

THE A.W.A. GATEWAY

Volume 2, Number 3, September 2012



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THOMSON

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.

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

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From The Editor

YOUR LETTERS ARE INVITED...

By now we've been publishing *The AWA Gateway* for about a year and a half, and I hope I'm correct in assuming that we have at least a few regular readers! At the recent AWA Convention, several people made a point of telling me how much they enjoyed *Gateway*, but these were usually brief interchanges with no time for much more than a handshake. So if you have some opinions about this publication, pro or con, your Editor would like to hear from you. Your letters will be published, of course, and will provide valuable input for determining *Gateway's* future direction.

...AND SO ARE YOUR ARTICLES

We're also always looking for new writers. Right now, much of the content is coming from a limited circulation newsletter I published several years ago. It was slanted towards newcomers to the hobby, which makes it perfect for

our intended audience today. And I'm very pleased to be able to make it available to a whole new group of readers.

However my goal is to make *The AWA Gateway*, like *The AWA Journal*, largely reader written. Because, while I still have plenty of the older material to draw on, the future of this publication will obviously depend on the growing participation of new writers.

As it happens, much of the material being republished, as well as the contributions of the two new writers who have recently joined the *Journal* staff is in series form. And

if you have an idea for a regular column, that's fine—but it's not essential. Single stand-alone articles are just as welcome, just as long as their thrust is to stimulate newcomers to join our fascinating hobby.

A few of the possible topics are radio history, basic restoration techniques, ideas for starting a collection, and the story of how you got started in the hobby.

Please send your letters, or ideas for articles, to me at mfellis@alum.mit.edu. I'll be delighted to hear from you.

—Marc Ellis, N9EWJ

From The Deputy Director

Hi everyone. The AWA just concluded a wonderful four and a half days of its 51st Annual AWA Convention in Rochester, New York. With over 30 professionally done presentations, a book fair, a flea market, an old equipment contest, an auction, and plenty of time to make and renew friendships and "talk radios," it was a great time. For the new collector, it was a super opportunity to hear in-depth presentations, see and touch fantastic equipment, ask questions (often of world renowned experts), and just enjoy yourself. And, there was no need to be bashful about questions. Most everyone is willing to help in any way they can.

Other than the AWA Annual Convention, are there other meets or gatherings you might attend? Yes, there are. Although most meets are not as extensive as the AWA Annual Convention, many clubs, including the AWA, sponsor one or two day events which would be invaluable to a person new to the hobby. Check the web sites of the clubs listed elsewhere in this *Gateway* for a meet closer to your home.



Antique radio flea markets can be a great source of vintage publications as well as vintage hardware. Dick Ransley photo.



Convention attendees examine auction lots laid out for inspection. Richard Neidich photo.

It will be a great opportunity to learn, possibly buy that "treasure" you can't live without, or just ask for advice or discuss a technical problem.

Also, don't overlook the hamfests in your area. Typically these are one or two day events offering a flea market, technical programs, and sometimes an auction. Although not specifically oriented to antique radios, hamfests provide a wonderful opportunity to find older radios, tube ham equipment (hollow-state as I call it; it's one of my favorite collectibles), parts, and

hams (amateur radio operators) willing to help answer your questions. Many hams are also avid antique radio collectors.

Many of the technical programs from various meets are also available as videos on *YouTube*. For example, if you search for "the AWA Museum," you can watch a variety of interesting presentations on video. The URL is: http://www.youtube.com/results?search_query=the+AWA+Museum&eq=the+AWA+Museum&gs_l=youtube.3...5545.9949.0.10853.14.13.0.1.1.0.181.1314.9j4.13.0...0.0...1ac.9VZ7uW_Cp0E (wow that is some URL).

Although you can watch some of the presentations on *YouTube*, there is nothing quite as good as being there in person. Then you can ask that perplexing question you may have or just have a great conversation about radios out in the hall or the flea market.

Don't be discouraged or dismayed over all the technical facts. It just takes time and exposure and finding someone to help you. I believe that you should buy your first radio because you like how it looks, or think it's "neat" or find it fascinating. Then try to find out all you can about that radio and its manufacturer. After a while, things will begin to make sense and you will be on your way to becoming an antique radio pro. Good hunting!

Bob Hobday, N2EVG
Deputy Director



An Ozarka radio on display in the Old Equipment Contest at the 2012 Convention. Dick Ransley photo.

Classical Receiver Circuits

Part 3: The TRF Receiver

By Marc F. Ellis, N9EWJ
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At the conclusion of the last installment, we made the point that one tube operating in a regenerative circuit actually does the work of three: functioning as a highly sensitive radio frequency (RF) amplifier, a detector and an audio frequency (AF) amplifier. Indeed, the rule of thumb is that it would take two tubes connected as RF amplifiers (without regeneration) and a separate detector/amplifier tube to provide the same performance as a single tube in a regenerative hookup.

Yet, looking for radios from the battery-operated era at any large antique radio swap meet, you are apt to find that the sets without regeneration (known as Tuned Radio Frequency, or TRF sets) far outnumber the simpler, smaller and (originally) much less expensive one-tube regenerative sets. Made in huge numbers, the TRF set, with its distinctive array of three large tuning dials, dominated America's living rooms throughout most of the 1920s.

Why such a marked preference for a much more expensive and (seemingly) more complicated radio receiver? There were a couple of very good reasons. For one thing, though the TRF receiver certainly had more tubes and controls, it was much easier to tune.

The regeneration control on a "regen" set required a very critical adjustment; too little regeneration and the set would be insensitive, too much and it would howl and squeal. The howls and squeals were not only annoying, but could also be picked up on neighbors' sets, interfering with their reception. Furthermore, the adjustment had to be changed each time a new station was tuned in.

It's true that three tuning dials had to be manipulated to pick up a station on a TRF. But the dials tuned in and out smoothly, with no howling or instability, and the index settings on each of the three dials were usually quite similar for any given station. This was a much easier set for the non-technically-minded to operate—an important factor as radio began to evolve into a major medium for family entertainment.

As an extra bonus, the three tuned circuits (contrasted with the single one used in most small regenerative receivers) enhanced the selectivity of these radios, making it easier to separate the growing number of radio stations that were beginning to appear on the dials. Equally important was the fact that, after Westinghouse purchased the regeneration patent from inventor Armstrong towards the middle of the 1920s, licenses to use the circuit became difficult and expensive to obtain. Manufacturers who were not already licensed through Armstrong usually offered TRF designs.

A typical "three dial" TRF usually had five tubes: these included two stages of RF amplification, a grid-leak detector, and two stages of audio amplification. Though it was possible to obtain headphone volume directly from the



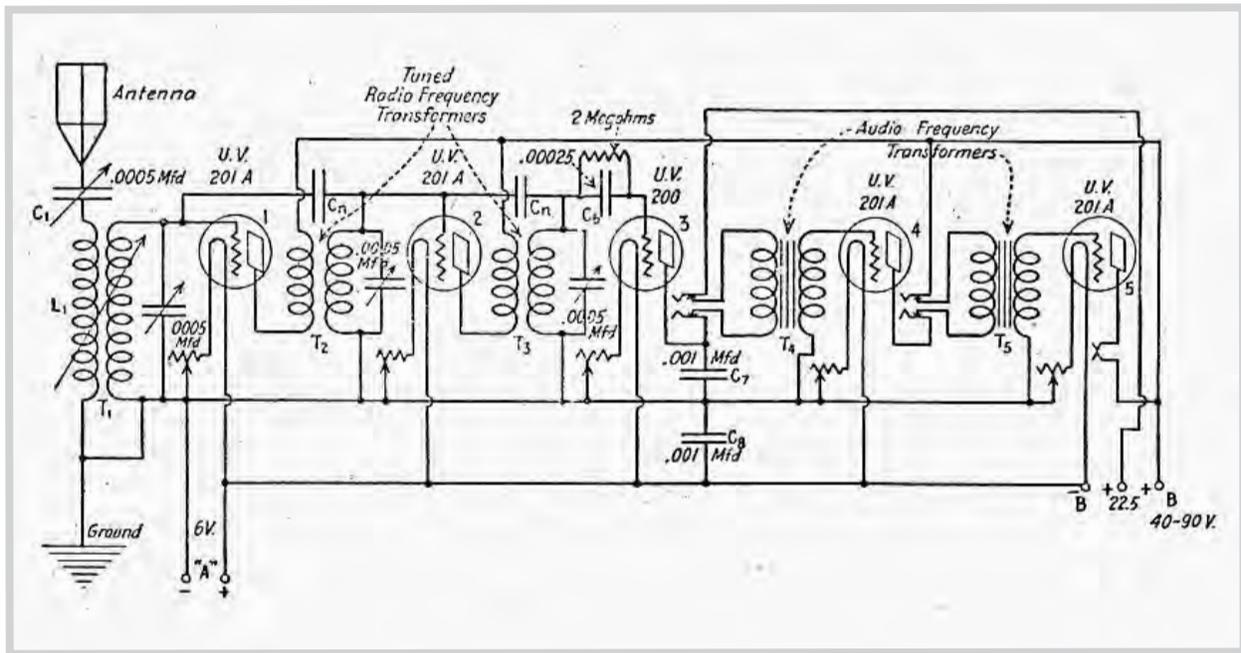
Detail from Gilfillan ad of 1925 shows style GN-1, a handsome 3-dialer with doors to conceal controls.

detector, the extra audio amplifiers allowed the set to drive the horn-type loudspeakers of the day. The thinking obviously was that, if it was necessary to use three tubes to provide adequate headphone performance, one might as well add two more to operate a loudspeaker—something a one-tube regen wasn't able to do.

The tubes used were classically the ubiquitous type 01-As. Plate voltage typically came from a couple of dry "B" batteries; filament voltage from a rechargeable automobile-style lead-acid storage battery. Sometimes, plug-in "battery eliminators" were substituted for one or both of these. The power sources were usually placed under the radio table, connected to the set above by a multi-conductor umbilical cord.

There was a problem associated with the design of TRF amplifiers, a problem that different manufacturers solved in different ways. An RF amplifier whose input and output is tuned to the same frequency (as is the case with TRFs) tends to be unstable, breaking into oscillation similar to that of a regenerative receiver—but not under operator control. This problem was aggravated by the high internal capacitance of the vacuum tubes of the day. Two of the better-known methods for dealing with the problem were (1) through the use of neutralization and (2) through the use of "losser" circuitry.

The neutralization approach was introduced by the prominent radio inventor Hazeltine, who called his circuit



Circuit of a typical 5-tube Neutrodyne "3-dialer." The neutralizing condensers, located above RF transformers T2 and T3, are labeled Cn.

the "Neutrodyne." Through coupling some of the energy from the tube's output circuit back into the grid through a small, precisely adjusted capacitor, the tube's internal capacity could be effectively canceled out—quelling the tendency to oscillate.

A typical neutralizing capacitor, such as was used in the Freed-Eisemann Neutrodyne sets, consisted of a pair of insulated wires inside a metal tube. The tube could be slid back and forth over the wires to achieve the precise capacitance required.

The "losser" principle simply involved making the RF amplifiers less sensitive by making them less efficient. By sacrificing some sensitivity, the tendency to oscillate could be eliminated without noticeably affecting the signals from broadcast stations. An inelegant solution to be sure, but it did work, making it unnecessary for the manufacturer to purchase a Hazeltine license.

There were several methods for introducing losses, and one of these was simply to avoid using the most efficient parameters in the design of the tuned circuits. Many manufacturers, Atwater Kent being among the most notable, also placed resistors in the grid circuits of the RF amplifier tubes to throttle down their gain.

In his book *Behind the Front Panel* (Wren Publishers, Philomath, Oregon, 1994, ISBN 1-885391-00-5), David Rutland tells us that in the Freshman "Masterpiece," a well-known TRF set of the 1920s, the tuning coils were mounted directly on the metal tuning capacitor frames. That not only simplified the installation of the coils, but also resulted in eddy currents being induced from the coils into the steel frames, loading down the circuitry in the

manner of a grid resistor without the expense of purchasing and installing the latter.

Also worth mentioning in any discussion of TRF receivers are the methods that were used to avoid unwanted coupling and interactions between the three tuning coils. Being large and bulky, these coils were difficult to keep physically separate. One method was to mount the coils with their axes at right angles to each other. A more elegant solution worked out by Hazeltine (as described in the Rutland book), was to mount the coils in line, but with each one tilted at 57 degrees from horizontal. This angle was mathematically calculated to keep interactions to a minimum.

Though the "three dialer" battery sets became obsolete in the late 1920s, when radios switched to a.c. power and single-knob tuning, the TRF circuit lived on. Shafts now belted together within the cabinet, the three tuning capacitors and their associated coils were still present, and the circuitry was virtually identical. A little later, the three capacitors would be ganged together on a single shaft, resulting in much more compact construction.

The TRF was able to hold its own (for a while), even against the powerful new superheterodyne circuitry, because of the late-1920's introduction of the type 24 (later 24A) screen-grid tubes. The new tetrode (4-element) tube could amplify signals at very high gain without instability or oscillation. In fact, long after the superheterodyne had become the dominant receiver design (as late as the 1940s and 1950s), TRF circuitry was still sometimes used in low-end sets.

Company Chronicles

See copyright statement at end of article.

OPERADIO

McWilliams Stone, who founded Operadio in 1922, brought a wealth of practical experience to his new enterprise. Fascinated by wireless communications since childhood, Mac was working summers as a radio operator on Great Lakes steamers by the time he was fourteen. At sixteen, lying about his age to the government Inspector, Stone received his commercial radio license. He spent several of the following summers on shipboard working as a Marconi operator.

Stone served in the Navy during World War I, doing mechanical work at the Fore River Shipyard (Quincy, MA) for most of this time. After the war he earned a BSME from the Armour Institute, then joined the Van Dorn Company — where he developed a widely used railroad-car coupler. Mac eventually became a Vice President at Van Dorn, but left after a few years to launch Operadio.

Operadio was essentially a one-concept company, best known for its line of “portable,” self-contained, receivers housed (complete with speaker and batteries) in suitcase-style cases. The radios featured a distinctive loop antenna constructed in the cleverly designed removable lid. Some models of this versatile set could be slipped into an optional drop-leaf desk-type cabinet, making them suitable for living-room listening when not in use on trips.

By 1927, Operadio’s tricky-to-operate regenerative circuit was both obsolete and subject to infringement suits by Westinghouse, which owned the Armstrong patent. Switching to the more user friendly TRF circuit was impractical because of high licensing fees being demanded by RCA. Sales slumped and the company went into receivership.

But Stone had already begun to develop a line of loudspeakers for which he must have envisioned lucrative sales opportunities among the many radio manufacturing firms headquartered, like his own, in Chicago. The company stayed in business, reorganizing as the Operadio Manufacturing Company, and soon opened an additional plant in St. Charles, IL. After a disastrous explosion and fire in the firm’s original plant, Operadio abandoned the radio set manufacturing business altogether — selling its loop antenna patent to Trav-ler, a competing manufacturer of portables.

Stone’s company survived throughout the 1930s as a manufacturer of loudspeakers and amplifiers, and expanded enormously in the mid-1940s thanks to World War II government contracts. By 1946, it was operating six plants in four different locations. After the war, the company diversified into the audio-visual equipment and

ultrasonic fields, changing its name to the Dukane Corporation in 1951. After, that the company enjoyed steady growth — reaching \$50 million in sales in 1985.

DAY-FAN

The “Day-Fan” brand was born when the Dayton Fan and Motor Company (established 1889 in Dayton Ohio) entered the radio business. Dayton Fan had been primarily a maker of electrical and water-powered fans for use in hotels, bars, restaurants and stores. But in 1921, company President M.D. Larkin hired Capt. Orin E. Marvel (no kidding!), who was in charge of aircraft radio research for the McCook Field Radio Laboratory, to design a line of radio components for manufacture by D.F.M. Larkin had been quite successful in handling radio products through another company which he operated (M.D. Larkin Co.), a distributor of mill and electrical supplies.

The original Day-Fan radio line consisted of components (similar to their Atwater Kent counterparts) to be mounted on breadboards. At first, finished radios were not offered, through the company did provide plans for assembling the components into complete receivers. The company’s first manufactured sets (the 4-tube OEM-7 and 3-tube OEM-11) appeared in September, 1924. They were modestly-priced 3-dial battery radios employing reflex circuitry.

At this time, Dayton Fan acquired a new president: none other than the legendary “Boss” Kettering of General Motors. Charles F. Kettering was the founder of Dayton Engineering Laboratories and the inventor of automotive self-starting and lighting systems. When he took the helm at D.F.M., Kettering was Vice President of GM and General Manager of its research organization. He changed the firm’s name to the Day-Fan Electric Co., invested additional capital (becoming a major stockholder), and moved the company to a 400,000 square foot plant elsewhere in the city.

Day-Fan’s 1925-1926 advertising showed several 4- and 5-tube radios in a variety of table and console styles, some with built-in speakers and/or single knob control. Also included was a free-standing accessory speaker and the “Dayphone,” a 5-tube panel set designed for mounting in the radio/phono combination cabinets being offered by some of the “talking machine” manufacturers. This is an amazing product line expansion undoubtedly resulting from the drive and engineering acumen of the new “boss.”

Day-Fan was an early entrant in the “light-socket radio” arena, showing plug-in sets in its 1927 advertising. The 1928 and 1929 models were mature examples of the radio engineering art that looked similar to other sets of their era. But by then the company was losing a few hundred thousand dollars per year.

General Motors purchased Day-Fan in October, 1929, creating the General Motors Radio Corp. In a secret “silent partner” arrangement, RCA, GE and Westinghouse became owners of 49% of the stock. GM was not so much interested in operating Day Fan as a going concern as it

was in acquiring the firm’s RCA license without seeming to be in overt collusion with RCA. However the arrangement became the target of a Federal anti-trust suit in 1930, and GM and RCA liquidated the General Motors Radio Corporation the following year.

These company biographies, used with permission, were abridged from Alan Douglas’s three-volume encyclopedia Radio Manufacturers of the 1920s, published by Sonoran Publishing, 6505 West Frye Rd., Suite 15, Chandler, Arizona 85226, sonoranpublishing.com, and copyrighted 1988, 1989 and 1991 by Alan Douglas.

ABOUT THE ANTIQUE WIRELESS ASSOCIATION

The Antique Wireless Association is an organization of about 2000 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 publications 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.

Play It Again

A No-Nonsense Guide to Vintage Radio Restoration

By Ken Owens
1932-2009
© 1995
The Radio Collector

PART 7—POWER FOR AC SETS

The introduction of AC-powered radios in 1927 immediately made receivers more complex and difficult to service. The power supply is the most troublesome part of an antique radio. The first AC sets were merely adaptations of existing battery sets. RCA modified their Radiola 16, added a power supply on a separate chassis, and made the cabinet longer to house it, creating the Radiola 17. The 1928 Radiola 18 was virtually identical.

Atwater Kent modified his Model 33 chassis, added an outboard power supply which sat beside the radio and made it the Model 36. Within 2 months, he brought out the Model 37 with the power supply inside the cabinet, but still in a separate box from the radio chassis. His 1928 Model 40 was almost identical to the Model 37.

The new AC tubes were: Type 26 - RF and first AF amplifiers; Type 27 - detector; Type 71A - power output; and Type 80 - rectifier. Millions of radios using this tube lineup were built in 1927-28. Radiola 17s and 18s as well as AK 40s are frequently seen at flea markets.

REQUIRED FILAMENT VOLTAGES

A typical "generic" power supply of 1927-28 is shown in Fig. 1. There were many minor variations, but most followed this design. The tube lineup for 1927 required four different filament windings on power transformer "PT": the 80 rectifier needed a separate 5V winding because that winding also carries the B+; the 27 detector took 2.5V; the 26 RF and AF amplifiers took 1.5V; the 71A output tube took 5V. The high-voltage winding was typically 500V center tapped.

RECTIFICATION AND FILTERING

A full-wave rectifier was universally used. The voltages at each end of a transformer winding are 180 degrees out of phase. When the top of the winding is positive, electrons flow from the 80 filament to the top plate and out through the center tap. Meanwhile the bottom of the winding is negative, so no current flows to that plate. On the next half cycle, the polarities reverse. The top of the winding swings negative and that plate stops conducting while the bottom goes positive and electrons flow to the bottom plate and out the center tap. The full AC wave is utilized, hence the name.

The output of a full-wave rectifier is DC pulsating at twice the AC line frequency (120 Hz). The purpose of the chokes, "CH," and the capacitors, "CF," is to filter or smooth out these pulsations leaving pure DC. Although electrolytic capacitors were available in 1927, nearly all manufacturers preferred paper capacitors. Because of their bulk, the values used rarely exceeded 4 uF. Therefore large amounts of inductance were needed for adequate filtering. Typical chokes were 30H with DC resistances of 500Ω.

BYPASSING AND BIAS

The very low internal impedance of fresh batteries allows stray voltages to bypass to ground. An AC power supply has a much higher internal impedance. Stray voltages are not bypassed and may couple from one stage to another, causing instability.

The bypass capacitors, "CB," prevent this. The resistor string ("R1-4") forms a "bleeder" resistor whose individual elements decouple sections of the receiver and also drop the voltage to values suitable for each section. The bleeder resistor is a constant load on the power supply which improves regulation and keeps the voltage from soaring too high as the set is warming up.

Grid bias for all tubes but the detector is the self or cathode type developed through resistors "RB." All of the type 26 tubes are biased with a common resistor; the 71A has its own bias resistor. The 27 operated as a grid leak detector without bias (cathode grounded).

HUM BALANCING

Each filament winding has a center-tapped resistor of 40-50Ω across it. The filament returns to ground through

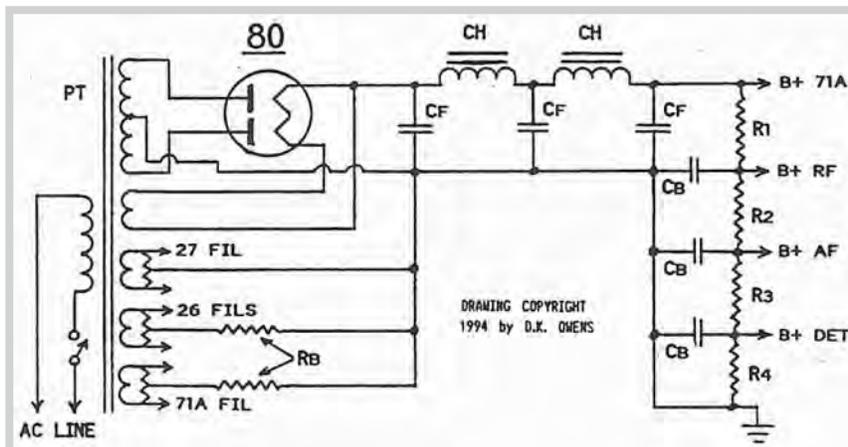


Fig. 1. Generic AC power supply of 1927-1928. Courtesy Pat Owens

the center tap. In battery sets, the return went to one side of the filament. If we did this with AC heated tubes, half the AC filament voltage would appear in series with the tube and ground causing severe hum. The center-tapped resistor balances out the hum. Although the 27 has its cathode grounded, hum can be further reduced by grounding the filament through a center tapped resistor. Some sets use potentiometers instead of fixed resistors for hum control because the best position of the tap for minimum hum is not always in the center.

POWER SUPPLY TEST RIG

You can't service an AC radio until the power supply is working. So we must check that out first. Build a test rig consisting of a 100-watt lamp wired in series with an AC plug and an AC socket. Plug in the test rig and insert the set's plug into its socket. The lamp in series with the set and power line keeps the current at a safe level even if there are shorts in the set. The glow of the lamp indicates the current being drawn.

Next time we will service a power supply

Enjoying Antique Radio

The AM Band

By Andy Ooms
oomspine@msn.com

An article about AM radio in a vintage electronics publication almost writes itself. Why? Because, beginning in the 1920s, AM is the band that carried the programming that resulted in Americans, Canadians, and citizens of most other countries buying and listening to the millions of consumer radios produced. The survivors of that production are now the vintage sets that we enjoy learning about and collecting. Except for a few of FM only sets, every collectible consumer radio has an AM band.

I'm writing about the AM broadcast band now because we began this series, which will eventually cover the entire radio frequency spectrum, with the lowest frequencies. The last article was about long wave, covering up to about 510 kilohertz. The AM broadcast band today covers from 540 to 1710 kilohertz. AM stands for Amplitude Modulation, the transmission mode used for that band.

Another description of the same spectrum portion is MW, medium wave. MW describes the band itself, regardless of the transmission mode. It is technically not an accurate description of the band's position in the spectrum, since it is still very much on the low end of the spectrum. However it does fall above the long wave and below the short wave bands so medium wave it is. Vintage radio dials and descriptions of sets may use "AM," "MW," or "BC" to indicate this band.

WHAT CAME FIRST?

What came first, radios or programs? The answer is radios, which were utilized for various marine, military, experimental, amateur, and other uses for at least two decades before broadcasting to the public began. When it did begin, the programming became interesting to most, and available to all.



For the first 15 years or so of radio broadcasting, families listened together in the living room. Later, the development of inexpensive and compact table models brought radio listening to any room in the house. Zenith Photo.

So naturally consumer radio production took off at that time (the early 1920s). By 1930, hundreds of companies were producing radios. Marketers included utility companies, department stores, automotive companies, jewelry companies (Bulova was a later example in the late 1940s) and of course electronics companies.

As their popularity increased, radio receivers became increasingly more user friendly. They went from needing earphones and a steady hand to guide a "cat's whisker" to a sensitive spot on a crystal to driving large speakers with operation so simplified that it could be managed virtually any adult or child. When sets that could be plugged into the wall replaced those requiring expensive and heavy batteries,

the ease and economy of operation increased many times.

As improvements in circuitry made radios more portable, the sets were no longer confined to living or sitting rooms, but could be enjoyed in kitchens, bedrooms, and any other rooms of the home. This dramatic evolution in power options and circuitry took less than one decade.

Early radio programming? That is a wonderfully interesting subject for many radio hobbyists, not identical to antique radio collecting itself, but definitely related. Receivers and content were symbiotic, one not surviving without the other. Many collectors have fond memories of the programs they listened to during the Golden Age of radio, mentally interlinked with the sets they listened to, or stared at, while the programs were on. Therefore, I am delighted with the addition to Gateway of Harold Cheetham's column, "Old Time Radio Programs."

There are entirely too many subjects related to AM radio to cover in one column or even one book. Among others, these include signal propagation, the FRC (Federal Radio Commission), the FCC (Federal Communications Commission), station specs, the enchantment of early long distance listening, call letters, and band history. Programming alone has subsets including OTR (old time radio), current broadcasting trends, the future of AM, networks, local programming, and non-commercial broadcasting. So I plan to start out with a little band history, and move on from there as the writing spirit moves me, probably coming back to AM after future forays into the short wave bands and beyond in the spectrum.

SOME AM BAND HISTORY

The FCC (which replaced the Federal Radio Commission in 1934) has generally controlled what is perceived as the AM band in the United States. Canada has an agency similar to the FCC, which operates with many of the same parameters. However the Canadian agency is much more involved with program content than is the FCC.

The U.S. AM band has not always ranged from 500 to 1700 kilohertz. The first regulations covering AM were adopted by the Commerce Department in 1921. Naively, the regs authorized only an entertainment frequency at 833 kilohertz and a news frequency at 619 kilohertz. Obviously restricting broadcasting to only two frequencies with limited allowable content very quickly became totally impractical, especially when cities began to have more than one station.

In 1922, the number of U.S. AM stations increased from under 100 to more than 500. Authorized frequencies ranged from 530 kilohertz to about 1400 kilohertz. The band expanded to 1600 kilohertz during the 1930s and to 1700 kilohertz in the 1990s. The 1600 to 1700 kilohertz spread was designated the "expanded" or "X" band.

Some sets of the 30s and 40s had a dial marking in the area of 1600 to 1800 kilohertz labeled "police band," "po-

lice calls," or simply "police." Police departments were then using that spectrum portion for communications, and listeners in areas with police activity could listen in. Although that is the kind of listening that I sought as a youth, I wasn't aware of many adults going to that part of the dial when there were so many other sounds to listen to on the rest of the band.

A FEW WORDS ABOUT BASEBALL AND RADIO

Baseball broadcasts sound very much today like the live broadcasts your vintage set picked up when originally purchased. However, as late as the 1940s, many games were not reported with live audio but via a telegrapher at the game connected by wire with an announcer in the studio. The audience heard the clicks followed by "translations" from the announcer.

In the 1930s, radio executives were not at all sure that baseball on radio would last. They thought that it was a passing fad, and would not have the staying power of, say, daytime soap operas. Well, baseball is still one of the stalwarts of AM broadcasting while the last soap was heard in 1960.

The size of baseball team networks today is not necessarily related to the size of the city where the team resides. New York, Chicago, and Los Angeles teams are not carried on the most stations. Boston is on many stations throughout New England, but the largest systems are likely Cincinnati, Saint Louis, and Atlanta. They cover huge regions where for many years they were the major pro sports team, and where they have had loyal fans who have been listening to the games for generations.

As this is written, the Atlanta Braves are carried on 84 AM and 56 FM stations. The Reds and Cardinals may be on as many or more. So get your old radio working, catch a game, and imagine yourself back in 1948 or thereabouts, at least until you hear mention of a "designated hitter."

JUST A LITTLE BACKGROUND

You may have noticed by now that my writing about radio is based on my memories of what I have seen, listened to, or read over a long period of time. It's mostly anecdotal, and therefore not intended to be as historically or scientifically precise as more scholarly material that might be produced by others.

I do not believe that any human knows all that there is to know about radio, no matter how much experience, research, experimentation or education that person possesses. So feel free to jump into the wonderful world of radio, antique or current, in any area that you feel interested in; do not let any perceived lack of knowledge hold you back.

You don't need to know it all before you can start enjoying the aspects that interest you. Let me know what areas of the radio hobby you find most interesting. Perhaps I will have something to write about them in the future.

Old Time Radio Programs

The Aldrich Family

As I noted in my last column, many radio shows originated from stage productions and others from comic strips of the day. One stage production that gave rise to a radio series was Clifford Goldsmith's Broadway play *What a Life*. It was reworked into NBC's popular, long-running, *The Aldrich Family* (1939–1953). The programs are remembered for their unforgettable introduction: Henry's mother calling, "Hen-reeeeeeeeeeeee! Hen-ree Al-drich!" and his response of "Com-ing, Mother!"

The popular radio teenage situation comedy was also adapted for film, television and comic books. It was built around the life of the middle class Aldrich family of Elm Street in the town of Centerville.

In particular, the show focused on the adventures of the Aldrich's high schooler son Henry.

Henry Aldrich began as a minor character in Goldsmith's play, which was produced and directed by George Abbott and ran for 538 performances (from April 13, 1938 to July 8, 1939). The Broadway cast included Eddie Bracken, Betty Field and Butterfly McQueen. The actor who brought Henry to life on stage was 20-year-old Ezra Stone, who was billed near the bottom as the 20th actor in the cast. Stone was also employed as the play's production assistant.

Time magazine found the play "short on plot" but noted: "Chief amusement centres in Henry Aldrich (Ezra Stone), a cross between Penrod and Willie Baxter, who attends classes mainly in the principal's office. With a talent for head-on collisions, always ingenious, never crafty, always there with an answer, never with the right one, brash, bouncing, rumped, rattled, rueful by turns, Henry grows into that rare thing on the stage—a person..."

After finding an audience with Kate Smith's listeners, *The Aldrich Family* was launched in its own series as a summer replacement program for Jack Benny in NBC's Sunday night lineup, July 2, 1939, and it stayed there until October 1, 1939, when it moved to Tuesday nights at 8 p.m., sponsored by General Foods's popular gelatin dessert *Jell-O*, which also sponsored Jack Benny at the time.

The Aldriches ran in that slot from October 10, 1939

until May 28, 1940, moving to Thursdays from July 4, 1940 until July 20, 1944. After a brief hiatus, the show moved to CBS, running on Fridays from September 1, 1944 until August 30, 1946 with sponsors *Grape Nuts* and *Jell-O* before moving back to NBC from September 5, 1946 to June 28, 1951 on Thursdays and then as a Sustaining program in its final run of September 21, 1952 to April 19, 1953 on Sundays.

The show was top-ten ratings hit within two years of its birth (in 1941, it carried a 33.4 Crossley rating, landing it solidly alongside Jack Benny and Bob Hope). Earning \$3000 a week, Goldsmith was the highest paid writer in radio, and his show became a prototype for the teen-oriented situation comedies that followed on radio and television.

Stone kept the lead role until 1942, when he entered the Army for World War II. Norman Tokar succeeded Stone as Henry for two seasons. Best known for his later work directing the television hit *Leave It to Beaver*, his approach of telling stories from the vantage point of a child may have been inspired by his work in the Aldrich episodes. Tokar also helped write many of the episodes.

Tokar was followed on *The Aldrich Family* by Dickie Jones (1943-44) and Raymond Ives (1944-45), before Stone re-

turned to his signature role. Bobby Ellis became the last Henry Aldrich in 1952.

Henry's parents, Sam and Alice, were portrayed by House Jameson and Katharine Raht, and his usual girlfriend, Kathleen Anderson, by Mary Shipp. The role of Henry's best friend, Homer Brown, was played by Jackie Kelk (as well as Jack Grimes, Michael O'Day and John Fiedler). Homer's parents were Arthur Vinton and Agnes Moorehead, among others. Eddie Bracken appeared in the earlier shows as friend Dizzy Stevens. The show's announcers included Harry Von Zell, Dan Seymour and Dwight Weist.

Henry Aldrich was a kid growing awkwardly into adolescence, and *The Aldrich Family* often revolved around Henry's misadventures with the girls and with his friends.

Henry Aldrich movies were made by Paramount Pictures



Jackie Kelk (left) as Homer Brown and Ezra Stone as Henry Aldrich on the air, 1947.

between 1939–1944:

What a Life (1939)
Henry Aldrich—Boy Scout (1944)
Life with Henry (1941)
Henry Aldrich for President (1941)
Henry Aldrich, Editor (1942)
Henry and Dizzy (1942)
Henry Aldrich Swings It (1943)
Henry Aldrich Gets Glamour (1943)
Henry Aldrich Haunts a House (1943)
Henry Aldrich, Boy Scout (1944)
Henry Aldrich Plays Cupid (1944)
Henry Aldrich's Little Secret (1944)

The first two films, *What a Life* (1939) and *Life with Henry* (1941), featured Jackie Cooper in the title role. In the remaining nine films, Jimmy Lydon portrayed Henry Aldrich.

On October 2, 1949, the program premiered on NBC-TV while continuing to air on the radio with a primarily different cast.

Over the course of its nearly four-year run on television, Henry was portrayed by five different actors: Robert Casey, Richard Tyler, Henry Girard, Kenneth Nelson and Bobby Ellis, the only one to participate in the radio production as well.

Other characters—including Mrs. Aldrich, Henry's sister Mary, and his best friend Homer Brown—were portrayed by multiple actors as well, a practice not uncommon in radio but unusual for television, where cast changes are more noticeable.

The program garnered some adverse publicity when film and radio veteran Jean Muir was signed to play Mrs. Aldrich in the second TV season, which was to begin on August 27, 1950. Shortly before Muir's scheduled premiere, right-wing groups accused the actress of being a Communist sympathizer (her name appeared in *Red Channels*, a pamphlet listing the names of performers allegedly involved in left-wing activities).

General Foods, the show's sponsor, cancelled the first episode of the new season, replacing Muir with Nancy Carroll a week later, when the series returned on September 3rd. Muir went on to defend herself before a Congressional committee, but her career never recovered from the charges. After General Foods ended their sponsorship in the spring of 1951, Campbell Soup Company became the new sponsor. The series moved from Sundays to Friday nights that fall. The final episode was broadcast on May 29, 1953, slightly more than a month after the radio series came to an end.

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 website for schedules, details and maps. Contacts: President, Olin Schuler oschuler@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, "Antique Radio Charlotte," on the 4th weekend in March. Executive committee meets approximately quarterly. For more info, visit the website

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, P.O. Box 31276, Houston TX 77231-1276 or call Bill Werzner, 713-721-2242; email: werz1943@gmail.com

- 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—Active since 1971. Meets quarterly in Feb., May, July and Sept/Oct. Flea market, old equipment contest and auction at all events. The IHRS Bulletin published quarterly since 1971. Meet details and club information at website www.indianahistoricalradio.org. Contact Herman Gross, W9ITT, 1705 Gordon Dr., Kokomo, IN 46902, 765-459-8308, email w9itt@comcast.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 lvrcreditor@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 Pl., 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.northlandantiqueradioclub.com.

- 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, con-

tact 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 dwwjw@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.

RADIO DAZE DISCOUNT FOR AWA MEMBERS

Radio Daze, a premier source of parts and supplies for radio restoration, now offers a special discount for AWA members. The discount is a generous 8% off of catalogue prices, and shipping on domestic orders is free (by ground service of Radio Daze’s Choice) for orders of at least \$50.00. Orders under \$50.00 will still receive the discount, but a flat rate of \$5.00 will be charged for shipping.

International orders also qualify for the discount, and shipping will be at a flat rate of \$15.00. For orders that would ordinarily ship for less than \$15.00, there will be a flat charge of \$5.00. Expedited shipping, if requested, will be charged at normal rates.

Radio Daze will check the membership status of of each AWA customer for the first order placed in each calendar year, keeping the status on file for the balance of the year.

To shop on line or request a catalogue, go to www.radiodaze.com



Members' Corner

News of Particular Interest to the AWA Membership

MEMBER SERVICES COMMITTEE REPORT

By Richard Neidich, Chairman
RGNeidich@aol.com

For those who could not attend the Membership Forum at the 2012 AWA Convention, the major topic presented was a review of plans for moving to our new museum facility this coming winter. An overview of this facility can be seen at <http://www.antiquewirelessmuseum.com/>. Grand opening has now been scheduled for August 20, 2013, the 2013 AWA Convention opening day. We can always use help, so contact the Museum Curator, Bruce Roloson, at broloson@stny.rr.com if you are able to volunteer and assist with the monumental effort to follow.

To keep informed about progress and preview events make sure your e-mail address has been provided to Ed Gable at awaprofileinput@gmail.com. AWA e-mailings will become a source of information to keep up with developments between releases of the *AWA Journal* and *AWA Gateway* publications. Make sure yours has been provided to us so we can be using an up-to-date e-mail address.

Current committee activities include drafting for the annual budget process and other preparations for the Annual and Fall Board of Trustees meetings. Over the next year, the Committee will be soliciting inputs regarding a major set of revisions to our web site regarding the new museum facility. If you have specific ideas as to what you would like to see, please make your ideas known to rgneidich@aol.com.

Naturally, the *AWA Gateway* will feature the new facilities shown during next year's opening activities.

MUSEUM NEWS

By Lynn Bisha, W2BSN Associate Curator, AWA Museum,
and Bruce Roloson, W2BDR, Curator, AWA Museum

COLLECTIONS

Ron Walker and his team have been cataloging the telegraph collection we just received. All items have been photographed, bar coded, labeled, description added and entered into the main Collection data base. We will be showing some of the photographs in the next *Journal*.

We have received the donations of a very significant Leutz receiver as well as a collection of early TV equipment and ephemera relating to the Sanabria-deForest TV Company. Additional photos will be shown in the upcoming *AWA Journal*.

MUSEUM IMPROVEMENTS

Work resumed on the new museum the week of September 10th. New doors, ramps, insulation, walls, rest rooms and flooring will be going in. We should have some progress photos in the upcoming *Journal*.

AWA CONVENTION

This year's AWA Convention included one of the best program arrays to date. The outstanding presentations included Collins Radio Collecting, Titanic 100th Anniversary, Key and Telegraph Seminar, Telegraph Pioneers, and photos and digital recreations from the actual Titanic wireless room. The Old Equipment Contest showcased many unique items, included was one of the three known examples of a complete Collins Desk Station.

The awards given at the banquet included:

Tyne Award (For Preservation of Vacuum Tube History) to Ron Lawrence; Taylor Award (for Preservation of TV History) to Luc Sirois for his Early 1950s TV collection; Bruce Kelley *Journal* Award to Richard Brewster for his article "Hollis Semple Baird—Bringing Electronic TV to Boston;" J.A. Moore Award to Eric Wenaas for the *Journal* article "The Oscillation Tube Tester: An Unexpected Discovery;" Houck Preservation Award to Eric Wenaas for preserving the history of the Radiola by his outstanding collection.

The Dr. Max Bodmer Award went to Dr. Thomas Perera for dedication to the compilation and preservation of resources supporting scholarship in the field of electronic communications history. A Special Award was given to Lauren Peckham for being the longest serving Board



An imaging tube from the television donation.



The Leutz receiver.



Jack Roubie with his Deputy Director's Award. Deputy Director Bob Hobday and Curator Bruce Roloson are at center and right, respectively.

Member. Lauren recently retired from the Board of Trustees after many years of service. The Director's Award for Significant Contributions to AWA was given to Ron Roach for his never ending work on the property, buildings, and new Museum construction.

Awards were also given to other people who make the museum what it is and what it will become. The Deputy Director Award went to Jack Roubie for his ceaseless behind the scenes efforts in the many odd jobs. The Curator Award went to Ron Walker for an outstanding performance in organizing the move of a significant telegraph donation. The Museum Award went to Warren Wiedermann for his major, quietly done, contribution to the computer networking system and the management of our databases.

READER INTERNET 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 readers might have posted on line. We agreed and solicited URLs. We received and included three of them last time. Here they are again along with some additions received since then. Four readers have responded so far. Additions to the list are always welcome!

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 recently redesigned his Lee de Forest website. Look it over at www.leedeforest.org.

Ron Lawrence sent several URLs featuring his collections and interests:
Radio Heaven Page
<http://radioheaven.homestead.com/menu.htm>

Clough-Brengle test equipment page
<http://cloughbrengle.homestead.com/>
Civilian Conservation Corp. page
<http://radioheaven.homestead.com/CCCradio.html>
Ron's YouTube channel—with video tours of his collections
<http://www.youtube.com/user/w4ron>

The Tube Collector's Association Tube Photo Gallery
<http://radioheaven.homestead.com/TCA.html>

Don Ignatius Collection
www.radionutzantiqueradios.com