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Motor Buzzer Transmitters: Spark Goes QRP! [1]

By Russ Kleinman, WA5Y, Karen Blisard, N5IMW, and A. J. Link

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Introduction

The success of wireless radio in the first few years of the twentieth century depended upon the ability of this new technology to bridge ever larger distances over land and sea. The simple circuits of the first crude transmitters used an air gap traversed by a spark that created a radio frequency current when a coil and capacitor were added to the circuit. As transmitters became increasingly powerful, their antenna systems became huge, and could easily cover several acres of land. The imagination of the public at large was captured by Marconi in 1901 when he first successfully heard signals in North America transmitted from across the Atlantic Ocean. To provide reasonably reliable long-distance communications, wireless stations had to transmit at enormous power levels. It was not unusual for a long-distance station to employ power levels up to hundreds of thousands of watts output.

Arc transmitters were also developed and deployed during the spark transmitter era, and competed directly with them for acceptance in the long distance communication arena. Powered by a different technology, arc transmitters were generally more complicated than spark transmitters. An electrical arc between carbon and copper electrodes in a hydrogen or hydrocarbon environment and sustained within a magnetic field replaced the spark gap and associated components in the transmitter circuit. The complicated nature of the arc system prevented rapid widespread acceptance of this alternative form of circuit, even though it provided the continuous waves needed for voice communication. This competition soon led to the construction of higher powered arc transmitters, just as had been the case with spark transmitters. World War I erupted during this era of wireless innovation, expansion, and high-powered competition. Equipment
designers turned their attention to military applications of wireless.

Most battleships and their accompanying support vessels carried spark or arc transmitters in 1917 [2]. The spark transmitters were usually quenched gap sets, and they were powered by the ship’s main power supply. One problem with these main battleship sets was that they could not easily operate at low power. Battleships needed the higher power capability to be able to communicate back to the mainland to receive orders, as well as to coordinate maneuvers between different groups of ships. But even when a typical battleship spark transmitter was operated at the lowest power possible, it radiated a potent enough signal to cause substantial interference to any other wireless communications at short distances. A different kind of transmitter (operating at lower power) was needed to provide for short-range communications. This short-range transmitter needed to be of simple construction, and it needed to be physically small enough to be carried on the ship without interfering with the main spark transmitter or other ship operations. The motor buzzer transmitter (Figs. 1 and 2) was developed to fulfill this need. (The Appendix provides a detailed list of system components sorted by Navy type number.)

Description of Motor Buzzer Transmitters

The first type of motor buzzer transmitter, the Type BC (Figures 3 and 4), was not a stand-alone unit, but was intended to be used in conjunction with standard 2-, 5-, or 10-kW quenched gap transmitters. Some later models, such as the Type BD, were manufactured as complete transmitters, and were particularly useful on ships without quenched gap spark rigs, such as those outfitted with arc sets [3]. Both the Type BC and Type BD sets were made by the Lowenstein Radio Company. Interestingly, motor buzzer transmitters could not be used with sets of less than 2 kilowatt output because the smaller capacitors of these sets would not run the buzzer properly.

To operate the unit, the same direct current power supply that normally fed the motor generator of the main spark transmitter was switched to the motor buzzer transmitter. The motor buzzer set was plugged into the main spark set in such a way that it directed the power away from the spark transmitter and the main set’s quenched gap. The motor buzzer transmitter output then plugged back into the oscillating circuit of the main set to transfer power to the ship’s
Figure 1. Spark and buzzer transmitters on board the U.S.S. Arizona, New York Navy Yard, 1920. Two motor buzzer sets, one above the other, are front and lower center. The motors and buzzer wheels are to the left, and the motor buzzer relays for the break system (SE 3633) are on the right. The motor buzzer stand, manufactured by the International Radiotelegraph Company, was designated the Type SE 1459.
Figure 2. Spark and motor buzzer transmitters on board the U.S.S. Pennsylvania, New York Navy Yard, 1920. In the original larger photo, the insulating segments on the buzzer wheels were easily visible. Figure 7 provides a better view of the wheel with its insulating segments. The bottom portion of the stand is taken up by parallel coils and resistances that were part of the receiver break and protection system.
antenna circuit. Since it could use the same power supply, oscillation transformer, capacitors, and antenna circuit as the main spark set, the motor buzzer transmitter took up very little extra space in the transmitter room on the ship.

The direct current supply to the rotating wheel of the motor buzzer transmitter was regulated by a rheostat [4] (Figs. 5 and 6), which could be turned down so low that a spark could be maintained at lower powers than could be achieved even with only one gap of the main transmitter in the circuit [5]. The output of the motor buzzer transmitter could be turned down until it radiated almost nothing, and its maximum radiation was only slightly more than the minimum radiation of a shipboard quenched gap transmitter. The maximum effective range of a motor buzzer transmitter was fifty to one hundred miles when properly adjusted. Occasional transmission was recorded up to about 400 miles.

The interference caused by a transmitted wireless signal also
depended on the degree of coupling of the energy to the antenna [6]. The motor buzzer transmitter could be operated with looser coupling between the closed oscillatory circuit and the antenna circuit than could be achieved with the main quenched gap set. In spite of this, the motor buzzer transmitter could have a broader signal than the quenched gap transmitter because the motor buzzer spark was not quenched to the same degree as the spark in the main set. The motor buzzer transmitter nevertheless usually caused less interference to nearby receiving stations compared with the ship’s high power transmitter operating at the same transmitting input power. Since motor buzzer sets were physically small, could operate at very low power, and were capable of causing less interference than the standard spark sets, they were just what the Navy wanted for intra-fleet close range communications. They were eventually installed on most combatant ships and even on many submarines [7].

**Function of Motor Buzzer Transmitters**

The motor buzzer transmitter was still a kind of spark transmitter,
Type SE 3639 power changing resistance, made by the Ward Leonard Electric Company of Mt. Vernon, New York. This rheostat was used to vary the power output of the motor buzzer transmitter. The motor starter for the buzzer motor, made by the Industrial Controller Company of Milwaukee, Wisconsin, is partially visible to the right.

but with an unusual and ingenious twist—it utilized a special kind of rotary gap, known as the buzzer wheel (Fig. 7), that functioned as both the interrupter and as the spark gap. Understanding the function of the buzzer wheel is key to understanding the function of motor buzzer transmitters (Figs. 8 and 9) [8].

The buzzer wheel (the SE 1515 and SE 1515A for 110-volt DC operation and SE 1516 and SE 1516A for 220-volt DC operation) consisted of a brass wheel turned by a small, usually ¼-horsepower motor (Fig. 10) [9]. The wheel was insulated from the motor shaft. The periphery of the wheel was interrupted by ten segments of insulating material, initially hard rubber or Electrose [10] molded into tapered slots under pressure, but later changed to mica for more even
Figure 6. Motor buzzer control apparatus of the U.S.S. Arizona, in a photograph dated January 1920. The fused single-throw double-pole switch in the upper left is the Type SE 1455 motor buzzer line switch. The motor buzzer inductances (SE 3559) are on the upper right. The motor starter is center left, and the power changing resistance (rheostat) is center right.
Figure 7. Motor buzzer wheel (Type SE 1515A). Note the ten mica insulating segments inserted into the periphery of the wheel. The SE 1515A threaded onto the shaft from the buzzer motor.

wear and easier construction.

A woven copper wire brush (Fig. 11), held in place by bronze brush riggings, and connected through iron core inductances [11] (Figs. 12 and 13) to the power supply, made side contact with the buzzer wheel at an angle. As the wheel rotated, the brush alternately contacted brass and insulated segments, and in this way acted as the interrupter of the direct current. When the copper brush was in contact with the brass segments on the rim of the buzzer wheel, a strong electromagnetic field was built up relatively slowly in the inductances. When the brush then moved onto the insulated segments, the energy in the magnetic fields around the iron core inductances [12] collapsed quickly, giving a strong charge to the capacitor. In this respect, the iron core inductances functioned like the coil of the older kicker coil spark sets that also utilized a metal core coil without a secondary winding to produce a surge of current when the direct current was interrupted [13].
Figure 8. Type SE 3558 and 3629 motor buzzer transmitter schematic. June 16, 1919 drawing by the Navy’s Bureau of Steam Engineering’s Radio Division in Washington, D.C.
Figure 9. This is a simplified schematic of a motor buzzer transmitter. The operating key, K, switches current in the circuit. Power is controlled by the resistance, R. The iron core inductances, I, and the capacitor, C, store and discharge electromagnetic fields as the angled brush, B, moves around the rotating buzzer wheel, W. The spark occurs underneath brush B as it approaches a conducting segment of the buzzer wheel. B1 is a stationary brush contacting the brass wheel, and L is the oscillation transformer (inductive coupler) which transfers energy to the antenna circuit where it is registered at ammeter A. O is the motor buzzer relay (SE 3633), part of the break system, to open the oscillating circuit between dots and dashes. Drawing based on one by G.H. Clark.

When the brush of the motor buzzer set next approached a brass conducting segment of the wheel, and just before contact was made, the discharge of the capacitor caused a spark to jump the small gap from the undersurface of the brush to the conducting segment of the wheel [14]. In this way an oscillating radio frequency current was set up between the buzzer wheel, the capacitor, and the oscillation transformer, to the antenna circuit. The process repeated over and over again as the wheel turned at 2,000 to 3,000 revolutions per minute [15].

It is interesting to compare the buzzer wheel of the motor buzzer transmitter to the rotary gap of a spark gap transmitter. A standard rotary spark gap acted solely as the spark gap, and generally required
Figure 10. Buzzer wheel motors like the ¼ horsepower one shown here were manufactured by companies such as Shedd Electric and Crocker Wheeler. (The CB 1598 motor on this set was made by Crocker Wheeler.) Note the arrangement of the brushes contacting the buzzer wheel, and the buzzer relay to the left on this Type BC motor buzzer transmitter.

Figure 11. Detail of woven copper brushes. The brushes were held in place by brush holders designed to contact the wheel at the optimal angle. The brush pressure on the wheel was adjustable.
Figure 12. The SE 3559 motor buzzer impedance was an iron core inductance consisting of two separate coils (each in one side of the DC supply to the buzzer wheel), wound on a common open laminated core. Impedance was varied by the controls on top of the unit. The SE 3559 on the left was made by the Lowenstein Radio Co.; the one on the right, by the International Radio Telegraph Co.

an alternating current power source, such as a motor generator to cause an effective oscillating current within the closed oscillating circuit of a spark transmitter. The buzzer wheel of the motor buzzer transmitter not only interrupted the DC current, providing a source of interrupted DC voltage to the iron core inductances, much like the older kicker coil sets, but also acted as the spark gap just a small fraction of a second later as continuity was about to be re-established with the circuit. The motor buzzer sets in this way combined elements of the kicker coil with elements of the rotary spark gap.

This design was particularly well suited for a low-power transmitter. Even operating at such low power, the sparking end of the brush contacting the periphery of the buzzer wheel needed to be advanced by cutting and trimming or had to be replaced with a new brush frequently as it wore down [16].

The telegraph key, the SE 3546, or slightly modified as the SE
Figure 13. Drawing of the Type SE 3559A impedance unit, dated April, 1919. When the inductance of the oscillating circuit of the motor buzzer set was adjusted to be the same as the total inductance of the primary operating circuit of the main set, transmitting could be transferred from the spark set to the buzzer set without further tuning being necessary.

Figure 14. The SE 3546A was the Navy's Morse key for use with motor buzzer transmitters. This particular key (with its case closed) was made at the Navy Yard, Portsmouth, New Hampshire, in November, 1921.
Figure 15. SE 3636 key transfer switch. The shielded Morse key could be switched from the main spark transmitter to the motor buzzer set and back using this double-pole, double-throw switch, made by the Bantam Company of Connecticut.

Figure 16. The same SE 3546A key shown in Fig. 14, but with the case open. Notice clips for connections to both the front and rear contacts.
Motor buzzer relay (SE 3633). This relay, mounted on the same board with the motor and buzzer wheel, was part of the break system of the transmitter, and permitted listening to the receiver between transmitted dots and dashes.

3546A (Fig. 14), was connected to either the main spark rig or to the motor buzzer set by the key transfer switch, the SE 3636 (Fig. 15). The key was connected by the key transfer switch through the main set’s relay key to prevent inductive interference that would otherwise have been generated along the leads from the key. The telegraph key was shielded, and had front and back contacts (Fig. 16). The contact nearest the knob of the telegraph key connected the oscillating circuit to the DC power supply. The contact on the other end of the lever of the key directed current to a network of parallel coils, which activated relays in a rather complex way to assure that the receiver was never placed in the antenna circuit at the same time as the transmitter [17].

The motor buzzer set was provided with a “break” system, allowing the operator to listen to the receiver between sending dots and dashes. The motor buzzer relay (Fig. 17), mounted on the motor buzzer transmitter board to the right of the motor and buzzer wheel [18], was an integral part of the break system.
Spark Transmitters in Submarines

The United States conducted underwater wireless experiments as early as 1909 [19]. Russia, France, Germany, and England were also developing wireless systems for use in submarines about this time. Submarines had the same need for lower power transmitters to complement their higher power spark transmitters as did surface vessels. Motor buzzer sets operating on 600 meters and taking up as little space as possible were developed during 1918 for submarine use. A wood base supported the motor and oscillating circuit. The key and a few other necessary components were mounted wherever was convenient. Experiments with the apparatus showed that an antenna current of 1.2 amperes could be fed into an antenna of 25 ohms resistance [20].

About 1923, the Type 41 Portable Motor Buzzer Set had been tested with satisfactory results under sea-going conditions in submarines. Signals were received up to a distance of 45 miles. Further modifications were intended for the Type 41 sets, but by this time CW equipment was rapidly becoming available [21].

Obsolescence

Motor buzzer transmitters were used in both the U.S. and British navies for a relatively short period of time before they were replaced by more modern equipment. The earliest references to them appeared about 1918 and they seem to have disappeared about 1923. In this short span of five or six years the U.S. Navy had intended to outfit all combatant ships with motor buzzer transmitters in addition to the quenched gap or arc transmitters already on board. We don't know to what extent this goal was actually realized, but judging by the relative rarity of these transmitters in private collections or museums today, we can surmise that priorities had changed in the Navy.

Motor buzzer transmitters installed on ships were replaced by an auxiliary spark transmitter known as the SE 3531 (SE 3612 when used on a 250-volt DC supply). These newer spark sets operated at 1,700 to 2,400 kHz and permitted simultaneous transmission and reception of intra-fleet and long-distance messages. Even these sets, however, were being rendered obsolete by the CW 936, which consisted of a transmitter and a receiver with an amplifier, both employing tubes [22]. Tube transmitters had the distinct advantage of allowing for
effective voice transmission, something that was almost impossible with a spark transmitter.

**Conclusion**

Motor buzzer transmitters performed a necessary function for the Navy during the World War I era—that of short range communication with less potential for interference than occurred with the higher powered spark and arc transmitters already present on battleships. The theory underlying the apparatus was an interesting combination of rotary spark and kicker coil transmitter technology. History has relegated motor buzzer transmitters to obscurity. Little has been written about them, most likely because their advent preceded by a few short years the arrival of continuous wave transmitters, which outmoded them.

**Acknowledgements**

We thank the many people who have helped us with our research on motor buzzer transmitters. Susan B. Strange, Reference Archivist at the Smithsonian National Museum of American History (Behring Center), was most helpful. The research assistants at the National Archives helped us as well. Warren Berbit provided assistance without which this paper might not have been possible. Mark Donnell and Walter La Fleur provided invaluable assistance preparing the manuscript.

**Photo Credits**

Figures 1, 2, and 6: Photographs by the author from the George H. Clark Radioana Collection, Archives Center, National Museum of American History, Behring Center, Smithsonian Institution.

Figures 3, 4, 5, and 7 through 17: Photographs from the Russ Kleinman and Karen Blisard collection.

**Endnotes**

1. Ham radio abbreviation for low power.
3. Arc transmitters generated continuous waves and competed with spark technology. Tube transmitters made both of them obsolete.
4. Called the “Power Changing Resistance,” Type Number SE 3639.

5. Quenched gap transmitters generally required multiple gaps in the circuit, one for each 1,000 volts or so in the oscillating circuit.

6. The antenna is directly coupled when it is physically connected to the oscillating circuit. A “loose” coupled antenna circuit connects to the oscillating circuit through the oscillation transformer, with a space between the coils that is varied to produce the proper degree of coupling. The terms are, of course, relative.

7. At least according to Howeth, though there is reason to doubt the number of ships actually outfitted with motor buzzer sets.


10. From http://www.r-infinity.com/Hewlett/Page3.htm. “Louis Steinberger was the owner of Electrose Mfg. Co. From about 1900 to about 1929, he obtained dozens of mostly unimportant patents for various uses of his composition insulators. The composition material used in the Electrose insulators was similar to the early plastic known as Bakelite.” Composition insulators were synthetic mixtures of multiple components.

11. Inductances were also referred to as “impedances” in the original literature.

12. The inductances were variable. Trial and error was used to find the best inductance setting for a given power, buzzer wheel speed, and wavelength used.

13. Early experimenters built kicker coils by winding the coil around bundles of wire.

14. If the motor buzzer transmitter was adjusted poorly, the spark arose from elsewhere on the brush and the signal was degraded.

15. Yielding a spark frequency of 333-500 sparks per second. The motor buzzer transmitter produced a characteristic low note compared to the main sets.

16. Personal typewritten notes, George H. Clark, Radioana Collection, Archives Center, National Museum of American History (Behring Center), Smithsonian Institution. The motor buzzer transmitters were supplied with two spare parts boxes. A smaller wooden box contained spare parts for the buzzer wheel and rigging and was put together by the
Lowenstein Radio Company. A larger wooden spare parts box contained parts for the motor itself and was supplied by the International Radio Telegraph Co.

17. Ibid.

18. The motor buzzer transmitter board could in turn be mounted on the motor buzzer transmitter stand, SE 1459, made by the International Radio Telegraph Company.

19. Ibid. These experiments were conducted by George H. Clark himself.

20. Initial experiments favored a loop antenna, which was found to be directional. The best signal was in the direction of travel, and the submarine would have to be turned to communicate effectively!

21. Ibid.


Appendix

Equipment List
(Sorted by Type Number)

For Battleship Motor Buzzer Transmitters and Key Control Systems

<table>
<thead>
<tr>
<th>Type Number</th>
<th>Equipment Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV 1484</td>
<td>Double Scale Radiation Ammeter, 0 to 60 and 0 to 3 amperes (10-KW)</td>
</tr>
<tr>
<td>CV 1485</td>
<td>Double Scale Radiation Ammeter, 0 to 40 and 0 to 2 amperes (5-kW)</td>
</tr>
<tr>
<td>SE 1406</td>
<td>Sliding Door Switch</td>
</tr>
<tr>
<td>SE 1411</td>
<td>Swinging Door Switch</td>
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<tr>
<td>SE 1455</td>
<td>Buzzer Main Line Switch</td>
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<td>SE 1456</td>
<td>Motor Buzzer – Main Set Transfer Switch, 5-kW</td>
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<td>SE 1457</td>
<td>Motor Buzzer – Main Set Transfer Switch, 10-kW</td>
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<td>SE-1458</td>
<td>Buzzer Transfer Switch</td>
</tr>
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<td>SE 1459</td>
<td>Motor Buzzer Frame</td>
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<td>Description</td>
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<td>-------------</td>
<td>-------------</td>
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<tr>
<td>SE 1486</td>
<td>Radiation Ammeter Panel (5-KW), including two CV-1485 Ammeters, one mounted and one free.</td>
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<td>SE 1514</td>
<td>5-kW Relay Key Panel, including two Type SE-3622 keys and transfer switch.</td>
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<td>10-kW Relay Key Panel, including two Type SE-3621 keys and transfer switch.</td>
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<td>Shielded Morse Keys with Back Contact</td>
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<tr>
<td>SE 3546A</td>
<td>Shielded Morse Keys with Back Contact</td>
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<td>SE 3558</td>
<td>Motor Buzzer Complete (110-Volt Supply)</td>
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<td>SE 3559</td>
<td>Motor Buzzer Impedance</td>
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<tr>
<td>SE 3589</td>
<td>Key Resistance</td>
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<td>SE 3619</td>
<td>Antenna Break Relay, 5- and 10-kW</td>
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<td>SE 3620</td>
<td>Booth Protecting Relay</td>
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<td>SE 3621</td>
<td>10-kW Relay Key with Interlock</td>
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<td>SE 3622</td>
<td>5-kW Relay Key with Interlock</td>
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<td>Motor Buzzer Complete (220-Volt Supply)</td>
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<td>SE 3633</td>
<td>Motor Buzzer Relay</td>
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<td>SE 3636</td>
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<td>SE 3637</td>
<td>Buzzer Motor Starter and Speed Regulator, 110 Volts</td>
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<td>SE 3638</td>
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<td>Buzzer Power Changing Resistance, 110 Volts</td>
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<td>Motor Buzzer Leads</td>
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<tr>
<td>SE 3669</td>
<td>Buzzer Power Changing Resistance, 220 Volts</td>
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</tbody>
</table>
About the Authors

Russ Kleinman (WA5Y)

Russ was born in Cleveland, Ohio, but grew up in southern California. He attended Stanford University as an undergraduate, and Case Western Reserve University in Cleveland for medical school. He did his internship and residency in General Surgery at the University of New Mexico in Albuquerque. After a few years in Ohio, Russ returned to New Mexico.

Russ, WA5Y, received his first amateur radio license in 1971 at the age of 16. He has been active in many phases of the hobby, but telegraphy has always been a primary interest. His major passion is the history of telegraphy and he has collected telegraph keys for more than 20 years. Although his collection of telegraph keys is extensive and varied, spark keys are his favorite, and he has spent the last several years pursuing information on spark key history. Much of this information is organized into the Spark Key Project, which is available on his webpage: http://www.zianet.com/sparks/index.html
Karen Blisard (N51MW)

Karen was born and raised in Lubbock, Texas, where she attended Texas Tech University as an undergraduate. She received her Ph.D. in Pharmacology and her M.D. from Case Western Reserve University in Cleveland. She did a residency in Pathology and a fellowship in Neuropathology at the University of New Mexico in Albuquerque. She was on the faculty at the University of Cincinnati Medical Center before returning to New Mexico to go into private practice in pathology.

Karen, N51MW, was first licensed in 1984, and earned her Extra Class license in 1986. She concentrates on CW and DX, and enjoys operating as a DX station. Her other hobbies include gem cutting and bird-watching. She helps with financial support of Russ's telegraph key addiction and is an excellent key-spotter.

Russ and Karen have been married for 25 years and live in beautiful Southwestern New Mexico. Their home at 6,700 feet at the edge of the Gila National Forest is shared with a border collie, three shelties, elk, mountain lion, bobcat, bear, deer, javelina, and various wild birds including humming-birds in season.
August Link

August (AJ) was born in Tartu, Estonia, in 1940. After the Russians invaded that country and killed his father, he and his mother fled to Germany, and then Los Angeles, where AJ attended high school and graduated from UCLA with a B.S.E. AJ worked as a systems engineer for Sprague Electric and North American Rockwell before starting his own company, Surcom Associates, in 1970. Surcom Associates is a major supplier of high power RF capacitors.

From an early age AJ was interested in historical items, and eventually that interest, plus years of selling military surplus equipment while attending high school and college, led to collecting military radios. This endeavor began with a WW I Signal Corps SCR-68 aircraft transeiver. His dedicated military equipment collection began with the addition of a 1917 Navy CF-99 tube-type motorboat set manufactured by the de Forest Telephone and Telegraph Company.

AJ has been collecting for more than thirty years. Initially he concentrated on American World War I vintage equipment and earlier military electronic memorabilia. Later, he expanded the scope of the collection to include the period between wars, and eventually to World War II equipment. His collection contains pieces dating from 1907 to 1945 and includes some representative foreign radios.
Wireless Specialty Apparatus  
Nomenclature Gone Awry

By Eric P. Wenaas

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Introduction

Wireless historians and collectors pride themselves on knowing and using the correct names and nomenclature of apparatus, particularly the historical icons of the wireless age such as the apparatus made by Wireless Specialty Apparatus Co. (WSA) in the early 1900s. It is amazing that the early WSA apparatus which was originally designated 1-P has been misnamed by radio historians for so many decades by using the letter "I" in place of the numeral "1," resulting in the erroneous designation I-P or IP.

The issue of the 1-P versus I-P designation was raised in the September 1968 issue of the Antique Wireless Association's Old Timers Bulletin with regard to the IP-76 receiver [1]. It was pointed out on the one hand that the venerable IRE founder Robert Marriott asserted in an IEEE Spectrum article in June 1968 that this receiver was originally designated the 1P76 and later called the IP76 [2], while on the other hand, the equally venerable civilian aide to the Navy, and RCA historian, George H. Clark claimed in an FM Radio-Engineering article in May 1943 that the first receiver was designated the "I-P-76, 1907 type" [3]. The AWA article ends by asking the question, "Who is right?"

I have found overwhelming and incontrovertible evidence that the Wireless Specialty Apparatus Co. originally used a system where model numbers for virtually all their early detectors and receivers began with the numeral "1," as in 1-P, and not the letter "I," as in I-P. The 1-P designation appeared on instruction manuals, order forms, contracts, and in correspondence to and from WSA. Further, WSA used this designation for at least eight years from its inception in 1907 until sometime after 1915—possibly as early as 1916, but no later than 1919—when the Company changed the designation to I-P.
That the I-P designation was in common usage by 1919 is clear from both contemporaneous advertising [4] and from the WSA catalog published that year, in which all receiver and detector apparatus for sale in 1919 was clearly designated I-P with the initial letter "I" [5].

The story of how and why this designation was changed is a fascinating one—coming together only after I reviewed and compared a number of historical documents found in the George H. Clark Radioana Collection, Archives Center, National Museum of American History, Behring Center, Smithsonian Institution [6]. In this article I review the incontrovertible evidence in the form of photographs, documents, and letters. Next, I analyze the George H. Clark article asserting that original designation was I-P-76. Then I offer a plausible reason for how and why and when the 1-P designation was changed to I-P. Finally, I tie up a few loose ends.

The Evidence for the 1-P-76 Designation

Shortly after the Wireless Specialty Apparatus Co. was formed in 1907, the company began to manufacture a line of receivers for the Navy designated 1-P-76. This receiver was improved upon from time to time, but rather than giving each improved receiver a new designation, WSA distinguished among sets by using the year in which it was developed in conjunction with the word "Type," so that the first set manufactured in 1907 became the 1-P-76, 1907 Type, the next version manufactured in 1908 became the 1-P-76, 1908 Type, etc.

WSA made at least nine distinct versions of the Number 76 receiver between 1907 and 1917 including Types 1907, 1908, 1909, 1912, 1913 (two versions), 1914, 1916, and 1917—although not all of these sets were manufactured in quantity. Four of these receivers including Types 1907, 1908, 1912, and 1914 are pictured in the 1919 WSA catalog [7], and several of them are also pictured elsewhere [8]. Two versions of the 1-P-76 were developed in 1913, although they were almost certainly not produced in quantity. The two 1913 Type receivers, which apparently have never appeared in a published document, should be of interest to the WSA enthusiast (Figs. 1 and 2).

Virtually all of the WSA receivers had name tags affixed to them with the WSA designation, so one might think that it would be a
Figure 1. One of the two versions of the 1-P-76 developed by WSA in 1913 (Radioana Collection, Smithsonian Institution).

Figure 2. A second of two versions of the 1-P-76 developed by WSA in 1913 (Radioana Collection, Smithsonian Institution).
simple matter to put the issue of the 1-P versus I-P designation to rest by examining these name plates. Unfortunately, this is not the case because a sans-serif font was used on virtually all the name plates of the early sets. Consider, for example, the 1912 version of the #76 (Fig. 3), which has a name plate typical of most of the early name plates used on WSA receivers. A close-up view of the name plate from this receiver reveals the sans-serif designation **TYPE I-P-76** (Fig. 4). Thus, one cannot tell whether the first character is a "1" or an "I" from the name plate alone. This same type of sans-serif font was used on most if not all of the early receivers, detectors, and other apparatus manufactured by WSA.

The most convincing evidence regarding the 1-P designation comes from the instruction manuals that accompanied these receivers, two of which are shown here (Figs. 5 and 6). It is clear beyond any doubt that the 1911 and 1912 versions of the #76 receiver were indeed designated 1-P-76. The characters on the instruction manuals have serifs which clearly show the initial character to be a "1." Similarly, the 1907 version of the instruction manual carries the 1-P-76 designation as well, although it is not quite as clear as the two examples presented here.

The instruction manuals are not the only direct evidence of the 1-P designation, however. There are scores of documents written by WSA personnel—many on WSA stationery—spanning the period from 1907 to 1914 referring to various versions of the 1-P-76. Two striking examples taken from the *Radioana Collection* are letters between WSA personnel, one from Philip Farnsworth to Col. John Firth dated February 13, 1909, and the other from WSA President William H. Seabury to Philip Farnsworth dated June 2, 1914 (Figs. 7, 8, and 9). In each case, the correspondents specifically refer to the 1-P-76 in which the first character is clearly a "one" and not a capital "I." (Fig. 9 is an enlargement of the section of Fig. 8 showing the receiver designation.) These three individuals (along with engineer Greenleaf W. Pickard) were the principals in WSA in the early years, and so their pronouncements were the final word.

The evidence presented to this point has focused on the 1-P-76 receivers, but there is also overwhelming evidence of a similar nature for all early WSA receivers such as the 1-P-105, 1-P-111, and 1-P-156, and a multitude of detectors. The detectors as a category
are most interesting because they introduce another level of complexity to the issue due to the variety of different nomenclatures observed on various nameplates, such as TYPE I.P. 81, TYPE-I-P.-176, and TYPE 1-P-89. Nevertheless, there are scores of early documents in the George Clark Radioana Collection that reference or list numerous WSA detectors, and for all receiver and detector apparatus that have two initial characters followed by two or three numbers, the initial characters are 1-P and not I-P. One such document is shown here listing two receivers and six detectors, all of which have the initial 1-P designation (Fig. 10).

The George Clark Article Explained

Given the massive evidence that the early receivers were desig-
nated 1-P-76, it is difficult to understand how George Clark—who had first-hand knowledge of the 1-P-76 receiver as a civilian aid employed by the Navy—could have written an article asserting that the #76 receivers were originally designated 1-P-76. George Clark's article first published in the May 1943 issue of *FM-Radio Engineering* and reproduced in the AWA *Old Timers Bulletin* clearly stated:

"The complete story behind this model [IP 501A] takes us back to the early days of the wireless art. In 1907, the Wireless Specialty Apparatus Company, of Boston Mass., made, among other specialties an efficient, compact receiver, designated by Professor G. W. Pickard. It was marketed under designation 'I-P-76, 1907 type'.

The prefix 'I-P', soon changed to 'IP' by popular rechristening, was the identification mark for all Wireless Specialty products of those days. For example, there was the I-P-200 silicon detector and the I-P-306 audibility meter. The designation '76' was given to all receivers. Redesign took place every year, culminating in the 'double-decker, a
short- and long-wave receiver of an upper- and lower-berth form, in 1914" [9].

This article was quite inexplicable until an original signed draft of Clark's article dated April 7, 1943—just prior to its publication in May 1943—was discovered in the Radioana Collection (Fig. 11). It turns out that the first page of this draft is slightly different in detail—but in a very significant way—from the published version. The signed draft clearly states the original designation for all WSA products began with the number "1" and not the letter "I":

"In 1907, the Wireless Specialty Apparatus Company, of Boston Mass., made among other specialties an efficient, compact receiver, designated by Professor G. W. Pickard, which was marketed under the trade name of 1-P76, 1907 type. The prefix '1-P'—very soon changed to 'IP' by popular rechristening, was the identification mark for all WSA products of those days, as for example 1-P-200 for a
Figure 7. It is difficult to see in this much reduced image, but this letter from Philip Farnsworth to Col. John Firth dated February 3, 1909 uses the designation 1-P-76 with a “1” as the first character to describe the receiver (Radioana Collection, Smithsonian Institution).
Figure 8. A letter from WSA President William H. Seabury to Philip Farnsworth dated June 2, 1914 also uses the designation 1-P-76 with a “1” as the first character. *(Radioana Collection, Smithsonian Institution)*. Figure 9 is an enlargement of the center section.
Figure 9. The small size of the fonts in the previous figures (which are full-page documents reduced greatly in size) makes it difficult to discern the characters. In case there is any doubt in your mind about the previous figures, here is an enlargement of the center section of the letter shown in Fig. 8. The first character of the receiver designation is definitely a “1.” Typewriters of that era typically used the same key for the numeral 1 and the lower case L. (Compare the 1 with the lower case L in “Aerial.”) Invariably, the upper case “i” had a serif on its top and bottom (I), therefore, an “i” would not be confused with the numeral 1.

Thus, the 1943 article by George H. Clark is easily explainable as an editorial blunder. The designation 1-P appearing in Clark’s original signed draft was changed by the editor to I-P before publication, who obviously thought—as most people did by 1943—that all WSA receivers had been designated I-P from the outset. Clark’s intent to use 1-P is underscored by his deletion of the I-P designation in favor of 1-P, a change Clark made in his original draft which can be clearly seen in the accompanying reproduction of the first page (Fig. 11).

The cynic might suggest that the typographical error was actually in George Clark’s draft, that the editor corrected the text, and that George Clark agreed to the corrected text as published. This interpretation makes little sense, because then the two paragraphs in Clark’s article would be all about how a dash was dropped between the “I” and the “P,” something that was not “very soon changed” or changed “by
Figure 10. Another document from many WSA papers in the Radioana Collection. It lists early WSA apparatus, including receivers and detectors, and again, a “1” is the first character, just as in the enlargement in Fig. 9 on page 34.
Figure 11. The first page of the original manuscript signed and dated by George Clark. There is no ambiguity here. Clark believed that the first receiver manufactured by WSA was sold under the trade name 1-P-76, 1907 type, and that the designation “1-P” was later changed to “IP” (Radioana Collection, Smithsonian Institution). Page 4 of this document was signed and dated by Clark on April 7, 1943—shortly before its publication in May 1943.
popular rechristening," as he asserted. The dash between the I and P appeared in WSA advertisements as late as 1919, in the WSA catalog of 1919, and on WSA name plates right up until the time RCA signed the agreements with United Wireless and WSA in early 1920, at which time RCA became responsible for marketing WSA products. It was RCA who first dropped the dash between the I and the P in its advertising and on the name plates of equipment manufactured by WSA for RCA circa 1921—so the dash was not dropped "very soon" and certainly not by "popular rechristening."

The Change to I-P: How and Why and When

There is still a loose end or two to this story, such as, how and why and when did the change from "1" to "I" come about? The key to how the designation was altered—and how the alteration has gone virtually unnoticed by collectors and historians alike—is the sans-serif print type that WSA used on the name plates, which make it all but impossible to distinguish between the numeral "1" and the letter "I." If the initial "1" on the equipment name plates had been stamped with a serif font, it would have been a constant reminder of the 1-P designation to the many collectors over the years who possessed early WSA detectors—if not one of the very rare 1-P-76 receivers.

While the san-serif font explains why the change has gone virtually unnoticed for many years, it does not explain how the change came about in the first place. The only real clue as to how the change occurred is the comment in George Clark's article that it came about by "popular rechristening." Since the Navy was the major customer for the 1-P-76 as well as other WSA apparatus, it is safe to assume that the Navy had a hand in the rechristening.

According to George Clark, the Navy developed a uniform numbering system for all of its radio equipment in 1915, and it is likely that the implementation of this new system provided the impetus for the popular rechristening. In fact, it was none other than George H. Clark who was tasked to develop the new type numbering system for the Navy. This numbering system for equipment began with two or three letters followed by a type number. Each company was assigned a different set of letters for sets they designed—Wireless Specialty was assigned the letters CR for the new equipment they designed, and the letters S.E. for equipment designed by the Navy's Bureau of Steam Engineering
and manufactured by WSA and other contractors, as well. For example, a later version of the #76 bears the designation CR-1917 (Fig. 12). An annotation initialed by George Clark on this photograph indicates that it was also known as a 1-P-76, Type 1919 as well as an I-P-77. If Clark's annotation is correct, then the change from "1-P" to "I-P" must have occurred later than 1916.

After this new system was put in place, there must have been a natural bias towards changing the first two characters of the WSA equipment from 1-P to I-P to conform to the general trend in the industry to use a nomenclature in which the first two or three characters were letters. This change would have been particularly easy to make for WSA apparatus since the initial character on existing WSA name plates could easily be interpreted as either a "1" or an "I."

Clark's view is supported by the pattern of correspondence between WSA and its customers—primarily the US Navy, but also other entities. Prior to 1912, all WSA documents and correspondence in the Radioana Collection uniformly used the 1-P designation. From 1912 to 1914, the Navy began to use the I-P designation in correspondence and contracts with WSA, but only very occasionally; most of the time the Navy continued to use the 1-P designation. However, the use of the I-P designation in correspondence with WSA increased in frequency in 1915 when other entities such as the Greek Navy began to use the designation as well (Fig. 13). All the while, WSA continued to use the 1-P designation in documents and correspondence.

However, in 1916, WSA produced a version of the 76 which appears to use the letter "I" as the first character of the designation (Fig. 14). If so, then WSA must have seen the wisdom in avoiding confusion by changing the designation to correspond to the common usage by its customers. The 1916 receiver bore the designation "TYPE I.P.76,16" (Fig. 15). This appears to be the first time that a 76 receiver had a designation using dots rather than dashes in conjunction with the 1 and the P, suggesting both are letters. Also, a serif font was used for the numeral "1" in the designation, and so if the first character had been a "1," it would have had a serif like the rest of the numbers in the designation—but it does not.

Unfortunately, no other documentation has been found to support the 1916 date, nor has any documentation been found to determine the date with more precision. All that can be said with any certainty at this point is that the change occurred no earlier than 1916 and no later than
Figure 12. This later version of the #76 bears the designation CR-1917, but the hand-written notation by George Clark indicates that it was also called the 1-P-76, Type 1919 as well as the I-P-77.

1919, the date of the WSA catalog in which the I-P designation was used extensively.

The 1919 Wireless Specialty Catalog

Another loose end to this story is the historical review in the 1919 WSA equipment catalog in which four of the early 76 receivers dating from 1907 to 1914 are labeled as I-P-76 receivers rather than 1-P-76 receivers. If the early receiver types were really designated 1-P-76 with a "1," then why were the four early models identified as I-P-76 receivers in a catalog published by no less than the manufacturer itself?

There are several possible explanations, one being a typographical error or oversight, another being ignorance on the part of the author or editor of the catalog, and a third being that it was easier to refer to the earlier types as I-P-76 receivers rather than having to explain why the older receiver designations were different than the newer ones being
Figure 13. By 1915 the correspondence received by WSA using the designation I-P (with the letter “I”) had expanded beyond the U.S. Navy to include other organizations such as Greece’s Royal Hellenic Navy (Radioana Collection, Smithsonian Institution).
Figure 14. The 1916 version of the 76 receiver as shown here appears to be the first receiver in this series assigned a designation with "I" as the initial character. A close-up of the tag is shown below. (*Radioana Collection*, Smithsonian Institution).

Figure 15. Close-up of the front panel of the receiver above, with I.P. as the lead characters. (*Radioana Collection*, Smithsonian Institution).
offered for sale in the remainder of the catalog. None of these explanations was entirely satisfying or supportable until it was realized that more than half of the equipment photographs in this venerable catalog were erroneously labeled! To see that this is true, one only has to compare the designations on the name plates in the photographs with the designations in the titles used by the authors and editors of the catalog.

Consider, for example, the photograph of a detector at the bottom of page 36 of this catalog which is represented to be an I-P-201 (Fig. 16). A close examination of the name plate in this photograph reveals that it is actually a TYPE 190 detector manufactured circa 1910. While WSA did manufacture a TYPE I-P-201 detector circa 1919 that was similar to the TYPE 190, it is not the one pictured in the catalog. The actual TYPE I-P-201 detector is clearly different from the TYPE 190 in several respects including the engraved nomenclature, different binding posts, and lack of threads on the small cylindrical element holding the cat's whisker (Fig. 17). Similarly, all of the other detectors pictured in the catalog are mislabeled: the detector labeled I-P-200 is actually a TYPE 176, the Type I-P-202 is actually a TYPE I-P-155 C first manufactured by WSA long before the I-P nomenclature could have been introduced, and the detector labeled I-P 203 is actually an S.E. 183-A detector manufactured by WSA for the Navy.

Mislabeling was not limited to the detectors. The receiver labeled Type I-P-501 on page 33 is actually the Navy's Type SE-1420. The same picture used in this catalog—right down to the dial settings and the grain in the wood—is pictured in Sterling's book *The Radio Manual*, where it is correctly labeled the SE-1420 [10]. The I-P-501 receiver actually had six binding posts at the top to which a load coil may be attached (Fig. 18). The I-P-77 shown on page 34 was actually a CR-1917, the Navy version of the I-P-76 according to George Clark (Fig. 12). Other types of equipment are mislabeled as well, including transmitters and other transmission equipment.

The only logical explanation for the wholesale mislabeling of equipment is that much of the equipment they intended to sell did not exist at the time the catalog was prepared circa 1919. It appears that WSA decided to market a line of wireless apparatus to experimenters and amateurs, most likely to make up for the loss of significant government business after WW I ended in 1918. To execute this
Figure 16. The detector labeled I-P-201 in the 1919 WSA catalog shown here is mislabeled. It is actually a Type 190 detector manufactured circa 1910 [5]. In the original image in the catalog, you can easily read the Type number on the label, and it says “Type 190.”

Figure 17. This actual I-P-201 detector (from my collection) manufactured circa 1919 is based on the Type 190, but is clearly different in detail.
Figure 18. The WSA I. P. 501 receiver. The receiver pictured in the WSA catalog for 1919 and labeled I-P-501 is not this receiver, but is actually an SE-1420. The label of this receiver is shown below.

Figure 19. The nameplate for the I.P. 501 in Fig. 18.
strategy, they must have decided to modify and rename existing equipment developed by and large for prior government customers. The catalog must have been prepared in advance for marketing purposes before WSA had an opportunity to modify and manufacture much of the equipment with the new designations, and so they photographed existing equipment with the old designations for illustrative purposes, labeling them with the new designations. Only later did they actually manufacture and sell the modified equipment bearing the new designations.

The wholesale mislabeling of the equipment pictured in the catalog without the slightest comment or explanation—for whatever reason—strongly suggests that the authors and/or editors were not clear thinkers, did not pay attention to detail, and had little or no regard for historical accuracy. Given the wholesale mislabeling that occurred, it should be no surprise that the authors and/or editors also mislabeled photographs of the early 1-P-76 receivers in this catalog.

As an aside, misrepresentations of historical facts and photographs have a way of propagating themselves. In this case, photographs of the four detectors in the WSA catalog were reproduced by Maurice L. Sievers in his excellent and widely distributed book, *Crystal Clear* [11], where labeling errors in the WSA catalog were also repeated: the detector labeled I-P-200 is actually a TYPE 176, the detector labeled Type I-P-201 is actually a TYPE 190, the detector labeled Type I-P-202 is actually a TYPE I-P-155 C, and the detector labeled Type I-P-203 is actually a TYPE S. E. 183-A. Also, the set labeled Receiver, Type I-P-501 on page 17 is actually an SE-1420. Similarly, the photograph of the SE-1420 in the WSA catalog was reproduced in the early 1922 RCA catalog, *Radio Enters the Home*, where it was mislabeled as an IP-501, and described as being "equipped with six binding posts...to which loading coils may be attached," but of course, the SE-1420 pictured does not have the six binding posts for loading coils referred to in the text [12].

**Interference Protector**

A final loose end has to do with the occasional assertion that IP in the WSA equipment name stands for "Interference Protector," presumably because of the highly efficient loose coupling system which minimized interference [13]. Given the fact that the original designation was I-P, it could not have originally stood for interference
protector, and given the fact that the name for all WSA equipment—including detectors, audibility meters and other apparatus—was changed by popular rechristening circa 1916-1919, it is highly doubtful that it was changed to stand for "interference protector." The preponderance of the evidence suggests that IP does not stand for anything.

Summary

There is overwhelming evidence that the sans-serif I-P designation found on WSA apparatus including receivers, detectors and other apparatus developed before 1916 stood for 1-P and not I-P. Sometime after 1915—possibly as early as 1916, but no later than 1919—WSA changed the designation of their apparatus to I-P, although much of the apparatus continued to be marked with the sans-serif designation I-P even after 1919.

While it is certain that the designation was changed, there is some uncertainty regarding the exact date when this change occurred. A photograph of the 1916 Type receiver suggests that the change was made in 1916, but the lack of any supporting evidence in terms of WSA documents is troubling. A second possibility is that the change from "1" to "I" was made in 1919 at the time WSA published their catalog, a catalog in which they re-designated much of the equipment they had manufactured at an earlier date for government customers.

Whether or not the correct name for these early receivers will be used in the future cannot be predicted. Once a tradition is established, it is difficult to change. Further, without knowing the exact date when the change occurred, it is difficult to determine the correct designation for equipment manufactured by WSA between 1916 and 1919.

References and End Notes


6. George H. Clark Radioana Collection, a collection of items concerning the early history of radio deposited at the Smithsonian Institution in the Archives Center at the Natural Museum of American History, Behring Center, in Washington, D.C.


12. Radio Enters the Home, (New York: Radio Corporation of America, Marketing Department) June 1, 1922


About the Author

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Dr. Wenaas retired in 2002, and since that time has focused on completing his extensive collection of receivers marketed by RCA in the 1920s, as well as American and French crystal sets. He has been interested in collecting antique radios and crystal sets since his youth when he experimented with radio devices and repaired radios and televisions as a hobby. In the last few years he has undertaken a large project to research and document early RCA history in general and the receivers marketed by RCA during the 1920s in particular. He has one of the most extensive collections of early Radiolas and other receivers made for RCA by Wireless Specialty Apparatus, Marconi, Westinghouse, and General Electric. He is a past member of the IEEE and a current member of the AWA.
20th-Century Evolution of the Submarine Telegraph
By Ludwell Sibley
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Introduction

Much of the early history of submarine telegraph cables is laid out in Bill Holly’s recent study and bibliography [1]. However, it may helpful to review developments in the cable art in the 1920s-1950s that yielded profound improvements in operating speed. This enlarged capacity was essential to the cable owners in fending off competition from the emerging radiotelegraph carriers and in handling the expansion of intercontinental traffic. The original transatlantic cable operated at only two or three words per minute. From then to the 1920s, the operation of a typical cable meant a receiving operator skillfully reading the vague meandering of an ink trace on a paper ribbon at perhaps ten words per minute. By the mid-1950s the typical cable was a multiplexed facility with receiving reperforators spewing out five to eight streams of punched paper tape at 60 WPM each.

Loading

In 1899 Professor Michael Pupin of Columbia University and Dr. George Campbell of the AT&T Company independently developed a scheme for improving transmission over a cable or open-wire line. (Dr. Pupin is perhaps better known today as mentor of and co-researcher with Dr. Edwin H. Armstrong of FM fame.) Physicist Oliver Heaviside had proposed the idea in 1887 but had failed to obtain usable results. Recognizing that the shunt capacitance of the conductors substantially degraded performance, Pupin’s and Campbell’s solution was to add inductors in series with the conductors at uniformly spaced points along the line. Pupin was able to show time-priority over Campbell and thus won the competition for a patent [2]. AT&T, knowing the value of Pupin’s invention, immediately bought rights to use it.

Loading can be done on this lumped basis, or in a distributed fashion, with a magnetic alloy wrapped around the conductor. In long-line terrestrial telephone service, the loading was always lumped. Applied to heavy-gauge (165-mil) open wire, it reduced transmission loss enough to make New York - Denver service possible in 1911. Used on cables of
16-, 13-, and even 10-gauge wire, it allowed “stormproof” service between Boston and Washington in 1914. In neither case was a repeater or other “gain device” used.

The engineers of AT&T and the Western Electric (WE) Company recognized about 1917 that loading would be helpful on submarine cables in offsetting the gross signal distortion caused by the cable resistance and capacitance. As an example of the latter, the San Francisco - Honolulu cable of the Commercial Pacific Cable Company, 2,277 nautical miles long, had a series resistance of 4,975 ohms and a shunt capacitance of 875 (!) microfarads [3]. Transmission through such a cable would benefit from a substantial increase in series inductance. The same principle applied to submarine telephone cables: the three Key West - Havana telephone cables of 1921 were continuously loaded with wrappings of iron wire around their center conductors.
The AT&T and WE companies were hardly in the submarine-telegraph business, but AT&T had controlled the Western Union Telegraph Company (WU) between 1910 and 1914. Development of submarine loading would represent an opportunity for revenue from licensing the technology. In addition, AT&T in the early 1920s had it in mind to open transatlantic telephone service, preferably by a choice of radio (for low cost) and loaded cable (for service quality). If a loaded telegraph-style cable could be redesigned for more bandwidth, a suitable voice facility would result. AT&T’s Bell Laboratories assigned significant talent to this research; a principal investigator was Oliver E. Buckley, previously a tube developer, and later president of the company.

Another development occurred in the early 1920s when G. W. Elmen of WE developed permalloy, a magnetic alloy of unusually high

Rear view of the Western Electric cable amplifier shown on the facing page. Wood cabinets were used to house equipment like this in those days.
permeability. It was far more promising than plain iron for either lumped or distributed loading. A nickel-iron alloy, in submarine use the material chosen was typically 78.5 percent nickel, with some manganese added to improve ductility. It was applied as a tape of six-mil thickness spiraled around the center conductor. The inductance of the resulting cable was 54 millihenries per nautical mile, or roughly 30 times the inductance of a non-loaded cable.

WE built a lump-loaded artificial line simulating a loaded cable of 1,700 nautical mile length and tested it in the laboratory in 1920. Western Union’s engineers were impressed enough with the results that, with permalloy available, a 170-nautical mile loaded field-trial cable was laid, looping out from Bermuda and back. It performed according to prediction. Licenses were issued, WE made the permalloy tape, and WE engineers provided application assistance to the cable manufacturer. A burst of construction took place beginning in 1924, and by early 1928 seven loaded cables were in operation. They totaled 15,000 nautical miles, or about 5 percent of the total length in use worldwide at the time [4]. They were:

- New York to Horta, Azores, 2,328 nautical miles, for Western Union (WU’s “1HO” cable): the first operational loaded cable. Its U.S. landing point was Hammel (Rockaway Beach), Long Island.
- Cocos Island to Perth, Australia, 1,800 nautical miles, for the Eastern Extension Telegraph Co.
- Horta to Emden, Germany, 1,880 nautical miles, for the Deutsche Atlantische Telegraphengesellschaft.

Cables loaded with permalloy tape. Top: Section of deep-sea (lightly armored) cable from the New York - Horta project. Bottom: Cable core with tape partly unwrapped. (Bell System Technical Journal, April 1928.)
The routes of loaded cables as of 1928, described in the text, are shown in this map. *(Bell System Technical Journal, April 1928.)*

- New York (Hammel) to Bay Roberts, Newfoundland (the “2HM-BR” cable) and Bay Roberts to Penzance, England (the “4PZ” cable), 1,344 and 2,023 nautical miles respectively, for WU.
- Bamfield, British Columbia to Fanning Island and then Suva, Fiji, 3,466 and 2,054 nautical miles respectively, for the Pacific Cable Board.

The New York - Horta and Horta - Emden cables initially operated with special high-speed siphon recorders in conventional fashion. They were fast enough that by 1928 they were being multiplexed by time-division into five teleprinter-speed channels using the standard Baudot code. Four of those channels were tied together at Horta for direct New York - Emden service. The fifth terminated on the island for miscellaneous messages to be relayed to other destinations via the cables of other carriers, e.g., Italcable.

The two loaded transatlantic routes had almost as much capacity as the 16 non-loaded cables then existing. The New York - Penzance system ran at 2,500 letters per minute, while New York - Horta carried 1,900. By 1949, the New York - Penzance cable was carrying eight
teleprinter channels [5].

The Bamfield - Suva line paralleled an existing non-loaded cable, laid in 1902. At 1,200 letters per minute, it was four times as fast.

The faster lines gave the cable operators new strength in competing with the radio carriers, and made near-immediate rate reductions possible. They did not arrive soon enough, however, to prevent the merger of British communications interests into Cable & Wireless Ltd. in 1928-29.

A quirk of loaded cables was that, initially at least, they were not generally suited to duplex (two-way simultaneous) operation, as was common on land or non-loaded submarine lines. This was not a major drawback, as the message flow was rarely equal in the two directions at a given hour. The practice was to operate the cable eastward for a few minutes, then automatically reverse the system and work westward long enough to pass the accumulated traffic. It was possible, however, to “duplex” a cable with “tapered” loading, that is, with no loading for 100 miles or so at the shore ends, a relatively small degree of loading for the next 100 miles, and full loading for the deep-sea portion. The 1928 Bay Roberts - Horta cable had this construction.

No mention has been found of later loaded cables, although there may have been one or two others laid between early 1928 and the onset of the Depression. There was no chance of adding new cables during WW II.

**An Alternative to Loading**

The speed of a telegraph cable could also be improved by a simpler method—use more copper. In 1923 the Commercial Cable Company
laid a cable, “The Jumbo,” from New York to London via the Azores [6]. In one main section the weight of the center conductor was 1,100 lb. per nautical mile. That works out to a diameter of about ¼ inch - a copper rod across the sea. This brute-force approach gave a speed of 500 letters per minute. This was the fastest transatlantic performance prior to the installation of the loaded cables.

**Submarine Repeaters**

In 1946-47, WU considered obtaining additional capacity by converting its non-loaded cables to lumped loading, and developed a 300-millihenry coil and housing suitable to be handled with the machinery on a cable ship and able to withstand the sea-bottom environment [7]. The cable would be raised and coils spliced-in at intervals of three to six nautical miles, depending on the characteristics of the cable. This has the sound of a ticklish and expensive proposition.

A less expensive alternative arose about then—the submarine repeater. During WW II the British Post Office had added a vacuum-tube repeater to each of two existing telephone cables operating with multi-channel carrier systems, one from Anglesey to the Isle of Man and one across the Irish Sea. In the Isle of Man case, the channel capacity was doubled. The repeaters were at a shallow depth (only 50 fathoms or less) but proved the concept.

For telegraph purposes, the repeater was to be located 100 nautical miles or so from shore, at the receiving end of a one-way non-loaded cable. Since this last section of cable is

![Western Union submerged repeater, first version. (Electronics, January 1952.)](image)
the most exposed to atmospheric noise and to “crossfire” from other cables, the best place to add a repeater is just before the exposure. Such a location is at deep-sea depth, requiring strong pressure resistance. The unit was to be powered over the cable from the adjacent terminal.

The power supply for the repeater had to provide strong current regulation, to offset the large stray voltages and currents that appeared on the cable during magnetic storms [8]. These had been an impairment to telegraphy - both terrestrial and submarine - from the start. The effect arises in the expulsion of charged particles from the sun. As these near the earth, they induce voltages in the ground, that is, differences in earth potential between the ends of the cable. Voltages of 300 to 400 volts, slowly swinging from positive to negative and back, were not unusual. During one such storm in 1941, the stray potential on the Hammel - Bay Roberts cable measured 480 volts [9].

WU pioneered the deep-water telegraph repeater in 1950 by adding one to a cable between Bay Roberts and Sennen Cove (Lands End), England, 270 fathoms down. This was in the same year as AT&T’s laying of two new Key West - Havana telephone cables, each with three repeaters at depths down to 900 fathoms. By 1954, WU had repeaters in nine transatlantic cables [10].

Substantial details are available [11] on a repeater added in 1951 to WU’s “1 HM-BR” cable (Hammel to Bay Roberts). It lay more than 100 nautical miles from shore, at a depth of about 250 fathoms. Its

![Western Union submerged repeater, later version. (Western Union Technical Review, October 1954.)](image)
housing was a cylindrical steel case with two cable stubs extending out the top, quite unlike the in-line format used elsewhere. Electronically, it comprised a three-stage push-pull amplifier, transformer-coupled to the cable. It used triode-connected pentodes for all stages, with two tubes in parallel in each side of the output stage.

The designers were taking no chances on repeater failure. The unit contained a working and a spare amplifier, with a shore-controlled switch that chose either one. To permit reversing the cable or testing into it, the switch offered a bypass mode.

The choice of tubes (16 per repeater) was something of a surprise. RCA was WU’s favored tube source at the time, and so RCA’s high-reliability “Special Red” line of tubes (the 5693, etc.) would have been a contender. The British Post Office had developed ultra-reliable submarine tubes, and so had Bell Labs (the 175HQ, in use in the Key West - Havana repeaters). At the time, 175HQs had been on continuous life test since about 1936. But WU chose instead the WE 310A, a bread-and-butter type used in millions of sockets in Bell System carrier and repeater equipment. We may suspect that the tubes used were carefully selected after “burn-in,” but they were certainly of simple origin.

The repeater was intended for use at depths up to 1,200 fathoms, at hydrostatic pressures up to 3,000 psi. Most of the housing was oil-filled and operated at sea pressure, but the tubes were in four cylindrical steel pressure vessels.

The case for a submarine cable loading coil. (Western Union Technical Review, July 1957.)
The “1 HM-BR” originally operated at 83 WPM, but the repeater tripled that speed. Similar repeaters were installed off Penzance; Heart’s Content, Newfoundland; and other landing sites.

**Incremental Improvements**

Between the rapid leaps occasioned by loading and repeaters, a variety of improvements in detail raised the speeds of existing cables.

The receiving termination on shore had first been a mirror galvanometer, then a siphon recorder, then the Heurtley hot-wire “magnifier” and cable relays. Most of these were replaced, beginning in the 1920s, by tube-based cable amplifiers. These provided gain and equalization (signal shaping) to optimize the signal quality. They also provided low-pass filtering to reduce the effects of crossfire and atmospheric noise. They operated relays that fed repeaters. The latter reshaped and re-timed the incoming signal into a replica of the signal at the sending end. The amplifiers started out about 1925 as piano-sized wooden cabinets. They were of WE manufacture, replete with tennis-ball triodes and WE-style tube sockets [12]. (The U. S. Army Communications-Electronics Museum at Ft. Monmouth, New Jersey, at one time had one of the amplifiers from the Signal Corps Seattle - Sitka cable, as upgraded in the 1920s.) By the late 1940s they had evolved into pentode amplifiers in steel rack cabinets, probably made in WU’s shops.
As mentioned above, duplex operation was common on non-loaded cable before the advent of repeaters. The duplexing operation basically used a balanced Wheatstone bridge to separate the signal going into the cable from the one coming out. The degree of balance, and thus the degree of interference between the signals, depended on having a balancing network (“artificial line”) whose impedance closely matched that of the cable. The current going out was typically 10,000 times that coming in. The speed at which a duplexed facility can be operated thus depends on the balance. During the 1930s and 1940s it became possible to design much more accurate networks, giving an improvement in speed of perhaps 30 percent. Use of an oscilloscope to adjust the networks began in the 1940s, giving better results than the previous use of a mechanical oscillograph.

A small improvement in speed came from raising the sending voltage from only 50 volts to the range of 90-120 volts. It had previously been feared that higher voltage was dangerous to the cable insulation, but this modest increase proved harmless.

Faster cables with multiplex operation allowed establishment of circuits between new points and consequent improved service. An example was Western Union’s opening of a direct circuit from New York to St. John’s, Newfoundland in 1938 [13]. This eliminated physical relaying at Halifax, apparently by connecting two multiplex channels back-to-back at that point.

These innovations applied as much to competing firms like the Commercial Cable Company as to WU.

While the idea of lumped loading was rejected for refitting existing cables, it became a preferred way to replace defective sections of continuously loaded cable. Stock non-loaded cable with load coils was a satisfactory substitute for the original.

Both cable and radio companies suffered transmission impairment from magnetic storms. The same solar-particle bombardment that induced potentials in the earth tended to cancel the ionosphere, particularly at high latitudes such as the New York - England great-circle radio path crossed. The radio companies could offset poor ionospheric transmission to some degree by re-routing: if the high-latitude transatlantic path was unusable, they could send traffic south to Buenos Aires for relaying via an alternate path [14]. RCA Communications had a strong advantage over competitors like Mackay Radio & Telegraph Co. because it had both high-frequency and very-low-frequency facilities. If the HF systems were out, the nominally
obsolete VLF alternators at RCA’s station at Rocky Point, Long Island could usually get through. These operated at frequencies of the order of 20 kHz, where damage to the ionosphere was relatively light.

**Cablephoto**

As the prospect arose in the late 1930s of money to be made by transatlantic transmission of press photographs by radio, Western Union developed a competitive response—the cablephoto. The transmission loss of the New York-Horta cable was 58 decibels at 20 Hz and 72 dB at 40 Hz, but by applying heroic amounts of amplification and equalization it could actually be used to pass telephotos. The signal was passed on to England via a Horta-Penzance cable and again equalized. The total amplification, New York to London, was 263 dB. The system required removal of all other traffic from the cable for the duration of picture transmission. A full-sized photo (6 by 7 inches), transmitted via a rotating-drum scanner, took 20 minutes of line time. Commercial service began in 1939 [15] and was offered between 10 PM and 5 AM nightly, at a rate of $83 (in 1939 dollars) for a full-size image. This arrangement was far less flexible than radiophoto service offered by RCA Communications and other radio carriers, and seems to have faded into obscurity.

A cablephoto of the Yankee Clipper flying boat, after arriving at Southampton, as sent from London to New York. (*Tel. and Tel. Age*, May 1939.)
Competition Up To the End

Just as the cable operators improved their transmission speed, the radio companies developed their capabilities. By mid-1945, RCA had a multiplexed radio system operating between New York and London. Under favorable transmission conditions it gave eight channels at 60 WPM each [16].

The competition between telegraph cable and radio continued until transatlantic telephone cables and satellite facilities made the two irrelevant. (A single voice channel on the new facilities could be rented and divided into telegraph circuits at a total of 960 WPM.) One writer from the radio side of the international business [17] observed that the world mileage of cables rose about four percent per year over many decades up to 1912, about the time at which radio competition became important. Then it rose about two percent per year while radio was becoming a mature medium. After 1930 the mileage of abandoned cables exceeded that of new ones. The last cable landing at WU’s Heart’s Content station was abandoned in 1965.

References


13. “Western Union Opens New Direct Cable Circuit Between New York City and St. John’s, Nfld.,” *Tel. and Tel. Age*, Oct. 1938, p. 221.


**Other Reading**


**Other Reading - General**


**About the Author**

Retired after a long career with Bellcore, Ludwell Sibley is a writer in the area of antique electronics and old-time telecommunications with perhaps 200 articles in the *Old Timer’s Bulletin, Radio Age, the AWA Review, and Tube Collector*. He produces the latter for the Tube Collectors Association and previously edited the *OTB* and *AWA Review*. A registered professional engineer (electrical), he wrote the book *Tube Lore* and served as technical editor for the *Telecommunications Transmission Engineering*. He holds the AWA Houck - Documentation, Tyne, and President’s awards. Ludwell collects telegraph equipment, radios (civilian and military), literature, and tubes.
Radio Advertisement and Fashion

By Barbara Havranek

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I enjoy browsing through early radio magazines for the wonderful ads. Until I read this article, I had not thought much about the psychology behind ad design, and the rationale for the use of fashionable women in radio ads. In this article, in addition to presenting some great examples of early radio ads, Barbara Havranek helps us understand the motivation of the advertising people who created them. The original ads were in many cases 8½ by 11-inch size, or even larger, so some detail has been lost by reducing them to fit into this considerably smaller publication, however, they are still a delight to peruse. - Editor

Introduction

The age-old marketing adage is “Sex sells.” Early advertisers realized quickly that to catch the attention of a man, place a woman next to the product in the ad. The elegant woman in the Atwater Kent ad on page 66 catches one’s eye before the radio is noticed. If an ad also incorporates a woman wearing the latest fashion, it will generate interest not only on the part of the male, but will also interest female readers. The use of women in radio advertisements is a phenomenon that started with 1920s flapper girls and continues today. Frequently, publicity photos and ads feature an attractive woman standing next to a product when the photo could just as easily have been restricted to the product being presented. The two photos on pages 67 are good examples.

Early 20th Century Advertising Developments

The association of a product with fashionable and beautiful women started with Coca-Cola advertisements at the beginning of the 20th century. Their success influenced advertisers to utilize that format with other products. It would only be natural that the cutting edge of fashion would coincide with the cutting edge of technology, and in the 1920s, radio was the cutting edge of technology. Younger generations
This Atwater Kent ad appeared in the April 11, 1925 issue of *The Literary Digest*. Most readers, particularly male readers, would probably gaze at the woman before examining the radio.
Here are two good examples of publicity shots that include women simply to catch the reader’s eye. Both the NBC truck (above) and the transmitting tubes (left) could just as easily have been pictured by themselves. Presumably the publisher believed that by including the women, readers would be more likely to study the photos carefully.

Both photos appeared in the AWA Review, Vol. 5 (1990); the NBC truck was the cover photo.
are more receptive to change within all areas of their lives. Therefore, to appeal to the target market, early radio ads had to have a visual fresh appearance that reflected the rapidly changing world of that era.

During the 1920s the newly created Madison Avenue marketing firms reviewed the formats of radio ads from the early days of broadcast radio and found them lacking pizzazz. These early radio ads typically featured a straightforward approach involving an image of the product coupled with an almost encyclopedic-style listing of information about the product. Such ads may have been adequate for the geeks of the day, but were less likely to appeal to the general public as radios became more of a household item. Compare the dramatically different Fada ads on pages 70 and 71. The ad on page 70 is clearly in the first category, aimed at male radio hobbyists, whereas the ad on page 71 was obviously intended to create an impression of wealth, and appeal to a broader audience. It features a fashionable flapper in a fur-trimmed velvet Oriental-style evening coat, sporting her bob haircut, along with classic makeup of the time (thin eyebrows and lipstick), as she impatiently waits for the man in a tuxedo to finish his program. It is a classic example of an ad selling luxury. The couple obviously has a stylish house, and the very expensive $400 Fada Neutrola-Grand radio fits right in. The not-so-subtle message is, “Buy a Fada and become part of high society.”

A similar comparison can be made between the Eisemann ad on page 72 and the Freed-Eisemann ad on page 73. The Eisemann ad appears designed to appeal to technical types whereas the Freed-Eisemann ad is selling social prestige. (Note that there is no connection between these two companies in spite of the Eisemann name in common.)

As more companies created radios, the necessity for spicing up the ads to make the consumer remember the product increased as the market place became crowded with competitors offering similar products. The early plain ads needed a new freshness, one that would increase in popularity in the decades to follow, and that still exists in the 21st century when the advertising industry has reached its current level of sophistication. Advertisers would strive to create a desire for radio-related products that “one can not live without.”

Advertising companies became educators for the new technologies of the 20th century. Early ads focused on four main points:

- What the invention is
It was the job of the marketing department to polish the final advertisement and emphasize the “new look” of the radio to the general public. The main purchasers of radios were younger males. Therefore, many of these ads incorporated a fashionable young woman to attract males—flapper girls in the latest fashionable garments. It is only natural that if fashion were moving in a new direction, consumers interested in the newest rage—the radio—would be in the same demographic group. Women were in the house most of the time with appliances, so the link to the radio to comfort, inform, and entertain as they performed household duties, and the use of the flapper girl with modern clothes, would also catch the eye of women reading the radio ads.

Early radios resembled science experiments—complicated hookups of tubes, wires, and other discrete electronic components. As technology progressed, later radios were easier to use as well as more visually appealing. Mid-1920s radios were often housed in long rectangular wood boxes that enclosed the glowing tubes that sometimes had been exposed a few years earlier. Increasingly, upper-end late 1920s radios were enclosed in cabinets that resembled reproduction 18th century highboy furniture pieces. These elegant cabinets appealed to the female market.

Radio Advertisements

Advertising has been around in many forms since entrepreneurs first began to create products to sell. The style and development of advertisements has changed throughout the centuries. Ads of today are abstract advertising that started first in Europe with symbols that represented products. These progressive ideas were very different from the often over-enthusiastic or groundless claims of early American print ads. American advertisements switched from the promotion of things and realism to the selling of ideas, and that was accomplished through lush abstraction. [2] The Atlas horn speaker ad on page 74 with the woman’s head morphed into the speaker bell illustrates the use of abstraction.

With the rise of mass communication, companies and advertisers wanted to reach past their regional community to a national level.
This Fada ad from a *Popular Radio* magazine circa 1925 touts their Neutrodyne kits. Clearly aimed at the technically minded, it shows a fellow soldering connections and emphasizes technical details. Unlike the ad on the facing page, this ad would not likely appeal to the general public.
With the man in top hat and tails, and the woman in evening dress, this ad (also from a 1925 magazine) was designed to convince consumers that the most elegant people owned Fada radios. It seems to say, “If you buy a Fada, you deserve to be in high society.”
Pride of Possession—

Ownership of the new Eisemann Broadcast Receiver imparts a sense of keen satisfaction.

Little is left to be desired—not simply because of distinctive appearance, but by reason of the remarkable performance of the RF-2.

New distance records have been reported almost daily since the introduction of this latest receiver.

A transformer—coupled tuned radio frequency circuit is employed, with two stages of audio frequency amplification.

ASK YOUR DEALER
Descriptive Literature on Request

EISEMANN MAGNETO CORPORATION
William N. Shaw, President
46 Thirty-Third Street Brooklyn, N. Y.

This Eisemann ad for the Model RF-2 from a 1920s Popular Radio magazine is predominantly technical in its approach. Compare it with the Freed-Eisemann ad on the facing page.
In contrast to the less elegant Eisemann ad on the facing page, this elaborate 1926 Freed-Eisemann ad for the Model 40-C-30, which appeared in *The Golden Book Magazine*, stresses sophistication and wealth. Designed by well-known artist Franklin Booth, this pen and ink drawing projects dignity, and was undoubtedly intended to appeal to women.
This Atlas ad from a 1920s *Popular Radio* issue uses abstraction to suggest that the singer is just inside the horn speaker, implying that with an Atlas speaker, voices will come through naturally. Of course the actual frequency response of this Atlas and all horn speakers was rather poor.
Through mass circulation magazines information could be disseminated to all socio-economic levels and target markets in all areas of the United States. Therefore advertisements of the early 20th century were promoting a new type of democracy—a democracy of consumer goods previously unavailable to the masses. The ads took on social class identities and helped link products with class, circumstance, and aspiration. [3] Radio advertisements were placed in specialty radio magazines as well as in financial magazines such as Fortune having a predominately upper income male-based audience. But ads also ran in The Golden Book Magazine aimed at the female market. Radio ads in newspapers with a broad readership were aimed at a wide audience base.

During the late 1920s intense competition among radio manufacturers necessitated the importance of advertisements catching the eye of the consumer. Advertisements touted respectability, fame and glamour. The 1920s were a prosperous time and most Americans enjoyed a previously unequalled standard of living. Advertisements exhorted consumers to have a good time and to enjoy life. Consumption was respected and expected. [4] Hence the world of “consumerism” had arrived in America. Science and technology were viewed as the new religion of the day, and radios were definitely “high-tech.” Even component manufacturers tried to capitalize on this excitement. The woman shown in the Cutler-Hammer ad on page 77 seems amazed at what she is hearing on the radio.

Advertisements reinforced and promoted materialism that portrayed products as symbols of status, success, and happiness. Self-centered and artificial ideas and aspirations fuel the selling of products. These ads created the need for radio and made the public want to purchase a new radio—even if the consumer already owned one—to take advantage of newer styles, better performance, and easier-to-use radios. Initially, it was primarily hobbyists who used radios, but late in 1920, Westinghouse founded the first commercial radio station, KDKA, in Pittsburgh. Westinghouse’s primary goal for the station was to encourage sales of their radio sets. [5] Westinghouse saw the commercial potential for consumer radio, and their sales as well as those of their competitors accelerated.

The Use of Industrial Designers for Radios

During the 1920s companies began to employ industrial designers to
The publisher of this September 19, 1925 *Radio World* magazine wanted people passing by the newsstand to buy the issue. Why was the woman’s picture in the dial? Was it to say to the buyer, “Find the woman of your dreams through radio?” The original, in which the background around the woman was bright red, is even more striking.
Cutler-Hammer made parts such as rheostats rather than radios, but even component manufacturers used images of attractive women to convey the excitement of this new radio technology.
create radios that were reflective of the new “modern” look. Industrial design was a newly emerging field that represented the marriage of art and commerce. The industrial designer integrated the analysis of a product’s functional performance with the cohesive styling of a company’s identity.

The advent of the Modernism movement created radical designs that influenced industrial design of objects, the style of letters or fonts used in advertising, images, and the placement of the “right” people in these new advertisements. Due to sluggish sales from over production and poor designs, companies commissioned advertisements that went from promoting their product to the promotion of an idea. The aura of the image was more important that the utility of the object. For example, radio ads evolved from an emphasis on informing the consumer about technical features to reinforcing the concept that the radio consumer is on the cutting edge of technology—part of the young and popular crowd. Hence the use of the new and cutting edge flapper girl. For the consumer of the Great Depression the sleek modern advertisements added sparkle to an otherwise gloomy period of American history.

Changes of Social Attitudes of the Early 20th century

Many factors influenced radio and tube advertisements during the 1920s. After careful examination, it is apparent that these ads reveal much about society, the target market, and fashion. To understand why so many 1920s advertisements used images of flapper girls we must first examine social trends in the era during which the radio was created.

After World War I soldiers who had experienced radio for military communications brought their love of the radio to the mainstream market. Companies wanted to convey a new fresh appearance to young males. The radio was a “new-fangled item” that probably frustrated the older generation of the 1920s much as the computer frustrates today’s citizens who did not grow up in the digital age. So, just as computers are easier to market to young people today, radio advertising of the 1920s preferentially targeted the young male. The younger generation was killed in mass numbers during World War I and wanted to forget the past, and especially the war. Along with this carefree attitude came a looser life style as well as a receptiveness to embrace a brighter future. Technology, combined with the new-found prosperity that many Americas enjoyed during the 1920s, led to a change in the view
of technology as well as to changes in product advertising.

With the newer and looser moral values that arose from a repudiation of the repressive Victorian lifestyle, sexier advertisements were developed (although they may seem pretty tame by today’s standards). World War I coupled with the end of Victorian prudishness and uptight behavior led to more accepted open sexuality and modernity.

Images of the opposite sex to draw the eye to an advertisement can be traced to wood engravings of the 1850s. Heads of beautiful women were commonly found in advertisements to make the readers look and “read me first” and then read about the product. [6] After 1865 the attraction of sex in advertisements led to images such as exposed bosoms with deep cleavage. With the advent of Victorian good behavior and questioning taste in advertisement, sex in advertisement took a hiatus until the sexual revolution of the Roaring Twenties, when clearly respectable standards were falling fast and the new attitudes were embodied in the flapper girl.

Advertisers used sex to attract male customers by using smart young women who leaned on cars, drove speedboats as their hair blew in the wind (like the Fisk Tire ad on page 80), or accompanied men in tuxedos and three-piece suits to elegant parties (like the Fada ad on page 71). The idea was that the product in the ad attracted beautiful women, and therefore he should purchase that product. Interestingly, advertising researchers compiled data that indicated that nearly ninety percent of men remembered the product featured in an ad with models portrayed in suggestive situation, versus 37 percent that remembered the product with a naked model in it. [7] (Presumably, total nudity was just too shocking, and actually distracted from the product.) The Atwater Kent ad on page 81 shows a young woman at a party with a dress cut very low in the back—a style that might have raised eyebrows in that era. The trend of using the current version and vision of the sexy woman of the day is not only an effective marketing tool in advertising but is still with us today.

Many advertisements focused upon the division between the public male workspace and the private feminine home space. Women looked at the new radio advertisements because they noticed the newest fashions as well as realizing that they, too, could benefit from radio in the home. The Atwater Kent ad on this page shows a couple listing to the radio in rather dressy clothing even though most people would not dress up to listen to the radio at home. Most women were stay-at-home
Radios were not the only products for which advertisers used images of smart women. The woman in this Fisk Tire ad is obviously part of the 1920s equivalent of “the jet set.”
The woman in this Atwater Kent ad attending a party and hearing music from the radio next to her is wearing a dress with a very low cut back that would have been shocking in an earlier era. Until the 1920s, the back was well covered, but then it became a focal point for fashion designers. The prospect for the man to caress the woman's back during a slow dance had suddenly become a very sexy possibility. Accordingly, this ad should have been of interest to both men and women. It includes the slogan "Think of what is back of it!" Might that message refer to the woman as well as to the radio?
This image from a 1920s Atwater Kent brochure shows a happy couple enjoying their new radio. The man is wearing a suit and even has white spats on his shoes, and the woman is wearing a necklace and an elegant dress. Heaven forbid you should listen to the radio in jeans or a housedress!

full time mothers who could receive updated news broadcasts as well as ease the hours of working at home. The modern flapper girl could listen to the latest jazz recordings on the radio. Certainly it made sense to include these women in radio ads.

1920s radio magazine articles often focused upon the ease of use of the new radios. The Freshman Masterpiece ad on the facing page even suggested that kids could operate the new radio. The smiling woman in the Cutting and Washington ad on page 84 suggests that tuning is easy, even though that was often not the case.

A 1924 article entitled “How Do Your Wife and Radio Get Along?” addressed the issue of how radios and wives were sworn enemies.
This Freshman Masterpiece ad is a departure from the more typical ads of the era showing adults listening to radios. Many 1920s radio sets were complicated to operate, so this ad touts ease of operation by showing children using the radio.
This 1924 Cutting and Washington ad features an attractive smiling woman and conveys the message that radio is not just for males.
This excerpt from the article is an indication of how people in that era viewed the role of women and their attitudes towards new technology.

“Does the wife spend two-thirds of her time protesting the home being turned into a laboratory and workshop, picking up solder and wires from the parlor floor and wiping up battery acid from the library table? No. Not any more. Nowadays friend wife is as much interested as the husband in the wizardry and blessing of radio. Why shouldn’t she be? Radio’s place is in the home, generally speaking, and in the great majority of American homes, wives are in a position to enjoy radio even more than the men folk. The universal appeal for all classes of women, whether housewife or lady of leisure... The main reason why radio has become so popular with women is that it is no longer a complicated maze of wires and controls such as she used to see her husband struggle with in the early days when he strewed the house with paraphernalia and profanity. Circuits have been developed which required fewer operations and controls than ever before. The “radio widow,” who supposedly sits home and mopes and mourns while her husband neglects her and all her outside social life and listens to the radio, is a new stock in trade for the jokesmith...In the average family one would be more likely to find the women as ardently interested in the radio as the men. If there is any real rivalry with the radio, the man is more apt to be the loser than the woman.” [8]

The timing of this article coincided with the appearance of fashionable flapper girls in the new style of advertisements. These women were more than just a reflection of the latest styles—they were the intellectual and emotional embodiment of the new woman.

**The Flapper Girl of the 1920s**

Understanding what the 1920s flapper girl represented helps us understand why these images were so ubiquitous in 1920s radio ads. Webster defines flapper as “a girl or young woman whose conduct and dress are characterized by somewhat daring and boldness.” The flapper girl of the 1920s embodied more than a woman wearing the newest style. She was a forward sexy and modern woman that had never existed previously—a strong fashion statement that signified not only a new dramatic fashion trend, but also a break from the morals of
The woman on this October 25, 1924 Radio World cover typifies the flapper girl of the 1920s. Well-dressed, attractive, and self-confident, she was a different kind of woman from her predecessors, and radio advertisers exploited that newness.
the past. The *Radio World* cover shown on page 86 exhibits just such a woman. The flapper girl was a symbol of a strong independent woman who embraced the future, technology, jazz, and the desire to have a good time. That image was precisely what radio ad designers intended to convey.

The 1920s is often called the Jazz Age. It was characterized by modernity and a departure from the formality of the pre-World War I period, not only in mental, but also in physical constriction. For example the flapper woman was released from the constraints of the corset, and wore non-restrictive slips and flattening bras. To older women, not wearing a corset was unheard of, but the wearing of a bra was viewed as only what a “loose woman” would wear under her garments. The emancipated flapper girl is the result of various events prior to the 1920s. The most drastic influence was WW I and its effect on the way in which people thought about life. After WWI, Sigmund Freud introduced his sexual theories. The changing social roles of women resulted in a drastic change within the “young” generation. The hard-edged, self-asserting flapper girl displaced the soft beguiling temptress.

The independent nature of the 1920s woman was also the result of the war. The women the soldiers returned to were not the women of Victorian times. Women worked in place of men during the war and were now used to independence and a social life of their own that included sports, dancing, and drinking. Woman had money and spent it on leisure as well as fashion items. Hence the new liberated woman who would be most likely to attract the young male was the flapper girl, and radio ads reflected that. Models used in advertisements reflected newfound freedom with the parallel association of the forward woman with the forward radio.

To appreciate what led to the distinctive appearance of the women who appeared in 1920s radio ads, we need to appreciate how dramatically fashion changed in that era. The drastic change from long ankle-length to knee-length dresses was the result of World War I. During the war many women helped in hospitals. For ease of movement, Red Cross uniforms had mid-calf skirts. Many of the men who served in World War I saw these women in these uniforms, and thus had become accustomed to seeing women in these shorter garments.
Fashion changes were on hold during World War I because of sumptuary laws that prohibited waste of textiles needed for wartime use as well as the fact that factories had to focus their energy on wartime production. When fashion picked up again after the war, the silhouette changed from a flared to a tubular skirt or dress. Women were androgynous and strove to look as much like men as possible. The tubular look was coupled with the cylindrical body shape that attempted to create a youthful, boyish appearance with the elimination of curves and the dropping the waistline to the hips. Flappers wore “flatteners”—a girdle flattens the breasts and the hips to achieve the new mode of the boyish look.

Prior to the 1920s, leg exposure was unacceptable for women and never seen in fashion history up to that date. Women who showed their legs were usually actresses such as the Parisian Can-Can girls, saloon girls or ballerinas, who, until the 20th century were on the stage to entertain the masses and the rich older men back stage. “Nice” girls did not expose their legs. But by 1925 skirt lengths had reached the dangerous level of the knees. That prompted several states to introduce bills to fine and imprison women who wore skirts higher that three inches above the knee. For example, a bill proposed in Utah provided “fine and imprisonment for those who wore a skirt higher than three inches above the ankle.” In Ohio the legislature sought to prohibit any “female over fourteen years old to wear a skirt, which does not reach that part of the foot known as the instep.” [9] The outrage of the older generation against this modern woman was reflected in this kind of legislation. By including images of daring new fashions in radio ads, advertisers were taking a certain risk of offending consumers with more traditional ideas about what was proper. But the people most likely to purchase radios were those who were on the cutting edge of new trends.

By 1926, the androgyny silhouette was well established for the flapper girl. Women cut off their long hair to ear length and called their coiffure the “bob”. (The Workrite ad on the facing page and the Randolph Radio catalog cover on page 90 both prominently feature women in the latest bob haircuts.) The only distinguishing feature of a woman was the use of makeup of rouged lips, lipstick and penciled eyebrows. As seen in some radio ads, many women wore a bell-shaped small-brimmed cloche hat fitted closely to the head, pulled deep over the eyebrow, that framed the face.
The two women in this illustration by noted artist Sundalon both have bob haircuts. The ad, which appeared in a Saturday Evening Post in 1924, displayed a strong fashion statement for the time because long hair had always been symbolic of a woman’s femininity. The fashionably dressed woman asks, “Can we get those blues from Memphis?” The flapper girl is adjusting the radio dials, and the implication is that a stylish woman who is not a radio expert can master the art of tuning a radio like this Workrite (even though at the time tuning was a tricky two-handed chore).
The bob haircut and the low-cut dress would have attracted attention from both men and women in 1927 when this catalog was published.
Fashion changes quickly, therefore experimental ads were run in test markets to gauge their appear. The fashion advertisements of the early 1920s were one of the first commodities to be influenced by commercial modernism. Women were portrayed wearing cloche hats and knee-length column sleek dresses and men wore fedora hats and tapered suits that replaced the excessively decorative frills that had embellished the garments of the past. Fashion modernity was promoted in *Vogue* and *Harper's Bazaar* magazines, but also in other popular magazines that featured radio ads. Meanwhile, industrial artists such as Lucian Bernhard were writing articles like “Putting Beauty into Industry” in such influential magazines as *Advertising Arts*.

So, flappers expressed the new modern woman. They were represented in Hollywood movies and were consisted modern and glamorous. Stars such as Gloria Swanson and Joan Crawford were cast as fashionable 1920s flappers who inspired millions of women to emulate their clothes, hair, and cosmetics, as well as their lifestyle that included parties, smoking and drinking. [10] When the advertisers coupled the modern flapper girl with the new modern technology of the time,—the radio—the industry now had a powerful combination. Today's marketing campaigns strive to create that same kind of excitement.

Using flappers in radio ads and promotional materials was more than just an intent to place a woman in the ad to catch the man’s eye. These modern women were out in the work force just as the men to earn money to have an independent lifestyle, which their male counterparts had previously enjoyed.

**Post-1920s Radio Advertising**

The use of women in radio advertisements continued throughout the 20th century. Women in these ads continued to wear the most fashionable clothing and styles of the day. As the years progressed the garments in these ads not only reflected the clothing styles of the day, but also the role of women in society. While 1930s ads also often depicted glamorous women, the Depression put a damper on the theme of wealth and high society that was more common in 1920s radio ads. The Midwest ad on page 92 is typical of 1930s-style radio ads.
Midwest ad from the November 1937 Radio News and Short Wave Radio. With most families’ incomes suffering during the Depression years, companies like Midwest often emphasized price and value in their ads (“$39.95 less tubes”). But we still see a smiling woman in an evening dress. She has a hairdo of that era rather than the bob haircut of the 1920s flapper girls.

The advent of World War II led to patriotic ads where images were more likely to be of tanks or airplanes rather than elegantly dressed civilians. The Motorola ad on page 93 is a good example of that genre. When women were pictured, more often than not they were shown as factory workers, substituting for males drafted into the military. The 1945 Tobe Deutschmann ad on page 94 is typical.

Sexuality played a much larger role in post-World War II radio ads, typified by ads showing, for example, women in bikinis on the beach with a smiling man. Americans wanted to forget the past and wanted to focus upon a carefree and uplifting spirit—a normal reaction after the horrors of a war. The ads on pages 95 through 97 are representa-
This November 1944 *Fortune* ad shows a Motorola Handie-Talkie, and the text emphasizes its importance to the War effort. No sexuality in this ad!
This image from a Tobe Deutschmann ad from the February 1945 Fortune magazine shows how dramatically the war effort affected advertising. During the War, ads were almost exclusively patriotic in tone. They often showed tanks, planes, and soldiers, emphasized how U.S. radio manufacturers were helping to win the War, and told of how companies were poised to introduce a cornucopia of new products when the War ended. Instead of women in glamorous evening dresses, we see a housewife in a apron and a female mechanic carrying a huge wrench. During the War the L-85 clothing regulations limited available styles. To save cloth, these regulations dictated the width of skirts and hems and limited pockets. Men’s trousers could not have cuffs. Wearing the correct garment during the War was a patriotic act. So even the business woman third from the right is restricted to a form-fitting skirt with no extra frills. Glamour took a back seat to patriotism during the early 1940s, and radio ads reflected that feeling.

Today ad designers are striving to sell high definition TV sets, Ipods, cell phones, and other electronic gadgets. Determining what will best attract potential customers is still the name of the game. While the women in ads for today’s electronic products may not look much like the 1920s flapper girls, you will still see modern fashion
When this Motorola ad appeared in 1945, people’s attention was turning back to civilian life. Even though the sidebar still shows the Motorola Handie-Talkie, sexuality has returned to radio advertising. The man, likely a soldier or sailor who came back from the War, is on the beach with his best girl and is probably thinking about something other than the radio. The ad agency hopes, no doubt, that the customer will equate this Motorola radio with romance.
It's too bad the AWA Review is not printed in color, because this ad is truly dramatic when seen in color. The woman’s eye-catching dress is white with bright red leaves that seem to leap out of the page. This ad could just as easily have been limited to images of the radios, but like the flapper girls of the 1920s, this glamorous woman tends to make the magazine reader stop at this page and study the ad.
Zenith hoped that including shapely young women in swim suits would cause readers to halt at this page, and then also examine their new portable radio models.
This Fortune magazine ad for a high-end General Electric radio/phonograph console appeared just as WW II was winding down. This couple appears overdressed to be listening to the radio at home, but just as in the 1920s, radio manufacturers turned to the theme of elegance to sell their new models. Once again, the woman is shown wearing the current fashion.

and modern society represented in ways designed to convince buyers that they MUST buy the product shown.

References


**Photo Credits**

Thanks to Elinor Williams for providing many of the original ads from which the images in this article were scanned, including those on pages 66, 70 - 73, 76, 77, 81, 82, 84, 86. Others were scanned from old magazines and catalogs in the collection of Brian Belanger or were found on Internet postings.

**About the Author**

Barbara Havranek is a fashion history professor at Virginia Marti College of Art and Design. She is a board member of the Art Deco Society of New York, a web editor for Greensward.org - the Friends of Central and Prospect Park, and a vice president of the Fairview Park Historical Society. Barbara received her Masters of Art in the Conservation of Decorative Arts at the Fashion Institute of Technology in New York City. *The Influence of Bakelite upon the Technical, Social, Political, Economic, and Stylistic Development of Early Radios* was the basis of her Master's thesis, which is on file in the Library at the Fashion Institute of Technology. She has published two previous articles in the *AWA Review*, “The Bakelite Radio: An Icon of the 20th Century,” which appeared in Volume 14 (2001), and “The History of the Development of Radio Grille Cloth,” which appeared in Volume 15 (2003). She has published other articles on topics such as Bakelite items and fashion trends.

Barbara has served as an archivist at the Metropolitan Museum of Art, the Brooklyn Historical Society, the Calvin Klein Library, and Leffert’s Homestead Museum. She also served as a guest curator at
the Scarsdale Historical Society.

Her passion for collecting and researching old radios was instigated by her parents, Martha and George, whose many styles of radios in every room of the house intrigued their daughter at an early age.
Introduction

The research presented here was done in conjunction with a special AWA Museum display in 2001 called “Made In Rochester.” The proximity of the AWA’s Bloomfield, New York, Museum to Rochester, New York, naturally results in a large visitation by residents of that city and its surrounding area. The display came about as a result of my work in the Museum and annex, assisting in an overall inventory of the collection, and in organizing the annex parts room.

In rearranging annex storage space it became apparent to me that there were a significant number of artifacts identified as having been made in Rochester. It comes as no surprise that Bloomfield’s proximity to Rochester, which was also the home of the AWA founders, should result in the collection being rich in materials produced in that city specifically, and western New York state in general. Rochester is the late 19th century birthplace of the Eastman Kodak Company. By the time Marconi created wireless telegraphy Rochester was already home to a rich mix of scientists and technologists attracted by the photography industry.

I make no claims of being complete or definitive in terms of the various company histories. Other authors have written in-depth articles about individual radio manufacturers such as Stromberg-Carlson and Mignon. My aim was solely to identify as many Rochester-based radio companies as I could, and also to document linkages between people known to have been early ham operators and the establishment of radio-related commercial enterprises. Despite my hopes to the contrary I’ve found only a few hams directly involved in early radio entrepreneurial efforts, although many unidentified hams undoubtedly served in subordinate roles. In all cases I have taken an interest in the lives of the people involved, whether they were hams or not, and reflected on their place in the evolution of radio.
My most prominent resource for this study was the collection of city directories in the Monroe County Public Library and state directories of manufacturers, [1,2] trade directories, [3,4] and secondarily, newspaper archives. I’ve pulled contemporary advertisements from the Museum annex collection of popular magazines published by Gernsbach and other national publishers, as well as QST. For some of the material presented here I can make accurate attribution. In other cases I am unable to make definitive attribution of the source of information presented because at the time I gathered the information, I had no intention of publishing it, and hence did not note the sources. Since I am no longer a western New York resident it has not been practical for me to retrace all my steps to recover that information. My apologies for my lack of diligence in this respect.

I found the research work personally rewarding and educational. I encourage other AWA members everywhere to seek out similar data from their own hometowns, as I am currently doing in my new home of Wilmington, North Carolina.

My report begins with Stromberg-Carlson, probably the best-known of all the Rochester radio firms. An alphabetized index of all the companies and brands mentioned in this article is included at the end of the article.

**Stromberg-Carlson Telephone Mfg. Co. (1914 – circa 1961)**

Originally incorporated in 1895, the founding partners Alfred Stromberg and Androv Carlson sold their interests and the use of their names in 1902. The company was re-incorporated primarily as an equipment supplier to Rochester Telephone Company, one of the more successful of the non-Bell independent telephone companies. The history of Stromberg-Carlson has been documented by others, for example, Alan Douglas in his *Radio Manufacturers of the 1920s, Vol. 3*, (Vestal Press, 1991) and Ludwell Sibley (“Stromberg-Carlson,” *Radio Age*, February 2003). I will focus only on a few items that are part of the AWA Museum’s collection, and one ham who became a Stromberg-Carlson design engineer, Virgil M. Graham, 8BSG.

Even before WW I Stromberg-Carlson's management realized that telephone components such as capacitors and audio transformers that the company made in Rochester could also be supplied to the developing radio field. The Museum collection includes several of these, as well as WW I trench telephone/telegraph sets in leather carrying cases dated for the war years. After the war Stromberg-Carlson continued in its primary business as a manufacturer of telephone equipment, becoming the
supplier of choice for several other non-Bell, telephone companies.

The 1927 New York State Directory of Manufacturers states that Stromberg-Carlson employed 1300 workers in 550,000 square feet of floor space, headquartered at 1060 University Avenue. Their first home entertainment receiver was the Model 1 Neutrodyne in 1923. From this beginning until the mid-1950s the company maintained a reputation for exceptionally high-quality, premium priced radio, and in later years, televisions and hi-fi sets.

The 1923 city directory lists E. Gertrude Graham as the widow of Virgil M. Graham, and their son Virgil M. Graham, Jr., whose occupation in that year is given as student. Callsign listings for 1922 lists V. M. Graham at an Augustine Street address, with the callsign 8BSG. This appears to be Mr. Graham, Sr. Prior to 1923, Graham senior was a salesman for Hickson Electric Co. (see next company listing). By 1925 Virgil M. Graham, Jr. had become an assistant radio engineer (and later, promoted to radio engineer) at Stromberg-Carlson’s 1060 University Avenue address.

Among V. M. Graham, Jr.’s published articles are one titled “The Making of a Radio Receiver” in the November 1925 QST, and an engineering article titled “A Modern Design of Radio Receiver” in the August 1929 Radio Broadcasting. The latter article describes the design of the Stromberg-Carlson Models 641 and 642.

During World War II, Stromberg-Carlson again produced a wide variety of radio and telephone equipment for the armed forces. The Museum collection includes a BC-348-P aircraft HF receiver from this period bearing serial number 5383, indicating it was late in the production run.

Stromberg-Carlson was absorbed by General Dynamics Corp. in 1955 and ceased radio and TV production the following year. The two founders’ names are still carried in the industry today as Siemens-Stromberg-Carlson. Stromberg-Carlson no longer exists in Rochester, but its buildings are, for the most part, still in use, having been subdivided into many smaller light industrial and office operations. The 100 Carlson Road address that appears on many later set labels was recently home to a Kodak medical products division.
Hickson Electric Co. and Stations WHEC, WHQ, and WHAM (1921 - Present)

In 1918 Lawrence G. Hickson, at the age of 25, along with his father, operated an “Electrical Contracting and Auto Service Station” on Reeves Avenue off Summerville Road.

The Hicksons lived in the northern suburb of Irondequoit, and Lawrence was well known as an avid radio amateur. The Rochester newspapers of December 1920 describe a broadcast from his home station of a program of music that was received by listeners throughout Monroe County. The 1922 Call Books show two amateur station assignments to L. G. Hickson, 8BIX, at East Parkway, RFD Rochester, his home and personal call, and 8ARA at the Lake Avenue Baptist Church. I presume the latter call was a station under his control used by that church for religious broadcasts.

The 1922 city directory is the first appearance of the Hickson Electric Company, with Lawrence G. Hickson as President. In that same year classified business listings contain the first instance of the category “Radio Apparatus,” with a single entry of Hickson Electric Co. An advertisement in the same directory highlights “Electric Fixtures & Supplies” and “Radio Appliances” with the fixture showroom at 5 Summerville Road and office and store in the downtown business district at 11 Corinthian Street.

Hickson continued random broadcasting from 8BIX several times a week during 1921, and soon thereafter set up a transmitter in the Times Union newspaper building where, together with that newspaper’s publisher Frank Gannett, he continued irregular broadcasting under the station call letters WHQ. This lasted only about four months, until July 10, 1922, when WHQ’s last broadcast was reported in the Times Union. On July 11, 1922 that station became WHAM, operated by Frank Gannett and George Eastman, and located at the Eastman School of Music. WHAM was sold to Stromberg-Carlson in 1927 and went on to become a 50,000-watt clear-channel station that is still on the air today under the ownership of Clear Channel Communications Company.

An ad for Hickson Electric Co. on the same page of the Times Union that recorded the demise of WHQ highlights “Radio Apparatus and Installation.” Station WHEC (W Hickson Electric Co.) went on the air in 1925 from 36 South Avenue. Later it moved to the Terminal
Building on Broad Street and then on to the Rochester Savings Bank Building at 40 Franklin Street. WHEC survives today only as WHEC-TV, Channel 10.

In the 1920s, advertising for Hickson Electric Co. often contained the phrase “Rochester Radio Pioneers, Owners and Operators of WHEC.” Frank Gannett bought out Mr. Hickson’s interest in WHEC in October 1932. In March 1933 Hickson took his own life at the age of 40. Lawrence Hickson was certainly the pre-eminent radio ham and broadcasting pioneer in the Rochester area. His early interests as a ham operator began when he was still in high school and formed the basis for his lifetime career.

Cel-Met Products Company (1919 - Present)

This company was originally incorporated in 1919 as the Cellu-Metal Corp. with Archie G. Progin as president and William C. Heindl as Secretary-Treasurer. From then through 1926 its primary business was celluloid toys and novelties. It was located at 17 Elm Street. Members of the Heindl family continued as officers of the business into the mid-1980s.

In 1927 the company moved to 254 Mill Street, also the address of two other early radio manufacturers—Precise Manufacturing Co. and Haig & Haig Manufacturing Co. In 1928 the company name was changed to Cel-Met Products Co. with William C. Heindl as manager and offices located in Room 202 of the Graves Building. Manufacturing was still carried on at the 254 Mill Street location where they occupied 5,000 square feet of floor space and employed 25 workers. One of their products was headphones, and Fig. 1 shows the Cel-Met logo stamped into the back of a pair of headphones.

Over the next three years the company’s primary business was still listed as “Novelties.” In 1931 the directory entry for the Graves Street office identifies their primary business as “Auto Accessories Mfr.”

During the 1930s the company successively moved to 17 S. Water Street and 89 Allen Street, with William C. Heindl elevated to President. In 1938 the hyphen was dropped from the company name, and it still exists today as Celmet Products Co. at 1365 Emerson Street. Throughout this entire period no association of Cel-Met with any aspect of radio appears to have been publicized in spite of the
During the 1950s through the 1970s various members of the Heindl family held corporate officer positions. In the mid-1980s the company was sold to a group of private investors. Their current business is sheet metal stamping and assembly.

The AWA Museum collection has several pairs of radio headphones clearly stamped “Cel-Met Products Co. Rochester, N.Y.” I infer that these were made at the 254 Mill Street location sometime after 1927. Current company president Rodney Bohman, in a telephone interview, was unaware that his company had ever been involved in radio. He was appreciative of several photographs of his company’s headsets that I was able to send to him.

From the beginning of regular broadcasting by WHAM in 1922...
there were several companies manufacturing complete sets, kits of parts, or single components in Rochester for the developing consumer market. The next four companies are in this category.

**United Radio Corp. (1922 – 1928) and United Reproducers (1928 – 1931)**

Probably the best-known United product is the Peerless brand cathedral-style speaker, of which large numbers were sold.

Although later advertising for Peerless loudspeakers and headphones contains the phrase “Since 1921,” public records indicate that United Radio wasn’t incorporated until 1922, with a capitalization of $50,000, and doing business in “Radio Apparatus” at 15 Caledonia Avenue. Officers of the corporation were Selden E. May, President/Treasurer; Hugh Davis, Vice President; and Milton F. Bickford, Secretary. By 1927 the Caledonia Avenue site housed 75 employees in 7,000 square feet of floor space. All three officers were Rochester residents, and May was also identified as Treasurer of the Vacuo-Static Carbon Co., of which not much more is known. None were hams.

The ad shown in Fig. 2 is from *Radio News* for December 1923. It depicts both Peerless and Davis headphones and a Peerless double tuning coil, all manufactured at the Caledonia Avenue site. The AWA Museum collection includes several examples of each.

The 1926 McGraw-Hill *Radio Trade Catalog* also lists this company as a provider under the heading “SETS, Knockdown”, i.e., kits of parts. United Radio is known to have produced a single battery-operated table model receiver under the trade name Victory in 1925. Whether the Victory TRF set was marketed as a kit or manufactured complete or both is unclear. No contemporary advertising for sets under the names Peerless or Victory has been found to date.

In 1928 the company merged with Precision Products Co. of Ann Arbor, Michigan; Buckeye Cabinet Co. of Springfield, Ohio; and Newcombe-Hawley Co. of St. Charles, Illinois. The new company was called United Reproducers Corp. Officers were Selden E. May, President; Arthur T. Haugh, Vice President; Robert W. Schapp, Secretary; and E.P. Smalley, Treasurer. The Rochester facility was relocated to 25 Leighton Avenue, where a one-story cinder block
Figure 2. A United Radio ad from the December 1923 Radio News (p. 792). The Peerless brand name was later used on speakers.

building still stands today.

1928 is the year when lower priced “Light Socket” home entertainment receivers began to supplant battery sets. AC-powered sets, although more attractive for use in the living room than battery sets, frequently still did not include a built-in speaker at this time. Sets could also be purchased as kits, minus tubes, speaker, and cabinet, leaving the aggregation of these items up to the consumer. The merger that formed United Reproducers is significant in its attempt to bring
these three major components of home entertainment radios—chassis, speaker, and cabinet all under one corporate aegis.

In 1929 United Reproducers, again under the trade name Peerless, produced five console model receivers and a console radio-phono combination. Under the trade name Courier they produced a single table model, three console models, and two high-end console models employing their patented Kylectron electrostatic speakers. All were AC powered with built-in speakers and handsome cabinetry. It appears that these receivers were assembled into cabinets in Springfield, Ohio, with chassis made in Ann Arbor, Michigan, and electrodynamic speakers from Rochester. Fig. 3 depicts the Courier Model 653 console currently in the personal collection of AWA member Jim Berg. Fig. 4 is a reproduction of a Courier brochure depicting the Model 653 and two other consoles.

The Rochester city directory for 1929/30 identifies Rochester Auto Parts and Radio Corp. at the corner of Culver Road and Atlantic Avenue as the local distributor for Peerless and Courier radios. This is just two short city blocks from United’s Leighton Avenue site.

The “Made in Rochester” museum display also includes an example of the popular “Peerless Reproducer,” the small cathedral style cabinet containing a horseshoe magnet with armature-driven seven-inch-
diameter paper cone-type speaker intended for use with any radio receiver with sufficient amplification (Fig. 5). A larger electrodynamic version with self-contained power supply was also available.

By 1931 United Reproducers Corp. was out of business, a victim of the intense competition of the period early in the Depression. The last known address of United Reproducers was 999 E. Main Street. In 1933 a company called Unit Reproducers, with a primary business of “radio parts,” was established at this same E. Main Street address. It lasted until 1938. No information regarding this company’s products or how it may have been related to United Reproducers could be found. As noted on p. 131, Unit Reproducer’s building at 999 E. Main Street was later taken over by Mellaphone.

Mignon Electric Manufacturing Co. and Mignon Industries & Export Co. (1922 – 1929)

Ernest C. Mignon began his career in Elmira, New York, before World War I, where he established a wireless telegraph service and a
receiver manufacturing business. Lauren Peckham, in his *AWA Review Vol. 3* article on Mignon’s receivers, describes him as having “emigrated from his native Austria to Elmira, NY prior to 1910.” He was imprisoned as “an undesirable alien” when the United States entered the war, and did not return to Elmira after that war. The Ellis Island immigration database contains just one shipboard arrival for an Ernest C. Mignon on August 4, 1907 aboard the ship *Caledonia* arriving from Glasgow, Scotland. It indicates that this Ernest C. Mignon was single, 27 years of age, and would reside at a 6th Avenue address in New York City. The 1907 manifest does not indicate his country of origin. Records from March 29, 1909 show the arrival of an Ernst Mignon (note different spelling and no middle initial) from Barbados. I believe it was the same Mignon. The 1909 passenger named Mignon was listed as 29 years old, born in Hamburg, Germany, and having previously been in the United States in 1907-1908 at an East 79th Street address in New York City.

From these records I deduce that he was born in Europe around 1880 and arrived here in 1907, having had a pre-arranged host at the 6th Avenue address. Whether he was born Austrian or German isn’t
important. What the 1909 trip to Barbados was for is just one of several unresolved mysteries about Mr. Mignon.

Mignon’s first appearance in Rochester documentation occurs in 1922, when he is identified as the Vice President of the Mignon Electric Manufacturing Co., doing business in radio apparatus at 25 S. Water Street. Ray C. Howard is identified as the company’s president. Why the company should bear Mignon’s name while he apparently was not the head of the company may be a directory error or another of the Mignon enigmas. A 1922 magazine listing of new radio incorporations lists Mignon Electric Mfg. Corp. with $25,000 capitalization. Officers are E. C. Mignon, A. L. and R. C. Howard. (A. L Howard is Alice, Ray’s wife.)

In 1924 Mignon is identified as the company president and Benjamin M. Haag as its secretary-treasurer. (See also Haig & Haig Mfg Co.) The 1925 radio store section of the AWA Museum includes a receiver clearly marked as having been made by “Mignon Electric Mfg. Co., Rochester, N.Y.” The front panel states “RW-4 Circuit, Pat #1329672”. Per Lauren Peckham’s Review Vol. 3 article, the RW-4 was made by the Mignon Manufacturing Corp. of Newark, New Jersey circa 1920.

The panel arrangement of the “RW-4 Circuit” receiver pictured in Fig. 6 bears no resemblance to the RW-4 receiver shown in Fig. 20 of Lauren Peckham’s AWA Review Vol. 3 article. The reference to the RW-4 Circuit implies that this was a later incarnation of that set’s
patented design. Museum curator Ed Gable has some reservations about the complete authenticity of this set. However, until proven otherwise I’ll accept this set as having been made in Rochester at the Water Street address.

In 1927 Mignon Electric Mfg. Co. is gone from the city directory. Instead, Mignon Industries & Export Co. appears at 282 State Street, with Ernest C. Mignon as president. Its primary business was electrical supplies. In 1928 that same State Street address becomes J. J. Steinharter Co., and in 1929, Cable Supply Company, with Abraham Rosenthal as manager for both. Cable Supply Co. was a contemporary New York City-based component manufacturer and distributor. The Museum collection contains a “Pygmy” variable capacitor bearing a Mignon logo. The box also bears the Mignon logo and is marked “Cable Supply Co., Sales Offices New York, NY, Factory, Rochester, NY.”

By 1928 there are no further references to the Mignon companies. However the personal entry for Ernest C. Mignon still gives his occupation as “Radio Manufacturer.” In 1929 his occupation is listed as “Radio Transformers,” with a business address of 203 State Street, undoubtedly an office rather than manufacturing site. By 1930 Mr. Mignon, who would have been 50 years old by that time, appears to have left Rochester.

Lauren Peckham’s *Review Vol. 3* article ends with Mignon’s appearance in Rochester, saying: “…where in 1923, and possibly later, the Mignon Electric Manufacturing Corporation offered a small line of components including variable condensers and audio transformers…,” and his concluding paragraph states that Mignon never married. The AWA Museum display contains an audio transformer and a variable capacitor from this period bearing the Mignon logo consistent with Lauren’s statements.

The 1928 city directory indicates that Ernest C. Mignon resided with his wife Laura H. at 326 Plymouth Avenue [5]. Over the course of the seven years that he lived and worked in Rochester he lived at five different street addresses, the longest, 1922 through 1926 as a single man. His marriage to Laura H. sometime in 1926 or 1927, and the demise of Mignon Electric Manufacturing Co., coincided with their move to the third residence. He and Laura apparently only lived there for a year and in 1928 their final address of 94 Field Street lasted just two years until they and the Mignon companies all
Valley Appliances first appears under the classified category “Radio Sets & Parts – Mfgrs” in a 1930 directory, doing business at 634 Lexington Avenue with W. Stuart Symington as president. In the 1931 directory Valley Appliances is gone, and in its place is Colonial Radio Corp. at the same address, with W. Stuart Symington again as president. Both the man and the company are gone in 1933.

The address 634 Lexington Avenue lies at the southeast corner of Lexington and Wren Streets and backs onto railroad tracks. The complex consists of several one-story cinder block buildings that appear to have been renovated in the 1960s, all the windows having been replaced by glass blocks. The buildings today house a variety of light industrial concerns, with no trace of Valley Appliances. Valley Appliances is not one of the better-known manufacturers of radio parts, but did play a role in Colonial Radio, as noted below.

Colonial Radio Corp. was founded in 1924 by Dr. Fulton Cutting in Buffalo. They produced a line of battery sets in the mid-1920s and then mostly AC-powered sets from 1928 until 1934. The front cover of a sales manual for 1930 and 1931 indicates “Factories – Rochester, NY”. Text inside says that Colonial Radio Corp. acquired Valley Appliances of Rochester for their manufacturing capacity. Valley Appliances is described as being a supplier of parts to radio manufacturers. I have been unable to positively identify any components in the Museum annex parts room bearing a Valley Appliances label.

W. Stuart Symington came to national prominence as the first Secretary of the Air Force in the Truman Administration. The Symington family operated a railway specialties business in Rochester where he began his working career after graduating from Yale in the early 1920s. The family is also mentioned as the purchasers of the Locke Insulator Manufacturing Co. plants in Victor and Lima, New York, in 1917. In 1925, at the age of 24, W. Stuart Symington founded Eastern Clay Products, Inc., possibly to capitalize on his family’s Locke Insulator holdings. It is unclear how or when he became president of Valley Appliances. Then in 1930 he became president of the nearly bankrupt Colonial Radio Corp. A contract with
Sears-Roebuck to make Silvertone radios saved the company from that fate, and it was bought out by Sylvania in short order.

It seems likely that the Lexington Avenue facility in Rochester produced components used in Colonial and Silvertone radios of that period. At about this same time Colonial also acquired the King Company’s receiver manufacturing facilities from Sears-Roebuck in Buffalo. Whether or not they manufactured complete sets in Rochester is still unknown.

Radioleake (1915-1918)

The crystal set pictured in Fig. 7 was found tucked away behind several other items in a display case in the 1925 radio store section of the Museum. The base is wood and all openings on the underside are wax-filled. A paper label on one edge reads: “Radioleake, Mfgd. By R.C. Leake, Lincoln Park, Rochester, NY.”

According to the Rochester city directory entries for that period, R.C. was Richard C. Leake whose occupation and employment history is as follows:

- 1913 – apparently unmarried, and listed as an electrical engineer
residing at 19 Gardner Street

- 1914 & 1915 – listed as an electrical engineer at Lincoln Park
- 1916 through 1918 – electrical engineer residing at 45 Gardner Street with his wife Edna. No place of employment indicated.
- 1919 through 1923 – listed as a designer for General Railway Signal Co. on the West Avenue Extension, and still residing at 45 Gardner Street.

From the above I infer that the Radioleake crystal set in the Museum collection was probably made between 1914 and 1919 at the Lincoln Park site. Lincoln Park was at that time an otherwise undeveloped stretch along Lincoln Avenue, bounded by West Avenue, Chili Avenue, and the Erie Canal. Street directories for the period indicate the existence of Lincoln Avenue but show no assigned number addresses or cross/side streets. The area today is mixed residential and light industrial.

The next five companies did not make complete receivers but instead found a market making specific components for commercial set manufacturers and amateur builders.

**Rochester Research & Testing Laboratory (1919 – 1923)**

Another nondescript item found in the Museum's 1925 radio store display case is pictured in Fig. 8. This cylindrical object about seven inches long and ¾ inch in diameter bears a label that reads: “Graham” Radio Frequency Amplifying Reactor”. Manufactured by the Rochester Research and Testing Laboratory, its stated frequency range is 325 to 500 meters. It sold for $4. A tag attached to the device indicates that it was donated by Virgil Graham, who was already noted in the Stromberg-Carlson section.

In city directory entries, the Rochester Research & Testing Laboratory first appears in 1919 at 104 East Main Street, at the corner of Water Street. Participants in the company, in addition to Mr. Graham, with no indication of their specific positions, are:

- Joseph F. Putnam, an electrical engineer working at the East Main address.
- Albert F. Esler, whose occupation is given as “Estimator” working
Edwin L. Grauel, with no specific occupation identified, but employed at the Automatic Electric Company at 25 East Main Street.

In 1922 J. F. Putnam is identified as President of Rochester Research and Testing Laboratory, and in 1923, as its General Manager. In 1923 E. F. Grauel has no occupation or employer listed. In 1924 RR&TL no longer has a presence in Rochester, and Grauel and Putnam show no occupation or employer. Mr. Esler is still identified as an estimator working at Wheeler-Green Electric Co.

In his 1938 obituary, Albert F. Esler was said to have been a member of the Rochester Engineering Society and Chief Engineer for T. H. Green Electric Company, the successor to Wheeler Green.

It appears that these men remained employed at their respective occupations and operated RR&TL as an entrepreneurial enterprise. It is unclear what other components they may have manufactured or how many other people, if any, they employed in the company’s four year lifetime.

The improbable name “RF Amplifying Reactor” prompted me to make the following rough measurements of its electrical characteristics:

- Self resonant at approximately 13.9 MHz
- 6 ohms DC resistance
- 18 pF capacitance

Figure 8. Graham RF Amplifying Reactor manufactured by the Rochester Research and Testing Laboratory circa 1921.

at 29 Street Paul Street, the address of Wheeler-Green Electric Company.
• $X_C = 634$ ohms
• $7.22\,\mu\text{H}$ inductance
• $X_L = 631$ ohms
• $Z = 650$ ohms

From its weight it does not appear to have a metal core. It is not attracted to an external magnet. It appears to be nothing more than an encapsulated coil of wire, i.e., an RF choke.

**Precise Manufacturing Corp. (1919 – 1930) and Precise Products Co. (1930 – 1938)**

The Precise Manufacturing Corporation first appears in Rochester directories in 1919 doing business as a maker of tools, dies, and gauges at 160 Court Street. The officers at that time were, Emil L. Opperman, President, and F.C. Schmalzbauer and C.F. Hallick, vice presidents. In 1922 their operation moved to 254-260 Mill Street where it remained until 1938.

In 1927 Precise Manufacturing Corp. occupied 12,000 square feet of floor space at the 254 Mill Street address and employed 150 workers. The same officers named in 1919 are still in place in 1927, and Harrison L. Chapin has been added as Secretary-Treasurer. The 1932 edition of that directory indicates the name change to Precise Products Co., still at the 254 Mill Street address but now with fewer than 24 workers, reflecting the Depression’s downturn in employment. Their primary business is “Radio Apparatus.” The company name change took place in 1930 when H. L. Chapin also became president.

An advertisement in the business section of the 1925 city directory highlights “AF & RF Transformers, Super Multiformers, Synchronizers, and Automatic Circuit Breakers for Fractional HP Motors.” This indicates that Precise was manufacturing radio and other electrical apparatus before the name of the company was changed.

A home-built receiver in the Museum's collection, documented as having been built before 1933, contains two variable capacitors, an audio inter-stage transformer, and an audio output transformer all clearly labeled “Precise Manufacturing Corp.” The cast metal brackets which support the bakelite front panel are also clearly marked “Precise Manufacturing Corp., Model 99.” The 1926 McGraw-Hill *Radio Trade Catalog* lists Precise under the classified heading “Brackets. Sub-Panel.” This same directory lists Precise as a
manufacturer of “RF and AF transformers and variable condensers (trade name: 'Synchrodenser').” The AF transformers carried the trade names “Comet”, “Eclipse” and “Precise.”

Directory listings remain unchanged through 1938. In 1939 Precise Products Co. is gone, and H. L. Chapin is listed as president of the All Purpose Metal Equipment Corporation at the 254 Mill Street address. The primary business is now office equipment.

It is interesting to speculate on the connection between this company and Cel-Met, which was concurrently located at the 254 Mill Street address. Both were engaged in similar business activities, and Cel-Met continues in business today as a sheet-metal works. (See
Figure 10. Precise Manufacturing Corp. ad from the December 1924 QST (p. 111).
also Cel-Met Products Co.) Fig. 9 shows a Syncrodenser from the Museum’s collection. Note the company’s micrometer logo on the box end. Fig. 10 is a full-page ad from a 1924 QST for the company’s Multiformer and AF transformers.

**Rochester Tool & Gauge Corp. (1920 – 1935)**

This company was incorporated in 1920 as a tool and die works at 45 Halstead Street. It was taken over in 1924 by members of the Joseph B. Robinson family of Brighton, New York, who were at that time operating the Rochester Ball Bearing Company.

The 1927 *New York State Directory of Manufacturers* shows Rochester Tool & Gauge Corp. with principal products: “Staking Machines, Radio Parts, and Tools”, employing 45 workers in 7,500 square feet of space at the Halstead Street address. The 1932 edition of that directory lists their principal products as “Radio Loud Speakers,” and reports that the firm had fewer than 24 employees.

Despite the state directories’ references to “Radio Parts and Tools” and “Radio Loud Speakers” none of the local Rochester directories include this company under any radio-related classified headings. It does, however, appear consistently under the “Tools” headings up through 1935. I have not been able to determine whether this company ever actually manufactured any radio parts or loudspeakers under their own name, or a trade name, or as a contractor to others.

**Haig & Haig Manufacturing Corporation, 1925 – 1927**

As noted below, there are discrepancies within the resource materials that I used regarding the spelling of the company name. In 1924 Benjamin M. Haag is identified as the Secretary and Treasurer of Mignon Electric Mfg. Co. at 25 S. Water Street, and also as a bank teller for the National Bank of Rochester.

In 1925 the Haig & Haig Manufacturing Corp. appears doing business in electric appliances, also at the 25 S. Water Street address. The president of Haig & Haig is Benjamin Haag, and the Secretary-Treasurer is Benjamin M. Haag, apparently father and son. Benjamin M. Haag’s occupation is also still identified as a bank teller. The company name is spelled HAIG and the family name is spelled HAAG. However, at the same time, the then-current Rochester Street Directory shows the 25 S. Water Street address occupied by Haag &
Haag Electrical Appliances Co. and the Mignon Electric Manufacturing Co.

Haig & Haig Mfg. Corp. produced a line of variable capacitors under the trade name “Straitline.” Their products were advertised in national circulation radio magazines of the 1920s.

The company disappears from local directories in 1928. Both Benjamins are still listed at their respective home addresses. Benjamin M. is still listed as a bank teller and Benjamin senior has no identified occupation.

The AWA Museum collection contains several Straitline variable capacitors. All are clearly stamped with the Straitline name and Haig & Haig Co., Rochester, NY. Fig. 11 is a quarter-page ad for the Straitline product taken from a 1925 magazine.

**IGRAD Condenser & Manufacturing Co. (1926 – 1934)**

The IGRAD Condenser & Mfg. Co. was incorporated in 1926, doing business at 26 Avenue D. The *New York State*

![Image](image.png)

**Figure 12. Igrad 2-microfarad, 1,000-volt capacitor.**
Manufacturers Directory of 1927 gives their principal product as fixed paper condensers, and states that the firm employed fewer than 24 workers. By 1932 the number of employees was “between 10 and 24 (includes women”).

The officers were: Louis J. Marchand, President/Treasurer; Carl Grams, Secretary, and Chester C. Eckhardt, Treasurer & General Manager. In 1930 the company was relocated to 4322 Lake Avenue, and in 1934, was apparently out of business.

The AWA Museum collection contains two examples of IGRAD capacitors, one of which is pictured in Fig. 12. Nothing else is known about this company.

The companies described in the next group were wholesale/retail suppliers of radio parts or equipment, catering largely to amateurs. Amateurs of that era typically got their start with a homemade crystal detector as a receiver. Headphones were commercially available as an offshoot of the fledgling telephone industry. A transmitter could be fashioned from an automobile ignition spark coil and other generally available hardware. Telegraph keys could be purchased or made from common hardware. As the sophistication of the technology advanced in the years leading up to WW I and then blossomed after 1918, a retail market developed for manufactured components such as capacitors, resistors, sockets, dials, inductors, and insulators. The earliest entrants supplying this market tended to be existing suppliers of electrical equipment and small businesses that already had a technological base. Such was the case in Rochester.

E. C. Sykes Co., Inc. (1914 – circa 1964)

Originally incorporated in 1914 as a locksmith and electrical contracting company, E. C. Sykes soon branched out into the emerging home electrical appliance field and other lines of business.

The first directory appearance of the classified business category “Wireless Apparatus” occurred in 1921, with just two listings: E. C. Sykes Co. and Rudolph Schmidt & Co. Thereafter only E. C. Sykes Co. is listed under Wireless Apparatus. In 1924 the word “Wireless” had been replaced by the word “radio,” and the “Radio Apparatus” classifieds for that year identified six companies, one of which is E. C. Sykes Co.
E. C. Sykes Co. was family owned and operated at 12 Front Street up through the early 1960’s when that address disappeared as a result of urban renewal projects. A circa 1925 photo in the Rochester city historian’s files shows a narrow three-story building with ground floor display windows. Oral history has it that when the building was bulldozed the upper floors still housed stocks of very early wireless and radio equipment.

**Rudolph Schmidt & Co. (1920 – circa 1929)**

Rudolph Schmidt & Co. was founded in 1882 by its namesake—an optometrist. The business operated at 51 E. Main Street for many years, and moved to a South Avenue address in the mid-1920s. Over the course of these years Mr. Schmidt moved in and out of several retail fields but maintained his primary optometry business. A 1921 advertisement for Rudolph Schmidt & Co. listed the following products and services: “Optometrists, Opticians, Wireless, Electrical Supplies & Contracting, Kodaks.” A similar ad in 1924 reads: “Sporting Goods, Radio & Electrical Supplies, Field Glasses, Kodaks, Guns, Fishing Tackle, Barometers, Thermometers.”

The Museum’s collection includes a 22-page circa 1914 catalog of Bunnell Co. products, with the title “Wireless Products” on the cover, and “Rudolph Schmidt & Co., Wireless Apparatus, 51 Main Street opposite Front, Rochester, N.Y.” stamped in a blank area provided for the purpose in the lower center of the cover.

A 1922 listing of amateur call signs shows 8BJM assigned to R. Schmidt & Co. at their 51 E. Main Street address. It was not unusual in this period for amateur call signs to be awarded to businesses as well as organizations such as churches, schools, and scout troops. Whether or not Mr. Schmidt or any of his employees ever actually put a station 8BJM on the air is unknown. We can surmise that Mr. Schmidt’s training in optometry and related physics of light provided a foundation for an early personal interest in wireless that led to his business involvement.

The optometry business continued at the South Avenue address into the 1940s but advertising references to wireless and radio cease in 1930.
Gundlach-Manhattan Optical Co. (1902 – circa 1928)

According to a corporate biography, Ernst Gundlach left Bausch and Lomb (apparently unwillingly) in 1878. In 1879 Gundlach was joined by a partner, Lewis R. Sexton. Together they set up and operated an optical goods business out of a home just a few doors down St. Paul Street from Bausch and Lomb’s headquarters. Over the next two decades Gundlach’s involvement in the business varied. Sexton continued to grow their joint business until he died in 1884. Gundlach reorganized the business in 1885 at a 29 Stone Street address calling it the “Gundlach Optical Company”. The company name and product lines changed several times again over the next ten years until 1895 when again Ernst renamed it the Gundlach Optical Co., with three new partners; H. H. Turner as manager, and two other opticians: J. Zellweger and J. C. Reich.

In 1902 the company acquired the Manhattan Optical Company of Cresskill, New Jersey, and changed the merged company’s name to the “Gundlach-Manhattan Optical Company.” This company was still primarily an optical goods manufacturer, then located at 741 S. Clinton Avenue. It was incorporated with a capitalization of $600,000, no small change in 1902.

The Museum collection includes a crystal set with the name Gundlach-Manhattan Optical Co. pressed into the base. It features a wood-based cat’s whisker detector and a sliding contact coil. My museum colleagues and I are unable to date this set accurately. However at the website www.radiomuseum.org there is a reference to a 1926 crystal set manufactured by this company under the trade name Korona, which was also one of Gundlach-Manhattan’s camera trade names. The McGraw-Hill Radio Trade Catalog for 1926 lists this company under the classified heading “Sets, Crystal.” Whether or not the sets were actually manufactured in Rochester or were made by others under contract is unknown.

The company was taken over and re-named again in 1928, moved to Fairport, New York, shortly thereafter and survived as an optical goods manufacturer into the 1970s under several other names and ownerships. No other references to wireless or radio have been found.

Robertson – Cataract Electric Co. (1924 – 1931)

The Robertson-Cataract Catalog No. 22 for the years 1922-23 has
been reprinted, and is widely available in the antique radio community (Fig. 13). This publication gives the company’s address as Buffalo, New York. In the 1920s the company was headquartered in Buffalo but maintained a sales branch in Rochester at 186 N. Clinton Avenue, managed by Henry C. Johnson. Their primary business was wholesale electrical fixtures and supplies.

In October 1925 the *Times Union* newspaper and the Rochester Radio Dealers’ Association co-sponsored their second annual Radio Exposition. Page 6 of the October 27, 1925 *Rochester Democrat and Chronicle* featured a photograph of a 24-tube superheterodyne receiver, described as having been developed by the Robertson-Cataract Electric Company and displayed at the exposition.

Although primarily an electrical wholesaler and contractor, Robertson-Cataract Electric served as a retail source of basic amateur radio materials such as antenna wire, insulators and knife switches.

**Midland Radio Corp. (1931)**

This was probably a branch office for the larger national company of the same name. It appears for just one year in the 1931 *Rochester City Directory* under the classified category “Radio Sets & Parts – Mfrs.” It was located at 59 W. Broad Street. W. Chester Moore was its manager.

**Figure 13.** The Robertson-Cataract radio catalog of 1922-23. The reprint of this catalog is available to radio collectors today.
The Joslyn Manufacturing & Supply Co. (1931 – circa 1960)

Jack H. Tod’s self-published book, “Porcelain Insulators Guide Book for Collectors,” identifies Joslyn Mfg. & Supply Co. as of 1960 as the successor to the Locke Insulator businesses in Lima, New York, using the trade name PINCO (a contraction of Porcelain Insulator Corporation). From page 146 of that book: “From the outset, one of the major stock-holders in PINCO was Mr. M. L. Joslyn, the founder of the Joslyn Manufacturing & Supply Company, a company which had always been a leading supplier of pole line equipment to the utility and electrical industries.” Needless to say, PINCO insulators were sold through Joslyn. The Museum collection includes antenna strain insulators made by PINCO.

This company first appears in the 1931 directories under the classified heading for “Electrical Supplies & Equipment – Mfrs.,” with the word “telegraph” in parentheses, indicating that to be a unique specialty. The original address was 53 Probert Street, followed by moves to 49 and then 50 Probert Street. Today Probert Street is just one block long between East and University Avenues. The Joslyn Co. addresses were adjacent to the railroad tracks on what is now a private driveway through the Harris RF Communications facility. These sites were a sales branch office site. Mr. James W. Tabb is identified as manager from 1931 through 1944, and as district manager thereafter.

This article closes with brief mention of nine additional fringe participants in the Rochester radio industry, from around the time of WW I through the 1970s.

Leon Telegraph Institute (1917 – 1920)

In 1915 Louis Leon boarded at 1850 St. Paul Boulevard, and was employed as a shipper. In 1916 he was a telegraph operator although no specific employer is indicated. At this time telegraph operators were still regularly employed by railroads, brokerage houses, newspapers, many banks, and of course Western Union, which was co-founded by Rochester businessman Hiram Sibley. From 1917 through 1920 Leon is identified as the Director of the Leon Telegraph Institute at 118 Beckley Bldg., 27 S. Clinton Avenue.

An advertisement in the city directory reads: “Prepares young ladies and men for Commercial, Railroad, and Wireless Telegraph
positions. Reasonable Tuition. Send for Catalogue.” During 1921 and
1922 there is no longer any evidence of the school, and Mr. Leon’s
employment is again shown as telegraph operator. In 1923 his
occupation changes to foreman but no place of employment is
identified.

In addition to my surprise at the mere existence of such a school in
Rochester, it is also interesting to note that it trained both men and
women. The ad reads “young ladies” indicating of course that married
women were not expected to apply for work outside the home at that
time.

Such telegraphy schools were common in many cities up through
WW I but faded rapidly with the rise of long distance telephone,
radiotelephony, and electromechanical printers such as stock tickers
and teletype machines. In my early working career with AT&T, I was
acquainted with several old-timers who had been Morse telegraph
operators. Morse was still used for some internal company
communications into the 1960s, but use of the land-line wire telegraph
was already declining in the early 1920’s.

**Rochester Electric Equipment Corp. (1922 – 1923)**

*Radio World, Vol. I, No. I* (April 1922), page 25, contains a list of
newly incorporated radio enterprises, one of which is Rochester
Electric Equipping Corp., capitalized at $15,000. Local directories for
the period reveal the following corporate officers: Hector Benzon,
President, (aka Ehtor Benzony and/or Benzoni); Niles G. Plank,
Treasurer; Anna L. Plank, Vice President. Local directories list a
slightly different company name--Rochester Electric Equipment
Corp., doing business as electrical contractors at 219 East Avenue.

The 1922 city directory lists the Electric Service Company at the
219 East Avenue address, with officers N. G. Plank and Ehtor
Benzony. A paid ad in the directory identifies their primary business
as “motor installers.” In 1923, Electric Service Company is gone, and
Rochester Electric Equipment Corp. appears at the East Avenue
address with the same two officers. In the 1924 directory neither
company is listed, and Benzony (or Benzon) and Plank are identified
simply as electricians. The East Avenue address is occupied by
Powertown Tire Co., and no employment address is shown for
Benzon and Plank.
Other than the *Radio World* listing there is no other evidence that either of the incarnations of this company were involved in radio in any way. An inference could be drawn that they added radio installation and perhaps service to their contracting business in 1922. In the early 1920s when radios were still simple, no doubt quite a few electrical supply firms erected antennas and sold radios, but then dropped out as the radio business became more sophisticated.

**Union Tool Chest Co. (1925 – 1926)**

The 1925 McGraw-Hill *Radio Trade Directory*, under the classified listing for “Cabinets, Wood” lists the Union Tool Chest Co, 19 Hand Street, Rochester. Hand Street no longer exists in Rochester. It was demolished in the 1960s for construction of the Inner Loop Expressway. The Rochester city directories for the period do, however, list this company at the Hand Street address. In the mid-1920s a large proportion of receiving sets were homemade, either from scratch or from pre-packaged kits of parts. Once a set was built and working in the family’s living room, aesthetics demanded a cabinet to house the radio and its associated batteries. This company along with many other furniture and cabinet makers of the time branched out briefly to meet this market demand. No cabinets known to have been made by this company have yet been identified. Of course 1920s radio cabinet makers did not always affix labels to their cabinets.


The 1927 Rochester city directory, under the business classified heading of “Radio Equipment & Supplies” lists the name Edward G. White Jr., at 239 Hamilton Street. The personal listing for White gives his residence as 381 Gregory Street and his occupation as “Radio Supplies.” One line above this is a listing for Edward G. White stating that he died 19 May 1926. Presumably this was Edward G. White Sr.

The previous year’s directory lists Edward G. White as owner/operator of White Radio Laboratories at 381 Gregory Street and his residence as 239 Hamilton Street The listing for Edward G. White Jr. lists his occupation as “Radio Supplies” at 377 Gregory Street His residence is also 239 Hamilton. The year before that, 1925, lists Edward senior’s occupation as “Salesman” and the junior Edward’s occupation as “Printer”.
Moving forward again to 1927, Edward Jr. is now married to Verona E. White, still living at 239 Hamilton Street and employed at White Radio Service Co. at 249 Monroe Avenue. The listing for the Monroe Avenue address shows this company with the name Frank A. Reineman.

I reconstruct the following likely sequence of events based on this data: Edward Sr. left his salesman’s occupation circa 1925/1926 to start up a radio supplies business at 381 Gregory Street. Soon Edward Jr. joined his father and established White Radio Laboratories. The elder White died in May 1926. The junior Edward married circa 1926/1927 and moved the business to 249 Monroe Avenue with a partner, Frank Reineman. From 1928 on the business is listed only with Frank Reineman.

It seems likely that the White father and son entered into the radio fray around 1925 as a small retail/service provider. Whether the “Laboratories” ever produced any local innovative products is unknown. Outside of the directory listings, no contemporary advertising for the White businesses has been found.

Halstead Radio Laboratory (1928 – 1933)

This company first appears in the 1928 Rochester city directory under the classified heading of “Radio Equipment & Supplies – Mfrs” doing business at 457 E. Main Street, Room 1. It remains listed consistently so up through 1933. Clarence C. Halstead is identified as proprietor. It is unknown what or whether this entrepreneurial effort ever produced during its five year lifetime.

Albert H. Marsh (1929 – 1932)

The Rochester city directory of 1929 under a classified heading for “Radio Installation and Service” shows the following: “Albert H. Marsh, Radiotrician, 413 Lexington Avenue [also his residence]. Authorized H. F. L. and Hammarlund-Roberts Service Station. Custom Radio Set Builder.” The term “Radiotrician” was used by the National Radio Institute (NRI) on the diplomas given to graduates of their radio servicing correspondence courses.

Mr. Marsh is also listed under the headings “Radio Receiving Sets” and “Radio Repairing”. His listings persist up through 1932 and then disappear. It appears that Mr. Marsh operated from his home using the
skills and knowledge he obtained from correspondence courses. He also appears to be yet another victim of the combined factors of improvements in commercially available off-the-shelf technology and the onset of the great Depression.

**Mellaphone Corp., or Mellophone (1929 – circa 1978)**

The Mellaphone Corp. was incorporated in 1929 with Carol M. J. Fenyvessy as President and Mella R. Fenyvessy, his wife, as Secretary-Treasurer. The company was named for Mrs. Fenyvessy, although it appears in some cases spelled Mellophone. The primary business of Mellaphone Corp. (located at 92 Mortimer Street, Room 10) was moving picture apparatus. Their most significant product was a system for using a disc recording synchronized to a silent motion picture to provide “Talkies.” A source who knew the family reports that the Mellaphone synchronized disc systems were in use in South America, and serviced by Mellaphone Corp. into the 1960s.

The Fenyvessy family was deeply involved in the early motion picture business in Rochester. Albert A. Fenyvessy served as the general manager of the Keith Family Theater and president of the Linwood Amusement Corp. Paul A. Fenyvessy was manager of the Strand Theater according to city directories of the early 1930s.

In the mid-1930s Mellaphone Corp. moved to 714 University Avenue and then 65 Atlantic Avenue. The 1932 *New York State Directory of Manufacturers* shows Mellaphone at the University Avenue address, employing fewer than ten workers. Then in 1940 the classified listings for “Radio Sets & Parts – Mfgrs” shows Mellaphone Corp. at 999 E. Main Street, the last address of Unit Reproducers Corp. (see page 110), with Floyd R. Terwilliger as manager. Apparently Mellaphone took over the Unit Reproducers facility at this point and entered into the radio parts business by doing so.

Mellaphone Corp. continues to be listed under radio parts, doing business at 65 Atlantic Avenue up through 1944. In the next year Carol Fenyvessy is still shown as President, but now Allen Hamilton is identified as Vice President, and their primary business as “Electronic Rectifiers,” at a 1462 Main Street location. The AWA Museum display contains a small Mellaphone rectifier power supply made during this period.
Ellis C. Arnold. (1931 – 1933)

The 1932 New York State Directory of Manufacturers lists an Ellis Arnold Co. at 36 Probert Street in Rochester. Its primary products were “Radio Speakers,” and it employed fewer than ten employees.

In 1929 there is no listing for an Ellis C. Arnold in the local directories. In that same year under the classified category of “Radio Cabinets” is listed Charles F. Hofman at 9 Leighton Avenue in the same block as United Reproducers. Mr. Hofman was carrying on the showcase manufacturing business founded by his father John Hofman in 1896.

In 1930 Ellis C. Arnold is identified as the factory manager at 25 Leighton Avenue, the address of United Reproducers, Inc. Again in 1931 Mr. Arnold’s occupation is identified as “Foreman” but without an indication of his employer or his employment address, and United Reproducers was no longer in business. In 1931 Charles F. Hofman’s showcase and radio cabinet business was located at 36 Probert Street, but the younger Mr. Hofman passed away in November of that year.

In 1932 Ellis C. Arnold is doing business at Hofman’s 36 Probert Street address, and he is listed in local directories under the category “Radio Sets & Parts – Mfgrs.” By 1934 there is no longer any listing for Mr. Ellis or his business. Today 36 Probert Street is part of a supermarket parking lot at the corner of University Avenue, directly across from the headquarters of Harris RF Communications Corp. a leading modern supplier of military radio equipment.

It appears that Mr. Ellis was introduced to the radio business while employed at United Reproducers, Inc. and then set out in partnership with Charles F. Hofman to produce radio speakers and cabinets, and continued this business for a few years after Mr. Hofman’s death. I have not been able to identify any specific products produced by this company during its three-year lifetime. It is a good example of the entrepreneurial efforts that characterized the radio industry in its formative years.

Supreme Radio Laboratory (1935 – 1942)

This company name appears in the 1935 through 1942 Rochester directories under the classified heading “Radio Sets & Parts – Mfgrs.,” doing business at 16 Fulton Avenue. The 16 Fulton Avenue address is
shown as the residence of Lee C. Mapes and his wife Gertrude. Their business is described as transformer re-winding. It appears that Mr. Mapes operated this business out of his home.

Notes and Resources

1. Information concerning dates of incorporation, capitalization, number of employees, incorporating officers, and square footage of work space was obtained from the Directories of N.Y. State Manufacturers, 1927 and 1932.

2. Information regarding people’s addresses, spouse names, and places of employment was obtained from Polk Publishing Co. City Directories for Rochester, New York.


5. With regard to Ernest Mignon’s apparent marriage: “Wife” is my assumption based on the format of the directory entry. The name Laura H. follows in parentheses on the same line as Ernest C, implying that her last name was also Mignon. Co-habitants with different surnames, if listed at all, would each have had separate line entries under their own names. If indeed the Mignons were married, then the wedding apparently took place between 1927 and 1928. I leave it for more diligent researchers to scour the marriage license records and/or newspaper archives for a definitive answer.

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About the Author

Allan Pellnat has been a ham since 1954, an AWA member for the past 20 years, and is retired from a lifetime spent in the telephone and computer networking industry. He has served as a docent in the AWA Electronic Communication Museum in Bloomfield, New York, and has been a regular volunteer with the Museum Annex Tuesday work crew. He is Deputy Director of the Museum, and a member of both the Museum and AWA, Inc. boards. The focus of his AWA activities has been on the people who were involved in the early days of the technology rather than the technology itself. Since moving to Wilmington, N.C., he has begun researching the earliest hams there and their involvement in bringing radio broadcasting to that city.