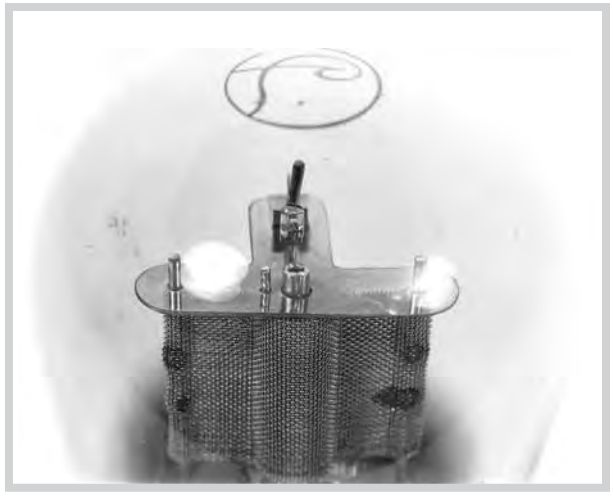
Here are the tubes that made the first true AC sets possible. From left: UX-226, UY-227, UX-171-A and UX-280.

1920s, the first AC-operated sets ("light socket" radios, as they were called) were introduced. But they were really just battery-set designs with built-in "A" and "B" eliminators. These radios were neater because all of the hardware was housed in a single cabinet. But they were just as cumbersome and just as expensive (if not more so) than battery sets with separate eliminators.

True AC-operated sets, with power supply and radio circuitry compactly integrated in one case, would have to wait until the power-hungry filament circuit could be operated directly from an AC source. Then the bulky and costly AC-to-high-current-DC "A" battery eliminator equipment could be abandoned

AC TUBES ARRIVE

The problem with operating the filaments of most battery tubes from an AC source was hum. The 60-cycle hum



Note the cylindrical cathode emerging from the top of the UY-227's interior structure.

Straight-down view of an AK 42. Power supply with 80 tube above; radio chassis with '26s, '27 and '71-A below.

from the alternating current supply would mix with the radio signal and be amplified along with it, causing a loud and unpleasant raspy noise that made it virtually impossible to hear the broadcast.

In 1927, RCA released two new tubes that solved the problem—each in a different manner. Except for its filament design, the type UX-226 looked very similar to the type '0l-A it was designed to replace. But engineers had found that one way to reduce hum was to balance it out by operating the filament at a lower voltage and a higher current. The '26's filament ran on 1.5 volts at 1.5 amperes (compare the '0l-A's heater specs of 5 volts at .25 amperes).

The type '27, however, was a true breakthrough design—the prototype for all AC-operated tubes to follow. Instead of directly supplying the tube's electron stream, the filament served only to heat a surrounding structure called the cathode (originally a ceramic cylinder coated with a metallic substance) which, in turn, emitted the required electrons.

The cathode had enough "heat inertia" to smooth out the AC pulsations, so the tube ran without hum. The '27's filament (properly called a "heater" in this application) ran at 2.5-volts, which was to become the industry standard for all AC tubes designed over the next several years.

Because it was necessary to bring out an electrical connection from the cathode, the '27 needed a new base having an extra pin. Called the "UY" base, it was like the "UX" design except for having five pins instead of four. The '27's original full designation was UY-227.

THE FIRST AC SETS

The earliest integrated AC radios (the familiar metal-cased Atwater-Kent Model 42 is a good example) tended to use '26s as RF and first AF amplifiers and the '27 as a detector. In more mature designs, as engineers became more comfortable with the new "cathode technology," the '26 was phased out—which, incidentally, eliminated the necessity of supplying an extra filament voltage winding on the power transformer. A good example is the very common RCA Radiola 60, which employs '27s throughout—except for the power amplifier and rectifier tubes.

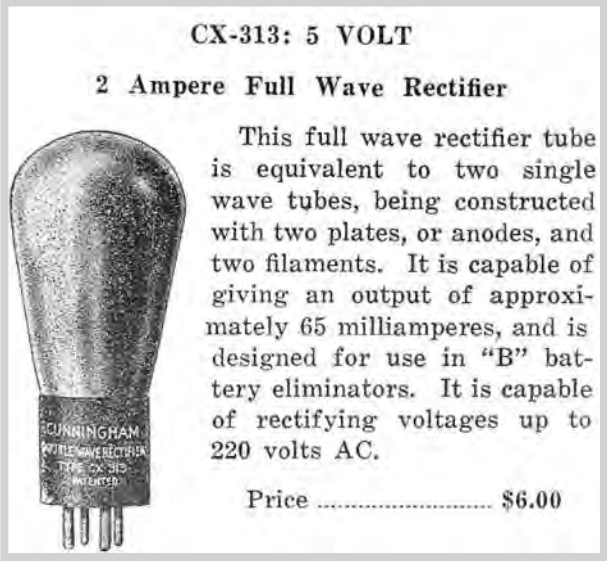
A few power amplifier tubes (otherwise known as audio output tubes) were designed for battery sets. Among them were the '120 (discussed last time), '112 and '171. They weren't widely used, however, because their extra power drain significantly shortened battery life.

As it turned out, the audio output stage wasn't as sensitive to hum as the earlier stages of the receiver. Battery types used for this purpose could be lit from an AC source with no ill effects. So, at least at first, no special AC audio output tubes were designed. The most common type used in the early AC sets was the UX-171-A, an improved version of the '171. Both the RCA and AK sets just mentioned used this tube as the power amplifier. Its filament operated on 5 volts at .25 amperes, just like an 01-A.

With tube filaments (and heaters) operating nicely on alternating current, one more arrangement had to be made to achieve an efficient "light socket" radio circuit: the conversion of the AC line voltage to well-filtered DC for use as the "B" and "c' supply. To achieve this required a full-wave rectifier circuit. Half-wave rectifier tubes (simple diodes having a filament and a single plate, but no grid) had been available since battery set days, but it required two of them for full-wave rectification.

In 1925, the first tube designed specifically for full-wave rectification (containing two plates in addition to the filament) was released. It was called the UX-213. This tube became obsolete almost as soon as it was released; radio circuits were rapidly becoming more sophisticated and powerful and the '213 wasn't able to deliver enough current to operate them. Very few radio sets incorporated a '213. I've never come across one myself.

The UX-213 was replaced, less than two years later, by the UX-280—which had about twice the current rating. The latter provided more than enough power for the sets then in use (both our examples above are powered by '80s) and for those that would be manufactured for years thereafter. In fact, the '80 is probably the most enduring tube type ever introduced, having been manufactured continuously for at least 50 years.



Type '13 as introduced in an early ad. As a Cunningham tube, it was designated CX-313. RCA's version was designated UX-213.

The availability of the types '26, '27, '71-A and '80 tubes made possible the development of the first generation of truly integrated AC-operated radios—receivers containing a compact power supply developed as part of the original design and built right into the cabinet along with the rest of the set. Even the table models, complete with internal power supply, were hardly bigger than the 3-dialer "coffin" sets of the previous generation.

Gone was the heavy umbilical dropping down to a jumble of batteries or eliminators under the table. Gone were the batteries themselves and the need to replace or charge them. The only power cable coming out of the new sets was a slender AC cord with a plug to be inserted into the wall socket. The cord took care of all energy needs, and the receiver could be operated for hours on just a few pennies worth of electricity.

Not only that, but the new sets were more sensitive and far easier to operate than the old 3-dialers. They also had better volume and tone quality. Is it any wonder that the old battery sets were relegated to attics, basements and (alas) ashcans as fast as their owners could get together the money to buy one of the AC models?

TAMING SELF-OSCILLATION

After the introduction of the first AC tubes, the next major innovation was aimed at overcoming a serious problem that limited the amplification available from vacuum tubes operating at radio frequencies. The problem was caused by the internal capacitance that existed between a tube's grid and plate. The unwanted capacitance resulted in feedback that caused instability and self-oscillation.

To combat the problem, early set designers had to either neutralize the oscillation (as in the well-known "Neutrodyne" circuit) or find ways to lower the efficiency of tubes operating as RF amplifiers. Either way, the full amplification potential of the tubes could not be realized.

The tendency for self-oscillation increased as the frequency of the signal being amplified was raised. So the heightened interest in shortwave communication beginning in the late 1920s intensified the need to solve the problem.

ADDED—A NEW GRID

Like so many important technological breakthroughs, the needed solution was arrived at, almost simultaneously, by experimenters working in different countries. It was found that the internal grid-plate capacitance of a triode (three-element tube) could be reduced several hundred percent through the introduction of an additional grid between the original grid and the plate.

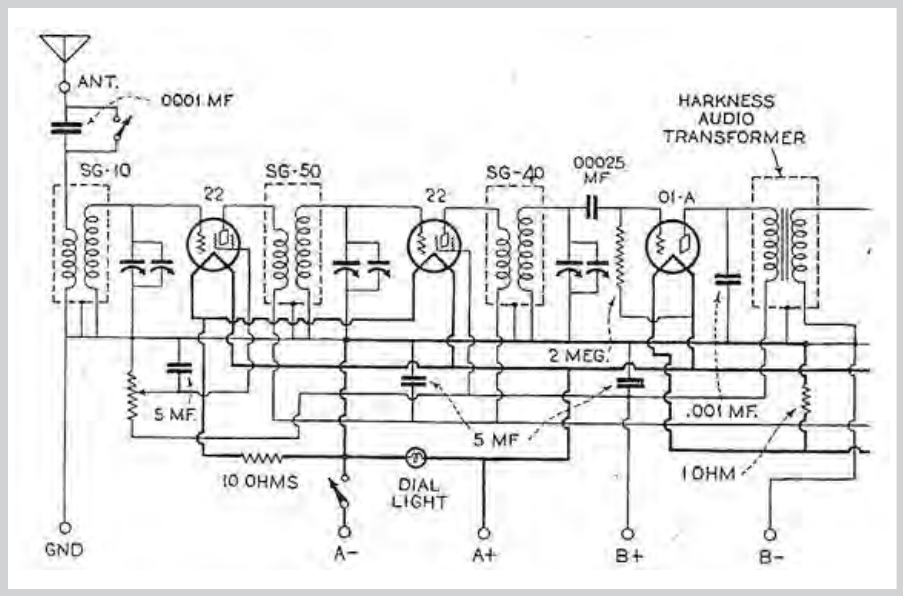
A technical explanation of the effect is beyond the scope of our discussion, but the capacity reduction was achieved through an "electrostatic shielding" effect obtained by maintaining the new grid at a voltage that was positive with respect to the tube's filament or cathode (but generally quite a bit less positive than that on the plate).

This added element was known as the "screen grid" to distinguish it from the "control grid," which carried the signal being amplified. The screen grid actually was a piece of fine-mesh wire screening wrapped into a cylindrical shape. Tubes containing a screen grid were known as "tetrodes" (four-element tubes) to distinguish them from triodes.

THE TYPES 22, 24, AND 24-A

The first screen-grid tube generally available in this country was the type 22 introduced by RCA. The 22, which was a battery tube, never saw wide usage because it was released as the era of AC-operated sets was dawning. In fact, the first true AC operated tube (type 27) was already on the market when the 22 was introduced.

In providing a connection for the 22's extra grid, the designers chose not to alter the standard 4-pin base. Instead, they brought a lead out to a cap at the top of the tube. This was used for the control grid because, by separating the control grid connection from the leads going to the other elements, they could further reduce grid-plate capacitance. The base pin previously occupied by the control grid was now connected to the screen grid.



The "Harkness" battery-operated screen-grid set (1929) used type 22s as first and second RF amplifiers. Detector tube was the usual Type 01-A.

The type 22 was quickly superseded by the AC-operated 24, released in May, 1929. This was a tetrode containing a cathode and a 2.5-volt heater like that on the type 27. It used the same 5-pin base as the 27, with base pins assigned to the heater, cathode, plate, and screen grid. As with the 22, the control grid connection was brought out to a cap at the top of the tube. Very soon after the 24 was released, it was replaced by the 24-A, a quicker heating version of its predecessor.

The 24-A saw very wide use,

and will be found installed in virtually all of the early screen-grid sets you will come across.

Even sets originally equipped with type 24s were eventually re-tubed with the quicker-heating 24-As. If you have any type 22s or type 24s in your collection, I'd suggest hanging on to them as collectibles. It's not that these tubes are now incredibly valuable. But they are certainly not common, and will be getting more rare as the years pass.

The introduction of the screen-grid tube had an impact at least as great as the introduction of the first AC tubes. One contemporary radio historian wrote: "…the improvement in gain and efficiency by this development over the original triode has not been duplicated by any single advancement since that time."

Most screengrid sets you'll come across will use the type 24A. Original issue was pearshaped; this one has "ST" envelope.

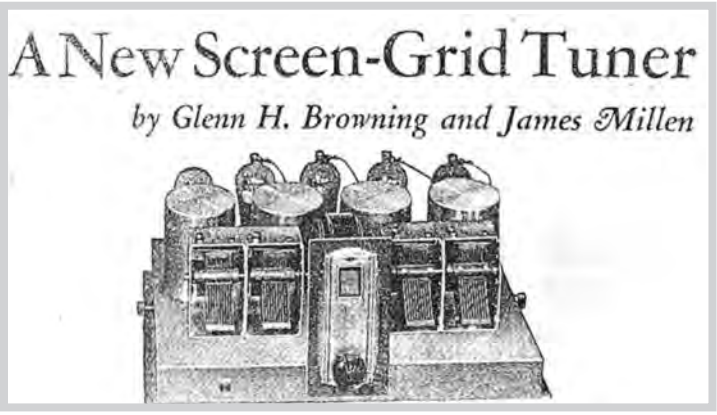
SOCIOLOGICAL IMPACT

Certainly, the impact on radio listeners, hobbyists and manufacturers was profound and immediate. Listeners marveled at the distant stations they could pull in with the new circuitry, and the magazines and trade papers were full of manufacturer's ads hyping new screen-grid sets. Hobby magazines overflowed with articles explaining screen-grid theory and providing constructional details on receivers utilizing the new tubes.

The development of the screen grid tube made it possible for the tuned radio frequency (TRF) radio design, originally embodied in the old "3-dialer" battery sets and also used in most early AC radios, to approach the sensitivity of the much more efficient superheterodyne circuit. This was a boon to the many manufacturers of the era who were reluctant to invest in an expensive superheterodyne license from RCA.

While the development of AC tubes had provided new convenience for the radio set owner, the development of screen-grid tubes enhanced his power over the airwaves that distinguished him from less affluent neighbors who couldn't swing the new equipment.

In an era when almost all types of technology were advancing rapidly, the introduction of the screen-grid radio was another part of the picture. Switching to one of the new sets was a little like trading in the old 4-cylinder Ford on a supercharged Lincoln V-12. And the physical appearance of a screen-grid receiver certainly fostered that illusion. A row of three or four 24-As, each with its top cap connected to the variable capacitor via a heavy rubber-covered wire, projected an image of power and energy-not unlike the ignition system of a high-performance car.


A New Screen-Grid Tuner

by Glenn H. Browning and James Millen

This 1929 National Company ad hyped a screen-grid tuner by two prominent radio engineers.

VARIABLE MU TUBES

The unique electrical characteristics of the screen-grid tube created an effect called "cross-modulation," which tended to reduce the selectivity of the set's tuned circuits. This was a problem because, by the time the screen-grid sets were being marketed, many parts of the country were able to support several powerful radio stations operating in the same metropolitan area.

Once again, the theory here is beyond the scope of our discussion-but the problem was corrected by redesigning the control grid of the tube. The spiral of wire forming the grid was changed so that the distance between its turns was non-uniform. Besides correcting the selectivity problem, the design change provided some important additional benefits.

The amplification of a tube equipped with the new-style grid could be smoothly controlled by varying the d.c. grid bias that was applied. This effect would make possible the design of efficient automatic volume control (AVC) circuits. Such circuits reduced the set's sensitivity when strong local stations were being received, thus preventing overloading, while automatically increasing gain to the maximum for the reception of weak, distant signals.

Tubes with a grid having this design are called variable-mu, remote-cutoff, or super control amplifiers. The first variable-mu tetrodes became available in 1931. RCA designated its version the type 35, while the virtually-identical tube released by most other manufacturers was dubbed the type 51. Like the 24 and 24-A, these tubes had cathodes and 2.5-volt heaters based on the design pioneered in the type 27.

Though the type 51 was discontinued not long after it was introduced, most manufacturers of replacement tubes labeled the type 35 as "35/51" indicating that it would replace either version. This practice went on for many years, and tubes labeled 35/51 seem to be more common than those specifically designated with either number.

Screen-grid tubes burst on the radio scene like a skyrocket, but their impact was fairly short-lived. The tetrode was replaced, in its application as a radio-frequency amplifier, by a new class of tubes known as pentodes-about which, more later!

Company Chronicles

Stewart-Warner
Matched-Unit Radio
INSTRUMENTS TUBES REPRODUCERS ACCESSORIES

Originally called the Stewart-Warner Speedometer Corporation, this organization was put together in 1912 through a merger of two parent companies. The company manufactured a large line of automotive parts and accessories but, concerned that the automotive business might decline, began investigating the radio market in 1923.

Stewart-Warner's original concept was to manufacture a complete line of radio items in addition to completed sets. The early advertisements stressed that Stewart-Warner radios employed "Matched Unit" construction; all parts, tubes and accessories were "designed and perfected" by the company. The firm's original radio models were manufactured with parts purchased from Erla, however, and an early attempt to set up a vacuum-tube manufacturing operation ended in failure.

Nevertheless the company reported profits of $1.8 million on the sale of 100.000 radios in 1925, and was said to be turning out 1000 sets a day by February, 1926. About a year later, however, plagued by overproduction and excess inventory, the firm dumped 75,000 sets at $15.00 each. The following year, about a million dollars worth of obsolete sets were unloaded. At that time, the radio trade papers reported that the company's radio losses were being offset by profits from its automotive products.

The mammoth Stewart-Warner Chicago plant falls under the wrecker's ball.

Stewart-Warner became a less conspicuous presence in the radio industry after that time, but continued to manufacture radio sets, and, eventually, television sets and phonographs, until 1954—when US production of these product lines was discontinued. The company continues to operate and grow today, maintaining diverse interests in such areas as military electronics, facsimile, furniture hardware, lubricating systems, heating and tools.

Stewart-Warner's mammoth Chicago plant was reported by a 1929 trade paper to contain a million square feet of floor space and employ over 5,000 skilled workers. The company vacated the facility in the early 1990s, moving most operations to the El Paso, Texas area. The buildings stood empty for a few years, but have since been demolished to make room for condo construction

BROWNING DRAKE

In the mid-1920s, at the height of the "radio craze," the newspapers and radio magazines were full of trick circuits—often bearing the names of the self-styled inventors, and usually backed by manufacturers with a vested interest in selling parts. To the casual contemporary reader, the Browning-Drake circuit might well have looked like just another over-publicized hookup of doubtful merit.

However, it was actually one of the relatively few designs that were competently engineered and lived up to their advertising hype.

The Browning-Drake circuit had its origins in a mathematical study of tuned-radio-frequency amplification carried out by Frederick H. Drake in 1923 during his senior year at Harvard. Later, Drake approached Glenn H. Browning, who was a Research Fellow at Harvard, with the idea of making experimental measurements to confirm the mathematical analysis.

In carrying out this work, the two researchers found that the usual TRF transformer then in use had far too much capacitance between its primary and secondary windings. This lowered the amplification available from the circuit. To correct the problem, they designed a transformer primary formed of small wire wound in a thin slot. The result was a significant increase in gain.

The Browning-Drake circuit found quick acceptance, and the National Company (a Cambridge, MA neighbor of Harvard's), which had supplied tuning capacitors and vernier drives for the experimental circuits, collaborated on the mechanical design of a consumer oriented radio kit utilizing the design. Towards the end of 1924, it went on the market as the "National Regenaformer" kit.

About a year later, Browning formed the Browning-Drake Corporation to sell complete receivers while National continued to sell the kits. The company did well for awhile, but emerging technologies made the Browning-Drake circuit obsolete and, by 1930, the company was being operated by a creditor's committee.

The firm continued in business until 1937, when Browning founded Browning Laboratories to manufacture a variety of electronic devices. Drake, who had remained at Harvard to earn his MA and PhD, went on to form the Aircraft Radio Corporation of Boonton, NJ in 1929.

Play It Again

A No-Nonsense Guide to Vintage Radio Restoration

By Ken Owens
1932-2009

PART 2—BASIC TOOLS AND INSTRUMENTS

In the previous column, we concluded the discussion on vacuum tubes with some suggestions about tube testers. Now let's go on to talk about some other items you should plan on having at your workbench.

TOOLS

As far as tools are concerned, you will need the usual assortment of wire cutters, screwdrivers and needle-nose pliers. A set of small socket wrenches in sizes from ¼" to ½" is almost essential. You will also need a good soldering iron.

Antique radios were assembled with 100-watt irons. The wiring is heavy and most ground connections are soldered directly to the chassis. The solder was high-temperature-melting, more like plumber's solder than what we use today. Small, pencil-tip irons are useless for antique radios. Get an iron of at least 40-45 watts rating with a large pyramid tip. It will handle most of the component connections. I use a 100-watt tinsmith's iron for chassis connections.

The tip of your iron must be "tinned" by melting a coating of solder onto it. Scrub stubborn spots with steel wool until they accept a solder coating. A poorly tinned tip doesn't transmit heat well and makes your job more difficult. Periodically wipe the hot tip on a damp sponge to keep it clean and bright.

THE VOLT-OHM-MILLIAMMETER

You must have a test meter to work on radios. There are three types: the volt-ohm-milliammeter (VOM), the vacuum tube voltmeter (VTVM) and the digital voltmeter (DVM). When your antique radio was made, the VOM was what servicemen used. The VTVM was a laboratory instrument and the DVM didn't exist. The VOM will tell you almost everything you need to know about your set.

The basic meter movement in a VOM is a milli- or microammeter. Let's assume that the basic movement is 0-1 milliamperes, full-scale, and we put a resistor in series with it such that the resistor plus the internal resistance of the movement equals 1000 ohms. By Ohm's Law, 1 volt will cause 1 milliampere to flow and register full scale. We now have a voltmeter reading 0-1 V.

If the resistance combination were to equal 10,000 ohms, the meter would read 0-10V; 100,000 ohms will read 0-100V; etc. We say that such a meter has a basic sensitivity of 1000 ohms per volt. If the basic meter movement were 100 microamperes, the sensitivity would be 10,000 ohms per volt; if 50 microamperes, 20,000 ohms per volt.

The meter measures ohms by applying a voltage to the unknown resistor from an internal battery and displaying the current through the resistor as ohms on a special nonlinear scale. Although the VOM will measure current, there is little use for this feature. Current measurements are rarely needed in radio servicing. A 20,000 ohms per volt VOM is excellent for radio work, and can be bought at Radio Shack among other places.

Be careful with your meter; it is easily damaged. Meters are most often damaged by applying voltage to them while they are set for current or resistance measurement or by applying a voltage or current higher than the selected range. Be sure the selector switch is set correctly for what you are measuring and the range switch is set for a value higher than you expect to find. Never try to measure resistance in an energized circuit with any kind of meter.

For voltage readings, the VOM works on current which must come from the circuit being measured. Most radio circuits have high resistances in them so the current through the meter will cause a voltage drop. This means that the voltage you read on the meter is less than the actual voltage because the act of measuring the voltage changes it. The higher the ohms per volt rating of your meter, the less the change.

THE VTVM AND DVM

In the VTVM a tube and a meter movement are connected in a bridge circuit which is balanced with the zero adjustment so that no current flows through the meter when there is no voltage on the tube grid. A test voltage applied to the grid unbalances the bridge to give a reading. Modern equivalents of the VTVM using semiconductors are available at Radio Shack. The VTVM has an input resistance of 11 megohms on all ranges, so it draws virtually no current from the circuit under test and grid voltages can be reliably measured. The VTVM can measure very high resistance values, but it can't measure current. Since you need current measurement so rarely, that lack is unimportant. I use a VTVM for most of my work and recommend it to you.

The DVM has some impressive features, but is probably the least useful meter for radio servicing. Alignment of a radio requires tuning its circuits for peak output. The sample and display cycles of the DVM cause dead intervals in the readings making peaks hard to see. Peaking is simple with an analog meter.

Safety Note! Whatever kind of meter you get, spend some money on a good, well-insulated set of test prods. You will be measuring some high voltages. Keep your prods in good condition and get new ones when they show signs of deterioration.

ABBREVIATIONS FOR ELECTRICAL UNITS

In the 1920s and 30s there was little consistency in the abbreviations for electrical units. When looking at old lit-

erature, there's a good chance of getting confused. Today the abbreviation for the unit is capitalized because units are named for people. Thus the old mv and ma are now mV and mA. Note that in the old days, capital "M" meant 1000, but today we use "k." For a more complete comparison of old and new units, see the chart (right).

Next time we will discuss sources of parts for your antique radios.

Comparison of Old and New Unit Abbreviations

Old	New
mv, ma (millivolts, milliamperes)	mV, mA
mf, mfd (microfarads)	µF
mmf, µµf (micromicrofarads)	pF (picofarads)
M thousands of ohms	k (kilohmns)
meg (millions of ohms)	M
cps (cycles per second)	Hz (Hertz)
mc, kc (megacycles, kilocycles)	MHz, kHz

ABOUT THE ANTIQUE WIRELESS ASSOCIATION

The Antique Wireless Association is an organization of over 2100 international members linked by a common interest in the history of electrical and electronic communications. AWA members come from all walks of life and our ranks include teenagers, octogenarians, and beyond in both directions. At one of our meets, you might find yourself shaking hands with a retired broadcast executive or military electronics specialist, an engineer in a high-tech electronics firm, or an eager young person looking for advice on restoring his or her first radio.

The organization was started in 1952 by Bruce Kelley, George Batterson, and Linc Cundall—amateur radio operators and radio collectors from upstate New York. Their initial goal was to establish a museum where they could collect and preserve early wireless and radio equipment and historical information before it was lost to future generations. Decades later, their legacy continues to motivate our members.

Some of us are most interested in the technical background behind the epoch-making discoveries that now make it as easy to communicate across the globe as around the corner. Others enjoy the romance surrounding the men and institutions that put these discoveries to work: the maritime radio operators who averted disasters with their alert ears and quick thinking; the short-wave stations that radiated glimpses of exotic cultures and mindsets; the giant radio networks that delivered unparalleled entertainment and timely news to our homes while hawking toothpaste, cigarettes and soap flakes.

Though AWA members share this common interest, which many can trace back to early childhood, they express it in different ways. Some of us collect radio-related literature and manuals. Others collect and restore hardware: Morse keys and sounders, battery radios of the 1920s, telephones, advertising signs, cathedral and console radios—you name it! Collections can become very specialized, restricted to such things as radio components crafted of shiny Bakelite and gleaming brass or perhaps the fragile and intricate vacuum tubes that made the communications miracles possible.

Among our members are meticulous craftsmen who enjoy replicating vintage receivers and/or transmitters. Those who are licensed amateurs frequently operate such equipment in special communications events sponsored by the AWA.

In addition to the commitment to the preservation of historical artifacts and background materials at the Museum, AWA also publishes *The AWA Journal* and *The AWA Review*. The *Journal* is a quarterly publication that gives our multi-talented members an outlet to share their historical research, equipment restorations, troubleshooting and servicing tips and other information of common interest. *The AWA Review*, which also publishes member contributions, contains more extensive and scholarly papers. It is published once a year.

The AWA Gateway is the latest addition to the AWA family of publications. It's delivered electronically and free of charge—downloadable from our web site www.antiquewireless.org.

Our content is targeted at those who may not be familiar with the AWA and who perhaps are just becoming interested in the history, collecting or restoration of vintage communications gear. For that reason, our technical articles are more basic than those in our other publication and our articles about AWA generally do not assume knowledge that that only those familiar with our organization might have.

The AWA also sponsors a four day annual convention in August featuring technical presentations and forums, a large auction, an awards banquet, an equipment and artifact competition, a book sale, and an active flea market. The convention affords attendees plenty of time to renew and make friendships, time to engage in long conversations on collection, preservation and all other aspects of the hobby.

The AWA is chartered as a non-profit organization in New York State, an IRS 501(c)(3) tax-exempt corporation, and is a member of the American Association of Museums. To learn more about AWA or to join our organization, visit the AWA website at www.antiquewireless.org.

DONATING ARTIFACTS TO THE AWA

You may have artifacts that you are interested in donating to the AWA. We would be pleased to discuss any possible donation. Please call us at (585) 257-5119.

Members' Corner

Photos by Richard Neidich

News of Particular Interest to the AWA Membership

ANNUAL SPRING MEET

The Antique Wireless Association held its annual Spring Meet on Saturday, May 7th, at the Bloomfield, NY, Elementary school. Traditionally offered on the same day as the spring board meeting, this is the sixth year the event has been held at the school. This year the registration fee was waived in favor of a free will donation to the development fund for our new museum.

Twenty sellers at tables inside the building and in the parking lot offered a variety of items for sale. These ranged from from antique radios with horn speakers to amateur radio gear and components from all eras.Museum sales proceeds reflected this year's increase in attendance and participation. Sales of surplus equipment exceeded 2010 totals by 21 percent and auction sales were up by 55 percent.

This year's presentation, conducted in the school auditorium by Museum Curator Bruce Roloson and Deputy Director Bob Hobday, focused on the history of the AWA followed by the latest details regarding the progress of museum development. The winner of the 50-50 drawing, a new feature introduced this year, was announced at the beginning of the presentation.

Ronald Roach, W2FUI, *Museum Operations Manager*

SEMIANNUAL BOARD MEETING

The semiannual board meeting of the Antique Wireless Association was held on Saturday May 7th at the Max Bodmer Media Center and Library (Building 2) on the new museum campus. A summary of the formal meeting minutes will be posted in a future issue of the *AWA Journal*, but here are a few highlights.

Deputy Director Bob Hobday presented the Finance and Capital Campaign reports, which showed that the latter was off to a good start. Various strategies for continuation of the fund raising effort were discussed, including follow-ups with recipients of the initial mailer and plans to send out a second mailer with expanded coverage.

Curator Bruce Roloson commented on the progress being made on the museum campus. He reported that Building 1, a former antique mall that is to become the new expanded museum, has now been emptied of its tenants and is ready for remodeling and reconstruction.

Bruce Roloson (at table), presenting jointly with Bob Hobday at the Spring Meet, discussed the history of AWA and plans for museum development.

Ed Gable's lively auctioneering quickly found new homes for a wide variety of artifacts and equipment.

Some spring meet sellers preferred to tailgate in the parking lot rather than display their wares inside.

The spring board meeting in session at the Max Bodmer Media Center and Library.

Storage space in Building 2 has been developed to house the extensive collection of tube manufacturing specifications rescued from the RCA Harrison, NJ facility when that plant was closed. Preparations are also well underway to house the archives of the Radio Club of America.

Significant progress has been made in the organization and stowing of the large collection of tubes and parts housed in the Display and Repair Building (Building 3). Elsewhere in the building finishing touches are being put on the museum's ham station and work is proceeding on the repair of test equipment and artifacts.

In addition to the progress reported by Bruce Roloson, Ronald Roach and Bob Hobday reported that the former Museum Annex building is now completely empty and has been turned over to the Town of Bloomfield. Permits have now been secured for the renovation of Building 1. A new access door has been installed in the southeast corner of the building to facilitate the movement of materials in and out. Telephone lines are being traced to facilitate the installation of a new security system and an interim surveillance system has been completed.

Membership Services Committee chairman Richard Neidich reported on Editor Marc Ellis' transfer of printing of *The AWA Journal* to a new printer and change in mailing status from First Class to Non Profit, resulting in significant postage savings. Ellis' successful startup of *The AWA Gateway* on-line publication was announced, as were *AWA Review* Editor Bob Murray's expected publication dates and costs, page sizes and other statistics. *Review* Editor Bob Murray is to have two new Associate Editors, David Bart and Eric Bruesche.

Neidich also reported on Ed Gable's continuing work with the membership database, including interfacing with the new Journal printer to eliminate glitches in the transfer of mailing label data and harvesting up-to-date e-mail addresses from membership renewals and other correspondence. Roy Wildermuth's planning for the 2011 Convention (covered elsewhere in this issue) was also discussed.

During the conclusion of his report, Neidich touched on strategies for soliciting new memberships from various other collector groups and groups with interests that overlap AWA's as well as long-range plans for a new web site with enhanced functions for members.

Included with the other business brought before the board was a report by Bob Hobday on the suggested goals for The AWA Press, a proposed new publishing initiative. The report touched on relationships with authors and publishers, strategies for marketing strategies, and selection of content. Hobday asked that the board approve the selection of a small committee to manage the creation of The AWA Press, reporting back to the board at three-month intervals. Approval was granted.

Marc Ellis, N9EWJ, *Journal* and *Gateway* Editor

Clubs That Will Welcome You

• The Antique Radio Club of Illinois (ARCI)—Meets bi-monthly. Meets generally held at the American Legion Hall, Carol Stream IL but meets In June in conjunction with the 6-Meter Club of Illinois at the Dupage County Fairgrounds and once per year for Radiofest at the Willowbrook Illinois Holiday Inn. Check web site for schedules, details and maps.) Contacts: President, Olin Schuler oshuler@comcast.net; Club Public Contact, Art Bilski, 630 739 1060, clubinfo@antique-radios.org. Website www.antique-radios.org

• Antique Radio Collectors of Ohio—meets first Tuesday of each month at 2929 Hazelwood Ave., Dayton, OH (4 blocks east of Shroyer Rd. off Dorothy Lane) at 7 p.m. Also annual swap meet and show. Membership: $10.00 per year. For more info, contact Karl Koogle: mail to above address; phone (937) 294-8960; e-mail KARLKRAD@GEMAIR.COM

• California Historical Radio Society—For info on current meetings, call the CHRS hotline: (415) 821-9800.

• CARS, the Cincinnati Antique Radio Society—Meets on the third Wednesday of each month at Gray's History of Wireless Museum, which is part of The National Voice of America Museum of Broadcasting, Inc., located in a building that is now on the National Historic Register at 8070 Tylersville Road, Westchester, Ohio. 45069. For more information contact Bob Sands at (513) 858-1755.

• Carolinas Chapter of the AWA—Hosts four "mini-swap-meets" each year (in January, May, July and October) plus an annual conference, "Spring Meet in the Carolinas," on the 4th weekend in March. Executive committee meets approximately quarterly. For more info, visit the web site at CC-AWA.ORG or contact Ron Lawrence, W4RON, Chapter President, P.O. Box 3015, Matthews, NC 28106-3015; phone (704) 289-1166; e-mail W4RON@carolina.rr.com.

• Central Ohio Antique Radio Assn.—Meets at 7:30 p.m., third Wednesday of each month at Devry Institute of Technology, 1350 Alum Creek Rd., Columbus. (1-70 Exit 103B.) Contact: Barry Gould (614) 777-8534.

• Delaware Valley Historic Radio Club—Meeting and auction begins 7:30 p.m. on the second Tuesday of each month. Location: Telford Community Center on Hamlin Ave. in Telford, PA. Annual dues: $15.00, which includes a subscription to the club's monthly newsletter *The Oscillator*. For more info contact Delaware Valley Historic Radio Club, P.O. Box 5053, New Britain, PA 18901. Phone (215) 345-4248.

• Houston Vintage Radio Association (HVRA) meets the fourth Saturday (January thru October) at Bayland Park 6400 Bissonnet, 9 a.m. in SW Houston. Each meeting includes an auction and program. Annual two day convention held in February includes three auctions, old equipment contest, technical talks, swap meet, and awards banquet. One day MEGA auctions held in the spring and fall. A newsletter, *The Grid Leak*, is published bi-monthly. Event postings, announcements, photos and other features are available on HVRA web site: www.hvra.org. Membership

is $20/yr. Address: HVRA, PO Box 31276, Houston TX 77231-1276 or call Bill Werzner, 713-721-2242; email: minggi53@sbcglobal. net.

• Hudson Valley Antique Radio & Phono Society—Meets third Thursday of month, 7 p.m. Meeting, swap meet, and membership info: Peter DeAngelo, President, HARPS, 25 Co. Rt. 51, Campbell Hall, NY 10916. (914) 496-5130.

• Indiana Historical Radio Society—Meets quarterly in Feb., May, Aug. and Oct. Flea market, old equipment contest and auction at all events. *The IHRS Bulletin* has been published quarterly since 1971. For meet details and information about the club and our Indiana Historic Radio Museum in Ligonier, IN. see our website at www.indianahistoricalradio.org, contact Herman Gross, W9ITT, at 1705 Gordon Dr., Kokomo, IN 46902-5977 (765) 459-8308, or email w9itt@ sbcglobal.net.

• London Vintage Radio Club—This Ontario, Canada club meets in London on the first Saturday of January, March, May, June and November. Annual flea market held in Guelph, Ontario in September in conjunction with the Toronto club. Contact: Lloyd Swackhammer, VE3IIA, RR#2, Alma, Ontario, Canada N0B1A0. (519) 638-2827. E-mail contact is Nathan Luo at lvrceditor@ yahoo.com.

• Mid-Atlantic Antique Radio Club (MAARC)—Meets monthly, usually on the third Sunday of the month at the Davidsonville Family Recreation Center in Davidsonville, MD. (But meets once or twice a year in Northern Virginia—check website for schedules, details and maps.) Contacts: President, Steve Hansman, 855 Arundel Drive, Arnold, MD 21012, (410) 974-0561, email: shans01a@ comcast.net; Membership Chair, Geoff Shearer, (703) 818-2686, email: gshearer2@verizon.net. Website www.maarc.org

• New Jersey Antique Radio Club—Meets second Friday each month, 7:30 p.m. Holds three annual swap meets. Visit the website, www.njarc.org or contact Phil Vourtsis, 13 Cornell PI., Manalapan, NJ 07726, (732) 446-2427, pvourtsis@ optonline.net.

• Northland Antique Radio Club (Minneapolis/St. Paul)—hosts four events with swap meets each year (in February, May, September and November) including an annual conference, "Radio Daze," for two days in mid-May. Annual dues are $12.00, which includes a subscription to the club's quarterly newsletter. For more info, visit our web site at www.geocities.com/northland. geo/; contact Ed Ripley at (651) 457-0085; or write NARC, P.O. Box 18362, Minneapolis, MN 55418.

• Northwest Vintage Radio Society-meets the second Saturday of each month at Abernethy Grange Hall, 15745 S. Harley Ave. Oregon City, OR. Meeting starts at 10:00 a.m. Membership $25.00 per year. Guests welcome at all meetings and functions except board meetings. Spring show, the second Sat. in May. For more information, contact Mike McCrow 503-730-4639; e-mail: tranny53@ comcast.net.

• Oklahoma Vintage Radio Collectors—Meets second Saturday of each month, (except for April, October, and December), at Hometown Buffet, 3900 NW 63rd St., Oklahoma City, OK. Visitors welcome. Dinner/Socializing, 6 p.m., meeting, 7 p.m. Swap meets on second Saturday in April and October at 8 a.m., Midwest City Community Center, 100 N. Midwest Blvd., Midwest City, OK. Membership $15/year including monthly *Broadcast News*. Info: contact Jim Collings at (405) 755-4139 or jrcradio@ cox.net. Website: www.okvrc.org.

• Ottawa Vintage Radio Club—Meets monthly (except June and July) in the Conference Room, Ottawa Citizen, 1101 Baxter Rd., Ottawa, Ontario, Canada. Contact: Lea Barker at (613) 829-1804 or check www.ovrc.org. Membership: $10 Canadian/yr.

• The Pittsburgh Antique Radio Society welcomes visitors to our Saturday flea markets, contests and clinics held at least four times yearly. A fall auction is included in September and our annual luncheon program is on the first Saturday in December. An annual Tri-State Radio Fest is held in April. Our journal, *The Pittsburgh Oscillator*, is mailed quarterly. For more information visit us at http://www.pittantiqueradios. org, email President Chris Wells at radioactive55man@comcast.net, or phone Treasurer Tom Dixon at 412-343-5326.

• Society for Preservation of Antique Radio Knowledge (SPARK)—Meets monthly at Donato's Pizzeria, 7912 Paragon Rd., Centerville, OH. Annual swap meet. Membership, $18/year. Write SPARK Inc., P.O. Box 292111, Kettering, OH 45429; e-mail sparkinc@juno.com or call John Pansing at (937) 299-9570.

• Texas Antique Radio Club—Meets alternate months in Kyle and Shertz, TX. Contact: Doug Wright, 625 Rolling Hills Dr., Canyon Lake, TX 78133. e-mail dwjw@gvtc.com; website www.gvtc.com/~edengel/TARC.htm

• Vintage Radio and Phonograph Society (VRPS) meets monthly on the third Saturday. Located in the Dallas, Fort Worth Metroplex, our current activities are annual convention, auctions, swap meets, repair training sessions and monthly programs. For details visit our website www.vrps.org, or by contacting VRPS President Jim Sargent at (817) 573-3546 or bsargent@swbell.net

EQUIPMENT AND HISTORY ON MEMBER SITES

In the April issue of *The AWA Journal*, we mentioned an idea proposed by reader Steven Johannessen. He felt that *Gateway* readers might find it interesting and stimulating to look at collections our members might have posted on line. We agreed and solicited URLs. Two members have responded so far. Allie Lingo (radiodoc@windstream.net) sent two:

RADIOS: http://www.radioatticarchives.com/contributor.htm?code=499

TEST EQUIPMENT: http://www.oldtestequipmentarchives.com/contributor.htm?code=26

Mike Adams (mike.adams@sjsu.edu) has just redesigned his Lee deForest web site.
Look it over at www.leedeforest.org