

The Jersey Broadcaster

NEWSLETTER OF THE NEW JERSEY ANTIQUE RADIO CLUB

May 2020

Volume 26 Issue 05



MEETING/ ACTIVITY NOTES

Reported by
Marv Beeferman

The ON-LINE Broadcaster

The *Jersey Broadcaster* is now on-line. Over 180 of your fellow NJARC members have already subscribed, saving the club a significant amount of money and your editor extra work. Interested? Send your e-mail address to mbeeferman@verizon.net. Be sure to include your full name.

I hope this May issue finds all our members in good spirits and health after what has been another trying month. Thanks to member Al Klase for sending out the following comment which probably sums up how many of us are feeling right now:



**30 days of containment - I'M FINE
THANK YOU!**

A well-deserved thank you goes out to member Dave Sica and all those who supported him in bringing us a flawless April meeting via Zoom. There were some 60 NJARC members attending. I for one was pleasantly surprised since I do not have cable and the entire meeting came through without a hitch on my iPad and DSL connection. Dr. Littman's presentation on Joseph Henry's experimental demonstration of electromagnetic waves was a joy to experience. Dr. Littman's



MEETING NOTICE

The next NJARC meeting will take place on Friday, May 15th, at 7:30 PM. The meeting will be conducted "on-line" via the video conferencing app Zoom. Information may be found at the club's website (<http://www.njarc.org>) with a link being provided by the NJARC Communicator prior to the meeting. We are asking you to get a little creative by setting up your "Zoom studio" in order to show off some interesting pieces in your collection during our "Radio Show & Tell" segment. A short story describing the significance and/or history of your selection(s) would be appreciated. Nothing new to talk about? How about participating in a discussion or perhaps a demonstration of those "hints and kinks" that have simplified your repair and restoration experiences?

**Marsha Simkin
33 Lakeland Drive
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ability to emphasize many of his points with physical examples and demonstrations and answer questions emphasized the fact that on-line learning can be just as viable as being in a classroom. The lecture inspired me to re-visit my two-volume, 1910 edition of "The Life of Lord Kelvin" by Silvanus P. Thompson to get a better idea of the attitudes of the time. You can experience a "rerun" of the meeting at:

<https://youtu.be/aR8W2vnutMo>

Payment via PayPal is also available at the club's website but it will cost us a fee. Also note that checks sent to pay dues in the last month or so may not be deposited for some time. Send any questions to mhsimkin@comcast.net.

As stated last month, there has been a good response to our efforts to reduce the number of hardcopy Broadcasters sent out each month. As of this date, we are down to 30 from a high of 47. However, 21 members have still not provided their response to two consecutive requests to consider a change to email delivery. As a result, these members who have an active address will be contacted by email. If there is no response after a reasonable amount of time, they will be automatically switched to email delivery. Note that email delivery is not mandatory (some members do not have a computer) but appreciated to reduce club costs.

As a result of the New Jersey lockdown, InfoAge has closed its facility at least through June 29th. The immediate effect has been a complete loss of income, with the requirement of continuing to pay bills such as electric, gas, insurance, etc. Therefore, InfoAge is requesting that those of you who have the means to please consider joining or making a donation to help offset these costs. This is especially important since the campus has had to deal with several acts of vandalism and break-ins over past weeks and the cost to beef up security with extra lighting and cameras will be another burden. Any amount will be gratefully received. You



**President Richard Lee "virtually"
collects 50/50 chances at the April
meeting.**

Membership secretary Marsha Simkin reports that there are still an unacceptable number of members who have not paid their dues for 2020. Normally, we would drop these members from our club rolls at the end of March, but, considering the circumstances, we will be extending the cutoff date for the time being. We would appreciate that you mail a check, made out to the "NJARC," to:

THE JERSEY BROADCASTER is the newsletter of the New Jersey Antique Radio Club (NJARC) which is dedicated to preserving the history and enhancing the knowledge of radio and related disciplines. Dues are \$25 per year and meetings are held the second Friday of each month at InfoAge or Princeton University. The Editor or NJARC is not liable for any other use of the contents of this publication other than information.

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can easily join or donate by going to the site www.infoage.org and clicking on "Contribute/Join." To help with this effort, your board has voted to contribute \$1,000 in consideration of all the benefits InfoAge has brought to the club including providing an historic site for the home of our Radio Technology Museum.

As you are probably aware, the Tube Collectors Association (TCA) was officially terminated on December 31, 2019. The association was fortunate to terminate with a healthy ending balance which its Board elected to donate to three "not-for-profit" historical radio organizations. As a result, the NJARC has received a check for \$4,831.37, a donation that "we hope will be helpful in increasing your organization's ability to preserve the history of radio." Thank you TCA!

The Mid-Atlantic Antique Radio Club (MAARC) has notified president Lee that it has published and selling a book describing the adventures of Alan Roycroft, a radio serviceman in the 1930s. Some of these stories were published years ago in *Radio Age* before MAARC took it over from Don Paterson. The club is doing this as an educational service to the radio community rather than a money-making exercise so pricing is quite fair. The book makes fascinating reading. If you are interested in participating in a club purchase, please contact Richard at radiatorich@prodigy.net or sign up at the May meeting.

Gary Schneider, who passed away on March 12th, was well known to many NJARC members and he will be sadly missed. He was the original publisher of *Antique Radio Classified* (ARC) prior to its sale to John Terry, and was the owner of Play Things of the Past. It has been recently posted that the "Play Things" inventory has been purchased with the intent of operating the business once the logistics part of the operation has been completed. If you are not familiar with this comprehensive source of NOS radio parts, you can get an idea of the offerings at the site <http://www.olderadioparts.com>. I'm sure the word will be put out through all the usual sources when the operation is up and running.

Technical Coordinator Al Klase reports that on February 29th, 20 members of the Black Glass Gallery stopped by InfoAge for a visit and became members. You can find their photographic interpretation of Camp Evans and the club's museum at <http://blackglassgallery.com/>. Scroll down to "Gallery," click on "Camp Evans" and click on the first photo to browse the whole collection.

Member Mike Shaw suggests checking out <http://radio.garden>. It shows a map of the world with green dots; you zoom in to an area and move your mouse over one of the dots and listen to the selected am/fm station live. "It's a great way to practice a language skill, hear the jazz influence over the world or hear local news."

It has been recently announced that the 2020 Antique Wireless Association's (AWA) Annual Conference will be transitioned from an in-person event to an online series of video Conference Presentations. These will be posted on the AWA YouTube channel. For more information, go to:

<http://antiquewireless.org/homepage/news/>

Finally, thanks go out to all those NJARC members who have kept our tube filaments "aglow" with suggestions and the hosting of video conferencing sessions that keep us entertained and informed. When they look back on these times in the future, our next generation of members might want to know about some of the things that maintained our sanity:

- Technical Coordinator continues to do a great job in hosting Zoom sessions that cover a host of topics from classic cars to fire trucks.
- Old shows that feature radio-related topics seem to be popular. Bill Hemphill suggested a Dagwood and Blondie episode where Dagwood decides to become a radio repairman that can be found at:

<https://youtu.be/kICXIONAUk0>.

One of my favorites is when Herman Munster becomes a ham and thinks he has contacted Mars. I don't have the link but just Google Munsters, Season 1 Episode 18, "If a Martian Answers, Hang Up."

- Bill also suggests the Internet Archive <https://archive.org/>. He says it is a great resource for books, printed material, audios (old time radio programs) and historic radio videos (i.e., "Hear and Now"). Bill also says that if you have Amazon Prime, you can watch the following two films for free: WWII Amateur Radio Films and Radio Broadcast Films.

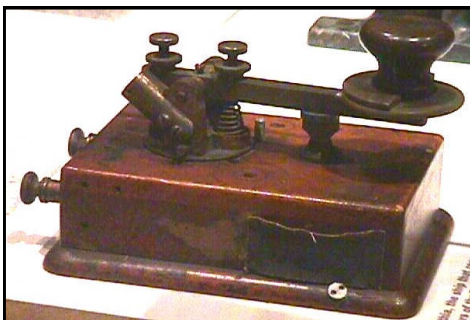
- Dave Sica suggests a promotional film from 1947 that was made by GE to explain FM Radio to the public:

<https://youtu.be/JN87floMeJ4>

- If your interested in 45 RPM record players, here's an RCA promotional film that you might want to watch :

<https://m.youtube.com/watch?v=cBgC7A2C4ZY>

• The RTM has a copy of what is purported to be David Sarnoff's telegraph key that he used when working for the American Marconi Co. during the Titanic disaster. (The original key is in the Sarnoff Collection at The College of New Jersey.) "Well and good" says member Al Klase "but when you examine the thing, you find it's very different from standard keys. He had it since he was about 17 years-old. Where did it come from?" This question started a chain of responses from NJARC members that is still ongoing and hopefully will result in a written resolution from Al. To date, Al doesn't feel that the key is unique. "I'm discounting that the Sarnoff key was a one-off or homebrew. It's primary difference is that the mechanism rotates. I speculate that this was a safety feature to ensure that power was not applied when someone was working on the high-voltage side of the AC transformer. I also suspect that the metal base of the mechanism started out as an investment casting, not the sort of thing you'd do for short production."



As they used to say on a well-known TV program, "keep those cards and letters coming folks!" The Communicator postings offered by our members during these last few months have played an important part in maintaining a connection that supports the strength and vitality of the club during a time when personal contact has become a rare occurrence.

Upcoming Events (Tentative)

May 23 - Spring Repair Clinic
 June 3 - E Board meeting
 June 12 - Monthly meeting: Joe Jesson presents "What You Didn't Know About the AR-88"
 June 27-28 - ARRL Field Day on InfoAge grounds
 July 25 - Summer Tailgate/Hamfest on InfoAge Grounds

DO YOU REALLY KNOW WHAT TIME IT IS?

By
Ray Chase

In the March "Broadcaster," we included an article titled "A Timely Donation" which talked about member Red Reiff's donation of a self-winding Western Union clock. As promised, what follows is a more comprehensive article which also appeared in InfoAge's "Marconigraph" for April/June.



The title of this article might seem to be a bit silly - we all have ultra-accurate time keeping devices available on our wrists or in our back pockets. So, what prompts the question? Well, knowing accurate time was not always the case. Our Radio Technology Museum (RTM) at InfoAge took a look at that from a technology standpoint when we were recently offered the donation of a Western Union wall clock. We were initially skeptical; why do we need a wall clock? The donor was a New Jersey Antique Radio Club member, so we felt obligated to at least take a look at it. We were pleasantly surprised, especially when we delved into a little horological history.

Over a hundred years ago, exact time keeping was not much of a problem, but with expanding transportation systems and national business interactions, differences in perceived time became a problem. Synchronizing of time around the country was deemed necessary for safety and convenience. One thing that already existed that could help solve the issue was a national telegraph system largely created by the railroads and then further developed by the Western Union Telegraph Co. Western Union (WU) set up a time standard service so that factories, businesses and local governments could

have accurate time standards. With the advent of radio broadcasting in 1920, this became even more important in order to synchronize broadcasting schedules. This brings us to the donated clock.

The subject clock is a plain brown large dial wall clock about 16 inches square. Inside, there is a spring wound mechanism regulated by a rather heavy pendulum. So, what makes this clock so different? First, it is automatically re-wound every hour by an electric vibrator powered by two large dry cells. A clock mechanism closes a switch that accomplishes this every hour. No one has to remember to wind the clock and it will continue to keep time during a power failure. Since the spring only has to power the clock for one hour, it provides a very linear force so the clock is very accurate.

The mechanism was actually manufactured by the Self-Winding Clock Co. of New York City. The real long-term accuracy comes from a synchronizing signal that WU sent every hour over a telegraph line. As long as the clock is within two minutes of the correct time when the hour changes, the WU signal causes a solenoid to reset the minute hand to zero minutes. Our clock does not have a sweep second hand but clocks so equipped were available, particularly to radio stations that needed observed second hand timing to accurately synchronize their programs. The WU signal also causes a small red indicator light on the clock face to briefly illuminate.

WU provided these clocks on a lease basis for about \$25 annually or as low as \$1.25 a month for basic models including the telegraph line. Other models could be connected to Time Stamps or worker Time Clocks. The official time signals were generated at the United States Naval Observatory and transmitted over national WU telegraph wires. As time keeping accuracy improved in the later part of the 20th century, this service eventually died out when the Western Union Telegraph Company itself passed into oblivion in the 1970's.

The RTM decided that this clock was indeed an item deemed worthy of exhibiting. Member Jules Bellisio took it under his wing and found it to be in pretty good working order except that the original two dry cells had been replaced with four flashlight "D" cells. A little cleanup and it was prepared for mounting on the wall, just to the left of our entrance door. But what about a synchronizing signal?

WU is long gone along with telegraph wires. Well, the RTM has no lack of "inquiring minds" so member Al Klase stepped up and conjured up a means of

obtaining a GPS satellite time signal to provide the hourly synchronizing signal to reset the clock as needed. A chip GPS receiver and antenna was purchased for a few dollars. It was then fed to an Arduino chip computer that AI programmed to supply the hourly contact closure to the clock's solenoid. A digital readout was added to the Arduino to observe the GPS time and a small annunciator sounds a "beep" on the hour when the synchronizing signal is delivered.



The clock kept very accurate time for several days while in the club's repair shop and then worked well after being mounted on the museum wall for a time, but then stopped rewinding itself. It was probably caused by depleted batteries or dirty contacts somewhere in the rewind mechanism. Unfortunately, the closing of our museum for the corona virus duration has prevented troubleshooting the problem. Meanwhile, we are indebted to NJARC member Red Riff for permanently donating this very interesting historic artifact to the RTM.

**JUST WHEN YOU
THOUGHT THERE WAS
NOTHING LEFT
TO FIND**

This article has no byline since its author has requested to stay anonymous. When you read it, you might get an inkling why. All that can be said is that an NJARC member was involved...Ed

In the following story, all of the names have been changed to protect the guilty!

During the hot Summer of 2018, the 100th Anniversary year of the pandemic of 1918, I was contacted by a Mr. "Smith". He asked me to be his partner (or was it accomplice?) in an antique radio venture on the East End of Long Island N.Y. I inquired where on the East End, but he hesitated to say, other than he would send the GPS coordinates to me at the right time. Now I've known Mr. Smith for over 20 years, but never in such a secretive way which was perplexing!

The coordinates came the following day in a text message. We were to meet a

Mr. "Jones" at 2200 hrs. but we could only come in one vehicle. I asked Mr. Smith why all this secrecy, and why we were doing business at 10 o'clock at night? He said I would understand later. So we met in the parking lot of a local I-Hop, and together road in his SUV to the agreed on meeting place.

We traveled a long, winding road between a decrepit country farm house and a corn field lighted only by our car's headlights. Eventually, the "click" of our GPS announced that we were at our destination, a very large barn. No lights, no activity, no one around, until, we heard the clanging mechanism of an old overhead door slowly opening. The door fully opened and there stood Mr. Jones who quickly motioned to us to pull in just as the door was closing behind our SUV.

We exchanged some quick pleasantries, I was introduced to Mr. Jones as Mr. "Hall" by my partner. We noticed that Mr. Jones was a young, thin man who was nervously smoking.

We asked about the antique radios since all we saw were pieces of his junk car business collected in piles over the broken, concrete floor. He pointed "up"...up to the hay loft, an easy 18 feet above our heads. So we naturally asked for the staircase. He laughed and pointed us to a mangled step ladder with an open hatch at it's top. Mr. Smith and I ventured up knowing that an extension cord and flood lights would be in order.

We could not believe what we saw among the petrified raccoon feces and half-dead, trapped raccoons. We squinted over boxes full of N.O.S. vacuum tubes from the 30's, 40's and 50's. There were consoles, cathedrals, tabletops, tombstones, speakers, boat anchors, phonographs, test equipment, records and manuals, of every description and brand and, of course, numerous parts!



I asked my "business partner," Mr. Smith, "what was the deal?" He replied "the "deal is to take what we want and pay Mr. Jones some money." "Some money?" I asked. "Yes...he's relocating and happy to receive some money for the stuff". Always the skeptic, I queried my

partner if he knew why Mr. Jones had stored all these treasures in a basically inaccessible hay-loft. "No, and I don't intend to ask him" Mr. Smith replied... "let's just start moving this stuff." My better half sounded alarms of caution but my collector half was able to muffle them. I was just hoping I wasn't being drawn into the plot of a Stephen King novel.

Hot and sweaty, we continued moving items down a "rubber" ladder into the SUV. Perhaps feeling sorry for the sight of two old men laboring or realizing it was getting past midnight, Mr. Jones suggested that we could use the "bailing lift" in the middle of the loft which was a barn at one time. We learned to use the lift very quickly, saving our knees and ankles from ruin. The night came to a close when the SUV was bursting with the fruits of our labor. We paid Mr. Jones a reasonable amount of money in cash and left as stealthily as we arrived, dividing the night's gains back at the I-Hop parking lot.



Taking inventory with the help of daylight.

Two more late night episodes took place in the same manner, without complication. But then, my partner received a text from Mr. Jones out of the blue explicitly saying that neither you, Mr. Smith, nor me, Mr. Hall, should ever come back to the barn!

It's been two years now and I can only wonder what happened to Mr. Jones, what was the fate of his remaining radios and how they came to be in the first place. Anyway, just when you thought there was nothing left to find, you might just get that cryptic phone call in the middle of the night that leads to radio treasure. Or perhaps you'll choose not to answer it!

**BRIEF CLAIM TO
FAME: THE
STROMBERG CARLSON
CAR RADIO**

**By
Vic Dowdell**

Member Vic Dowdell (AB1NQ) recently forwarded his appreciation for the car radio articles that appeared in the April "Broadcaster." Below, he offers a piece that he wrote for the NEARC newsletter that appeared in early 2016 that he thought would be of interest...Ed

Upon my discharge from the Army in 1957, I took a job in Rochester, New York with Stromberg-Carlson (S-C), known as a pioneer in high-end radios and innovator in television and audio equipment. When S-C was purchased and renamed General Dynamics/Electronics, I worked on various defense contracts and, most notably, on the solid state control computer for a supersonic wind tunnel which is still the world's largest.

At that time, in the late 50's, General Dynamics (GD) was not particularly interested in S-C's independent telephone business and the consumer electronics business was losing ground. So GD decided to chase the upsurge in automobile sales by designing a car radio.

I don't recall whether they developed a completely new design to be marketed to all automobile companies, or if the design used Automatic Radio's technology. Regardless, the resulting single "fits all," vibratorless (12vdc B supply), vacuum tube chassis had a separate two-transistor output amplifier. Many different bezels were designed to fit into the décor of a gamut of automobiles. As an employee, I installed one in my new Nash Rambler station wagon. It was a decent radio.

GD submitted sample radios to all the automobile manufacturers. As interest picked up, the OEMs wanted production capacity. So S-C invested in a semi-automatic production line with approximately 10 female workers at various stations.

When the Ford Motor Company designed a new line of automobiles, it selected Stromberg-Carlson to supply the car radio. Once again, S-C was on the way back to fame and glory. Or was it?

Ford installed a Stromberg-Carlson car radio in every single Edsel it manufactured. The irony is, however, that Edsel went defunct in its third year of production and S-C never built another car radio.

Editor's Note: Although Stromberg-Carlson made OEM radios for the Edsel, the company also provided aftermarket radios in 1960 for Chevrolets (CH-60M, PB), Darts (DA-60-PB), De Sotos (DE-60-PB), Dodges (DO-60-PB0), Falcons (FA-60-M, PB) and Fords (FO-60-M, PB). Some radios with the same Edsel circuitry have been found by collectors with the



Stromberg-Carlson 85SE, AM push-button radio that appeared in the 1958 Edsel Ranger, Pacer, Corsair and Citation.

audio power unit screwed to the top cover of the control head/tuner's case, unlike Edsel where the audio unit was located far-removed from the control head. Many 1959 Edsels carry a cheaper Bendix radio instead because of what was termed a "swing" application. The customer had no choice and paid the same price for the radio whether Ford Motor Company decided to install the Bendix or deluxe Stromberg-Carlson. It was all a matter of what was available for production at the moment.

Stromberg-Carlson apparently took advantage of the tooling for their OEM Edsel radios as they marketed their "C.A.R.7" and "C.A.R.9" models as aftermarket for the '59 Edsel or Ford. They are virtually identical to their OEM line. Ford may not have been too pleased with this situation.



After-market Stromberg-Carlson car radio from a 1960 Valiant.

WHEN BRUTE FORCE TRANSMITTERS RULED THE AIR

Part 1

By
James E. O'Neal

NJARC member James O'Neal (K4XAR) has been involved in broadcasting for nearly 60 years including a 37-year-long career in television engineering. This included more than 30 years with the television side of the Voice of America.

In 2005, he launched a second career in journalism including editing "TV Technology" and writing for "Radio World," and other periodicals, concentrating largely on radio's colorful history and the individuals who helped make it possible. Mr. O'Neal is the editor of "IEEE Broadcast Technology" and serves on the boards of two radio and television-oriented museums. The following article was first published in the April 26th issue of "Radio News" and is carried below with the kind permission of the author and "Radio News"...Ed

Admittedly, there's really not much in the way of transmitter maintenance today, save for routine cleaning and occasionally sending an ill-performing module back to the manufacturer for repair or swapout. Vacuum tube-based units required more attention but could operate for fairly long stretches with little more than replacing failed tubes.

There was a time though when operating a certain breed of transmitter meant changing out large carbon electrodes several times during an operating shift, switching to a standby rig to allow the main to cool long enough to remove a prodigious amount of soot from its interior, replacing a transmitter insulator that had begun to burn while on the air, and the regular topping off a reservoir with alcohol, kerosene or maybe even gasoline.

This was what it took to keep the kilowatts on the air some 100 years ago. I'm referring to the Poulsen arc converter technology for generating a continuous carrier wave.

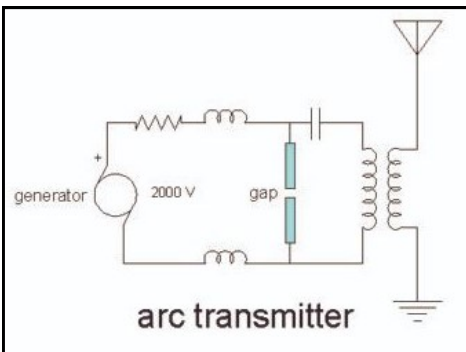
PUTTING A NUISANCE TO WORK

Most readers will have witnessed what happens when a path is abruptly broken in an energized circuit (anything from opening a knife switch to using a screwdriver to discharge a large capacitor). There is a bright flash of light and (depending) on the amount of voltage and current involved, a sound anywhere from a small "smack" to that of a lesser thunderbolt. The phenomena involved is an electrical arc - a flow of relatively low-voltage, high-current across an open space.

It was at one time (in pre-incandescent lamp days) used for artificial lighting, and even after the advent of the Edison lamp, served for several decades as a high-intensity light source in motion picture projection and some large spotlights.

Today, the electrical arc comes in handy for welding, "electro-erosive" fabrication of metal parts, and melting metals

in high-temperature furnaces. Otherwise it's a sometimes dangerous and expensive nuisance that occurs when relay contacts open or screws aren't snugged down tight in power panels.



The arc transmitter or "converter" in its simplest form. It's nothing more than a DC arc with a series-tuned circuit connected across the arc electrodes.

Early in radio's history, however, the electrical arc was at the core of some of the most powerful transmitters ever put on the air.

NOT TO BE CONFUSED WITH "SPARK"!

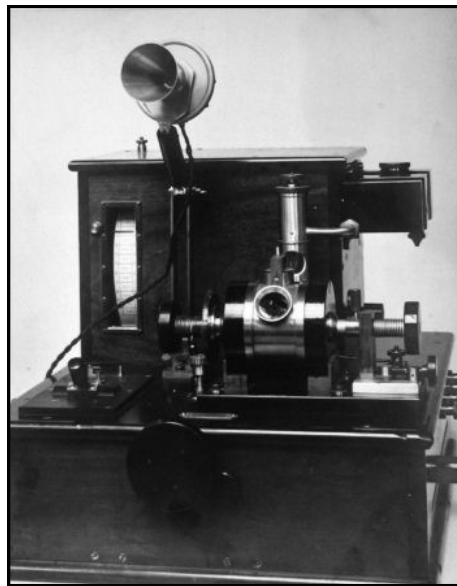
Now, I'm not referring to the big "rock crusher" spark transmitters championed by Marconi and others in radio's caveman days. Those were rather diametrically opposed to arc technology, as their operation involved relatively low currents and very high voltages (tens of thousands), and generated a "damped" wave oscillation that produced a very wideband (spread spectrum) type of signal.

Arc transmitters, or "converters" as they were known (they converted DC into radio-frequency AC), with the exception of the very large devices, typically operated with potentials of a few hundred volts and currents usually measured in the hundreds of amps.

The Marconi "rock crushers" were fine for communication via telegraphic code (well, not really, but they got the radio industry started). However, for Reginald Fessenden and other visionaries who desired to transmit speech and perhaps music, they were useless as the damped oscillation (think ringing a bell) produced was not suited as a carrier wave that could be modulated with an audio component.

Fessenden solved the problem of generating a continuous wave by pressuring the General Electric folks to produce an alternator that spun fast enough and had enough poles to generate an output in the

LF portion of the radio spectrum. That took time, and it was not cheap either.



A small tabletop "arcphone" radio transmitter. The arc chamber and its associated hydrocarbon liquid reservoir are seen at the center right. The transmitter's carbon microphone projecting above the top is firmly attached to the unit, as it became very hot in operation and could not be hand-held.

Elsewhere, others explored the production of continuous radio waves - or, as they were called back then, "undamp't" waves - and found that a certain property of the electrical arc made it a good candidate.

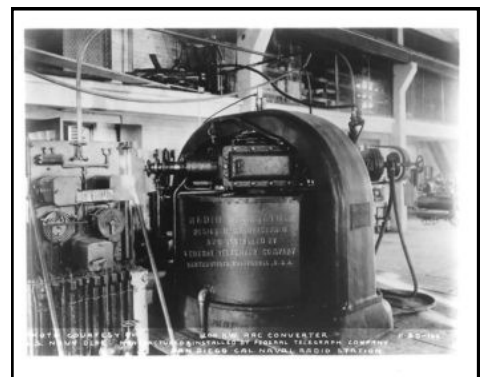


A production model Federal Telegraph arc transmitter. Although the size is not stated in the photo data, it is likely in the 30 kW range. (Courtesy of History San José)

Arc transmitter technology stemmed from the discovery by English physicist

William Duddell in the 1890s that if a series-resonant circuit was connected across an arc, an oscillation developed, with its frequency determined by the external inductance and capacitance. Following in Duddell's footsteps, Danish inventor Valdemar Poulsen (also the inventor of magnetic recording) made improvements on Duddell's "singing arc." He secured a patent for his work in 1903 and began marketing the first arc transmitters.

The technology formally arrived in the United States in 1909, when Cyril Elwell, a recent Stanford University engineering graduate who had done work in the field of electrical arc furnaces, became interested in Poulsen's technology and secured patent rights to manufacture the transmitter. This Palo Alto, Calif., venture was originally known as the Poulsen Wireless Telephone and Telegraph Co., but later changed its name to the Federal Telegraph Co., and manufactured arc converters in varying sizes until the arrival of the high-power vacuum tube transmitter in the early 1920s.



A 200 kW unit manufactured for the U.S. Navy. The plumbing (pipes and hoses) necessary for cooling the arc's large electromagnet and its copper anode are clearly visible. The array of cylindrical devices at the bottom left appear to be replacements for the consumable carbon cathode. (Courtesy of History San José)

HOW DOES IT WORK?

It's useful to consider the physics of the arc converter (transmitter). While striking a DC arc is a simple and basic exercise - momentarily pushing energized electrodes together and then separating them to create the arc - putting it to use in making radio waves involves an understanding of the physical phenomena surrounding such an electrical discharge.

The most intriguing (and valuable) aspect of the arc is that it belongs in the

category of devices possessing “negative resistance” characteristics. These include tunnel and Gunn diodes, vacuum tubes when operated under certain conditions (the dynatron oscillator), neon-filled tubes and lamps, and even ordinary fluorescent lamps.

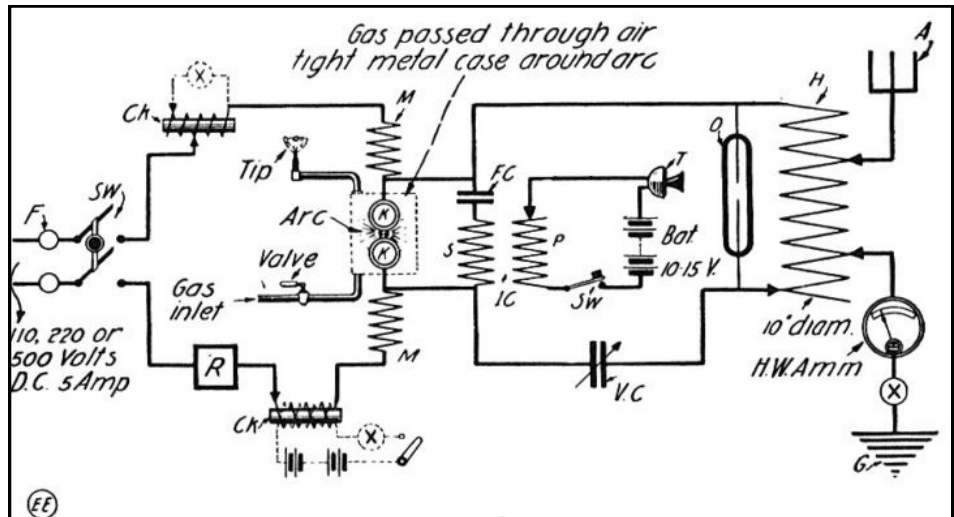


In this 1957 photo, Federal Telegraph's Leonard Fuller (middle), and Cyril Elwell (right) admire an early electric light bulb owned by another early Federal employee, Douglas Perham. Perham was also a broadcast pioneer, establishing station WJAM (now WMT) in Cedar Rapids Iowa in 1922. (Courtesy of History San José)

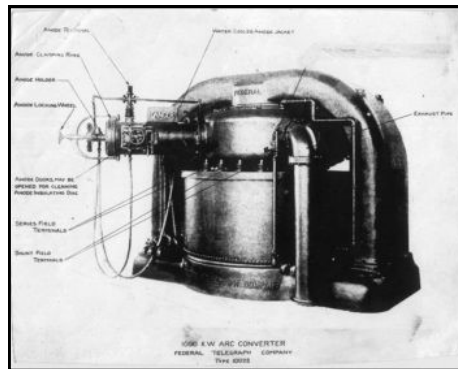
True to Ohm's law, when the voltage across an ordinary resistor increases, the current flowing through it increases proportionally ($I=E/R$). The opposite occurs in negative resistance devices; an increasing voltage results in lowered current flow through the circuit.

And while this sounds like a violation of physics, a negative resistance, in a way, produces power, rather than consuming it, as would a carbon resistor. Without getting too technical, in an arc converter, the negative resistance characteristic of the arc counteracts the positive resistance associated with the series-resonant circuit connected across it, thus maintaining its oscillations, which would otherwise die out in short order. (The same principle as in conventional radio transmitters in which an amplifying device [tube or transistor] supplies energy to sustain tank circuit oscillations.) While not a perfect sine wave, the arc converter's oscillations are pretty close, and can serve as a carrier wave.

Actually, it's not quite that simple, as more enhancements (add-ons) are necessary to make a truly practical and workable arc-based transmitter. A powerful magnetic field and a continuous source of hydrogen are also necessary. The magnetic field is needed to “blow out” the arc during an RF cycle and the hydrogen is used to help residual ions from around the arc electrodes during this once-per-cycle



This diagram is from a “Boys Build Your Own Arc Radiophone” type of article appearing in a popular 1916 magazine (*The Electrical Experimenter*). As shown in the drawing, audio modulation is achieved by inductively coupling the output of a carbon mic (telephone transmitter) into the “tank” circuit of the arc. The transmitter could also be audio modulated by connecting the mic at points designated with the circled “x,” as well as by breaking the antenna lead and connecting the mic in series with it. (The upper left connection point is especially interesting — dangerous — as it places the mic across a choke connected to a DC source of as much as 500 volts.)



A catalog drawing of the largest arc converter produced by Federal, a 1,000 kW model. The technology was scaled up for 2 and 5 megawatt units, but the technology became obsolete before these went into production. (Courtesy of History San José)

downtown.

As seen in the diagram on the next page, the electrodes are connected in series with the windings of the electromagnet so that when the arc is struck, the magnet is energized and blows out the arc, which in turn extinguishes the discharge. Heat and a few residual ions ensure that the arc is immediately re-struck as soon as the magnetic field is dumped. Of course, all of this is happening at an RF rate, so the arc would appear to be continuous to an observer. (Additional details will be included in Part II.)

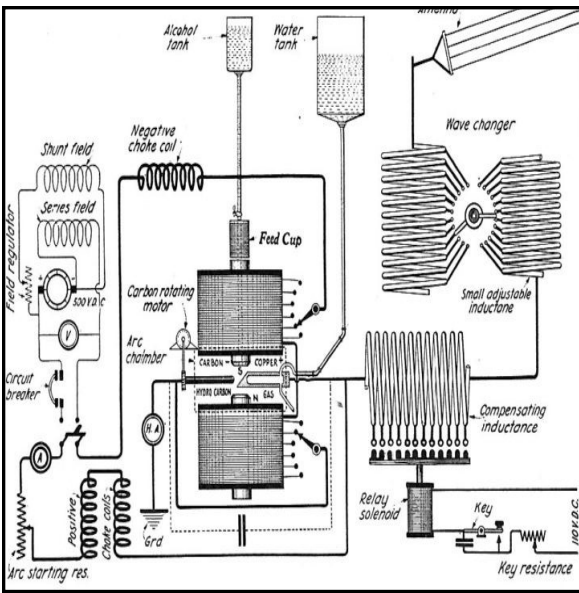
Note that even though the arc is being extinguished and re-lit during an RF cy-

cle, the converter could not be “keyed” for radiotelegraphy in the same manner as other sources of radio-frequency energy, as the time interval between the “dits” and “dahs” would be far too great and the arc would have to be manually reignited.

This was solved, in what today would be a rather inelegant way, by connecting the telegraph key across a portion of the RF inductor used to set the transmitter's frequency. During “key down,” turns would be shorted out, shifting the frequency higher. (With the really big converters and their accompanying very large RF currents, a relay with correspondingly heavy contacts was used. This is shown at the bottom right of the diagram of a large U.S. Navy converter on the next page.)

Of course, this frequency-shift keying used twice the amount of spectrum, but in the 1910s and 1920s, who cared? (My own early mentor, who was born in 1904 and developed an interest in radio during the period when arc converters ruled the airwaves, recalled that the really good radiotelegraphy operators could copy this “back” or “compensating” wave as it was called, with equal dexterity, listening for the “holes,” rather than the carrier.)

A “workaround” of sorts was eventually devised to conserve spectrum, but it was somewhat cumbersome and not employed everywhere. This involved dumping the converter's RF into a dummy “antenna” (load) during “key up” conditions so that only the transmitting frequency reached the antenna.



This diagram is fairly representative of the arc converters produced by Federal Telegraph for the U.S. Navy. Note the apparent lack of a capacitor in the output circuit. In practice, the capacity between the antenna and ground formed this circuit element. This was done as a way of sidestepping Marconi transmitter patents.

listeners may be a bit tired of around-the-clock coronavirus updates. The survey also revealed that listeners to urban format stations reported the strongest desire to hear coronavirus-focused programming.

The survey also found that favorite music and entertainment via funny, lively AM/FM radio personalities was a high listener priority. Localized programming also scored high marks. Ashworth went on to report that:

"AM/FM radio was also considered to be a key outlet for reliable, enlightened information about current events. The RAB and Jacobs Media study found that for coronavirus information, consumers place their greatest trust in government medical organizations such as the Centers for Disease Control and the National Institutes of Health followed by their favorite AM/FM radio station. Social media ranked lowest on the trust scale."

We'll leave James' article at this point and continue with the history of "brute force" transmitters in the June issue.

STAY-AT-HOME AND PARKING LOT RADIO
 Edited by **Marv Beeferman**

It might be interesting to find out what have become of the desires of the radio listening public during this time of "stay-at-home" mandates. In an April 21st article in *Radio World* by Susan Ashworth ("Amidst Stay-at-Home Orders, Radio Listenership Remains Strong"), she notes that several recent surveys have reported that people "want reliable information, entertaining hosts, a little less COVID-19 coverage and a healthy dose of local coverage." These surveys were conducted by the Radio Advertising Bureau and Jacobs Media; the March 2020 Nielsen Portable People Meter Survey; and a Westwood One survey.

It appears that listeners are still tuning in but mainly to their home stations. However, it has been found that many of these listeners aren't aware of exactly how to tune into their AM/FM stations on smartphones or laptops. A key finding as part of the Westwood One survey was that

The survey also found that despite shelter-in-place orders, radio is still reaching many commuters. Surprisingly, 47% of those who normally work outside the home are still making the commute to work.

My eyes were really opened to the sizeable number of surveyed listeners who did not know how to listen to AM/FM radio on a smart speaker or desktop computer. As Ashworth points out:

"The Westwood One survey found that one out of four smart speaker owners do not know how to listen to AM/FM radio stations on their device. The same is true for smartphone owners - one out of five of those individuals don't know how to listen to AM/FM radio on their phones. The trend continues when it comes to laptop/desktop users as well as tablet owners: 17% of laptop/desktop owners and 26% of tablet owners do not know how to tune in an AM/FM radio station on those devices."

Finally, the Nielsen survey revealed that AM/FM radio had maintained nearly all of its audience between February and March after being faced with shelter-at-home orders that predicted the possible loss of listener participation.

In another *Radio World* story reported by Paul McClane (April 24th), it was reported that the Radio Design Group in Oregon is planning to introduce a low-power AM transmitter to support current interest in specialized, very local broadcasting. The company calls the project "Parking Lot Radio." The project was inspired when company president Jim Hendershot was contacted by a church that wanted to hold services while maintaining social distancing by using a transmitter to send audio to car radios. When you look at the details, this project may be of interest to members who are looking for a more upscale AM broadcaster.

The design of the Parking Lot Radio includes a balanced audio input which Hendershot says is compatible with professional sound boards rather than the usual 1/8-inch stereo plug that hooks up to a computer or MP3 player. The company felt that the average user would more likely have a "real" sound system rather than a cheesy karaoke machine. The unit is expected to provide excellent audio limited more by the receiving radio's capability than the transmitter itself. The unit will come with a basic wire antenna but could be attached to a whip up to 3 meters per FCC regulations. Range is expected to cover an average parking lot. Cost is expected to be about \$250.

The Parking Lot Radio is expected to be released within a matter of weeks. To sign up for e-mail updates with regard to progress and purchasing information, send your request to:

<http://parkinglotradio@radiodesign.com>

Some of you might be already familiar with the "Talking House" AM transmitter (www.theRADIOsource.com). It normally sells for \$129.95. This unit has already been turned into a Parking Lot Radio by a talented church pastor.

The unit sits on a utility cart with a 10' piece of plastic conduit attached to one leg so the antenna can be oriented vertically for best coverage. The cart also holds a portable mixer, wireless mike pickup and multi-plug AC receptacle. Audio from the microphone and a keyboard player are combined in the mixer which delivers an ideal audio level. The mixer allows compression and limiting to be added to the vocal and music channels as needed for best quality and listenability.

The balance between the voice and music is adjusted during the service, so that the pastor and the music are at the right levels or when playing simultaneously - during singing and when the pastor is speaking and wants background music.