The Eminent Years of Powel Crosley Jr., His Transmitters, Receivers, Products, and Broadcast Station WLW, 1921-1940

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Chapter One
The Early Years

Born September 18, 1886 to a prosperous family in the Walnut Hills area of Cincinnati, Ohio, Powel Crosley Jr. became well known during his lifetime for his radios, automobiles, refrigerators, and numerous other products [48]. At the early age of 34, he courageously diverted his energy and sales experience from various other business ventures to the development of radio reception and radio transmission as a commercial enterprise. He expanded this enterprise to include an exceptionally wide range of products. This is the story of his most productive years.

His father, Powel Crosley, Sr. was a prominent lawyer who invested in real estate. He was a millionaire until the financial panic of 1893, when he lost nearly everything. Shortly thereafter, the Crosley family moved to a modest home in the College Hill area of Cincinnati, Ohio. Powel and his younger brother Lewis spent their early years in a country setting [6]. Powel Jr. soon became interested in farming, and both boys worked at odd jobs. Powel spent his earnings quickly but Lewis was more frugal. It was from Lewis that Powel borrowed eight dollars to buy the parts for his first automobile adventure, a battery-powered motorized wagon. Their father bet Powel Jr. ten dollars that he could not get the vehicle to operate. Powel Jr. was successful and repaid his brother the borrowed eight dollars and then split the remaining two dollars in profit with him. This early partnership was to last a lifetime. Later Lewis demonstrated that he had the education, patience, steadiness, and ability to guide the day-to-day operations that kept the Crosley Company running at top efficiency.

The early years of Powel Crosley are very interesting [94]. His academic education consisted of public school and the Ohio Military Institute that was located near his home in College Hill. His early interest in mechanics and automobiles led him to enter the University of Cincinnati as an engineering student in 1906. He lasted two years and then, to please his father, he began to study law. After a short time, he left school, to the great disappointment

of his parents. He had a short attention span and was too restless to be a good student but he was very ambitious, with lots of energy and ideas. Powel Jr. decided that there were more opportunities for a quick financial gain than he could find in law. He was fascinated with anything mechanical, especially automobiles [94]. After his abbreviated college days, he had numerous jobs, mostly involving automobiles. He was a bond salesman, chauffeur, lineman, and owner of an automobile agency. He built and raced his own gas-driven car. He organized his own advertising agency [83]. This was followed by the organization of a company that was to manufacture low-priced six-cylinder automobiles. At this time, there were not more than two or three makers of six-cylinder automobiles in the market. His six-cylinder automobile was built and operated successfully but it was never put into production because of lack of funds. He again returned to advertising and sales. In a short time, he organized two automobile manufacturing companies to build four- and six-cylinder lightweight automobiles. However, the two companies never went into business because of financial difficulties.

For a period of approximately six years, 1908-1914, Powel Jr. decided to make advertising his career. He had never lasted very long in any job but he thought he might do better in the advertising field. In 1910 he married his childhood sweetheart Gwendolyn Bakewell Aiken, against the wishes of her parents who probably felt that he had changed jobs too often. In 1914 Powel Jr. began to work for an advertising agency, earning twenty dollars a week. A short time later, he joined another advertising agency and by 1916 he had built up a large and profitable clientele. Powel Jr. had finally settled down, much to the amazement of his parents, in-laws, and close friends [87, 99].

One of his advertising clients asked him if he would be interested in helping to form a company that would sell automotive specialties. He knew he could progress more rapidly working for himself so he helped organize the company, gave up his advertising job, and, with some financial help, bought the automotive specialties company outright in the spring of 1917. The name he chose for his new business was The American Automotive Accessories Company, and it was located at 1601 Blue Rock Street on the north side of Cincinnati. It

Figure 1. *American Automobile Accessories advertisement, still in business in 1923.*

was incorporated on December 13, 1917. (Figure 1) His resources were limited, but his ambitions and abilities were unlimited. During the first year that he was engaged in the mail order automotive accessory trade his business amounted to more than $1,000,000. The most popular accessories for automobiles were tire liners and an inside starter. During World War I, flag holders, which could be mounted on the hood of a car, were popular since people wanted to be patriotic.

Figure 2. *Marion Phonograph Company advertisement.*

In the wintertime the sales of his automobile accessories were slow, so the company built wood cabinets and a phonograph which he called "The Marion" [94]. He manufactured them in his "Marion Phonograph Company." (Figure 2) His business expanded rapidly. In a few years he not only owned one of the leading automotive accessory companies in the United States, but he was also the owner of a large woodworking plant, a phonograph plant, a printing plant, and other businesses [99].

Chapter Two
The 20-Watt Transmitter

On Washington's birthday in 1921, Powel Crosley III (Crosley Jr's son) expressed a desire to own a radio set [75]. His companions had been "tinkering" with radio for some time. The boy's father, always an obliging parent, began that afternoon with his son to learn anything they could about radio. They went to the Precision Equipment Company on Gilbert Avenue to buy a radio set and were amazed at the cost— $130. Powel thought that this was much too high a price to pay for those materials and that workmanship, since it was just to be a present for his nine-year old son. Instead, he bought

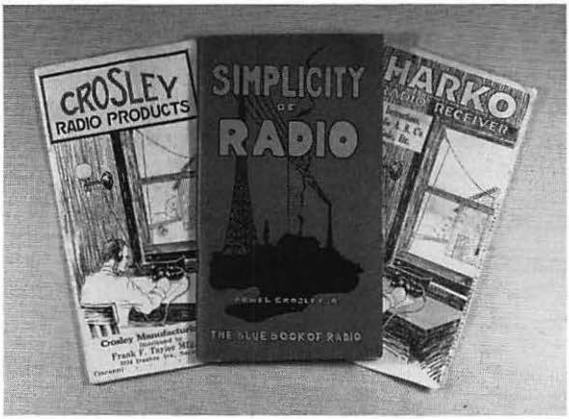


Figure 3. *Crosley radio booklets.*

the parts for the crystal set along with a small book called *The ABC's of Radio* for $35. Father and son cooperated in building the crystal set. Similar booklets would later be given out to promote Crosley radios. (Figure 3)

Crosley knew merchandising values and quickly realized that the price asked for a radio was not in proportion to the cost of labor, materials, advertising, and sales. The cost was too high, and he began to think of the great number of people who would be interested in buying a radio set at a reasonable price. He wondered: "Why couldn't I manufacture such a set and sell it at a low price - so that everyone could afford a radio?" He then inspected the set carefully and immediately knew he could manufacture similar sets that would sell for considerably less. With the production and engineering assistance of his woodworking plant he could produce better and cheaper sets.

After considering the situation for a few days, he hired Dorman Israel and Elmer Hentz, two co-op students from the University of Cincinnati. They would work out plans and design the parts for his first radio, a crystal set. Powel Jr. assisted in the engineering but spent most of his time carefully surveying the radio field. He then decided the time was right to enter into the radio business, and he quickly became obsessed with radio.

The remaining months of 1921 were busily devoted to the

Figure 4. *Crosley products in 1922.*

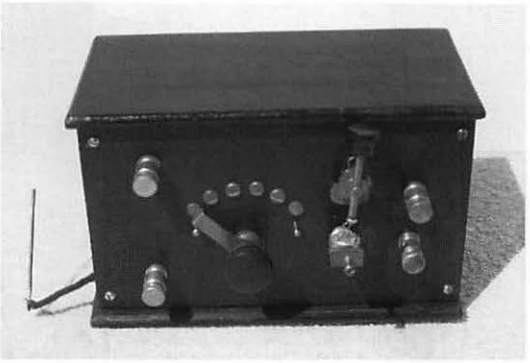


Figure 5. *The Crosley Harko crystal receiver, showing the "poor man's buzzer" on the left side, 1921.*

startup of the Powel Crosley Manufacturing Co., which produced the Harko Radio Receiver, porcelain tube sockets, variable condensers, variometers, vario-couplers, tap switches, rheostats and wooden cabinets. (Figure 4) These were all sold as radio accessories. When it was time for testing of the new Harko radio, interest at the factory was intense. Employees gathered around the little box and they were delighted and amazed when they heard music coming from station WRK, in Hamilton, Ohio, a few miles away. Crosley immediately started an advertising campaign by placing ads in radio magazines and newspapers to promote his new radio and radio parts business. He now began using the same building on Blue Rock Street to manufacture radio sets and radio parts that he had been using for his automotive, phonograph and woodworking businesses.

The first radio receiver to be marketed under the Crosley name was a crystal set called "Harko." (Figure 5) Its name came from the word "hark" or "listen" [6, 92, 106]. The radio came with a galena crystal detector, a coil with switch taps, headphones, and wire for an aerial and ground. Built into the set was a unique "poor man's buzzer." This buzzer used a "C" battery connected through a choke coil made of enameled wire wound on a nail and then connected to a short piece of a hacksaw blade mounted on one edge of the front panel. The sharp teeth of the saw blade protruded from the corner of the cabinet. The other side went to a short length of bare copper wire. By scratching the wire along the saw blade you produced a "buzzer effect" which helped you adjust the cat whisker to find the most sensitive spot on the crystal.

These receivers were produced in the wood-working plant using the regular male help. There was so much trouble with poor soldering and sloppy assembly of the radios by men, that girls were soon hired and trained. This was the start of the practice of hiring large numbers of women to work in the Crosley factories for years to come. The Harko crystal set was first sold in November 1921 just prior to the Christmas season. They were marketed largely through the Milner Electric Company of Cincinnati. The price of just the radio was $9, or, if it was sold complete with headphones, 125 feet of antenna wire, and insulators it cost $15.

The first accessory Crosley offered was a molded white porcelain tube socket called the V-T that sold for sixty cents [76]. (Figure 6) This socket had the advantage of being either base- or panel-mounted and it was cheaper than any other socket being sold. The Crosley socket was first advertised as "A Smashing Hit." (Figure 7) The socket was made of porcelain and would indeed be a smashing hit if dropped! Crosley was informed of this

Figure 6. (Right) *Crosley's VT porcelain tube socket, 1921.*

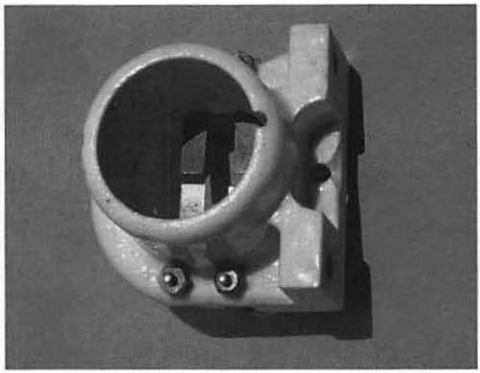


Figure 7. (Left) *Crosley's "A Smashing Hit" advertisement, 1921.*

Figure 8. (Right) *Crosley's "Announcing" advertisement, 1921.*

aspect of the advertisement and it was immediately changed to "Announcing" the new socket. (Figure 8) The later tube sockets were made of different materials.

The first Crosley motto: "BETTER COSTS LESS" had begun to be used at this time.

Another interesting accessory was the Crosley variable condenser [77, 78]. (Figure 9) These condensers were advertised to withstand one thousand volts. Three models were made; "A" had plywood plates, "B" had molded plates, and "C" had ceramic plates. The plates were surfaced with a thin sheet of copper, and the insulating material between the plates was mica. A cam on a shaft turned by a dial knob on the front panel of the radio varied the spacing between the plates to form a variable condenser. A light spring maintained tension on the moving plate as the dial was turned to minimum

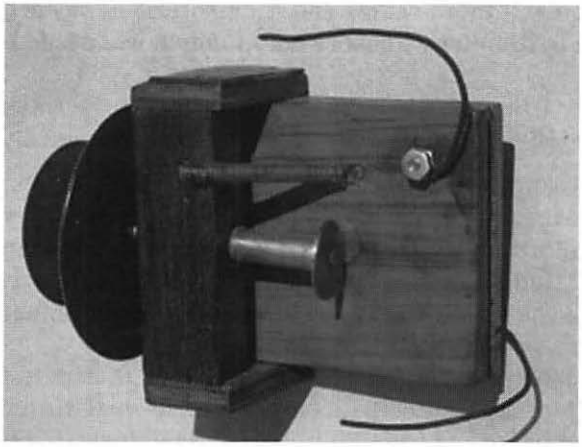


Figure 9. *Crosley "Book" or "Barn Door" variable condenser, 1921.*

capacity. These condensers are often referred to as the Crosley "book" or "barn door" condensers.

Realizing there was a great demand for various units that could be used by the experimenter, the TUNO, CONDENSO, DETECTO, De-AMPLO, and DUO-AMPLO UNITS were introduced in 1922. These small units were built from standard Crosley parts and were sold in the price range of $4.00 to $14.00.

The first transmitter that Powel Crosley Jr. owned was a 20-W, grid modulated, amateur transmitter which he purchased from The Precision Equipment Company in Cincinnati, Ohio. With his amateur radio call sign, 8CR, he began to broadcast from his College Hill home in Cincinnati in April of 1921 [92, 100]. (Figure10)

He broadcast phonograph records using one of his Marion phonograph machines playing "Song of India" and "Dardinella" over and over. (Amateurs were permitted to broadcast phonograph music at that time.) When the records were not playing, Powel Jr. could be heard requesting mail or telephone reports from listeners.

Powel Jr. was inspired by the reception reports that he received from as far away as Troy, Ohio, a distance of 70 miles. He now realized that radio listeners must have quality programming and scheduled broadcast times if radio was to find a place in

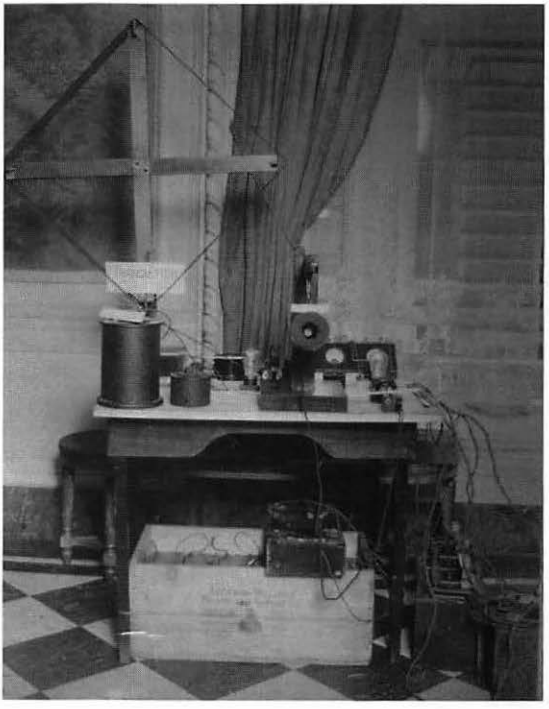


Figure 10. *Amateur radio station 8CR at the Crosley home, 1921.*

the daily lives of people. To sell more radios and accessories, he needed more coverage. Therefore, a transmitter with more power output was needed.

Chapter Three
The 50-Watt Transmitter

Since Crosley's radio broadcasts had received such positive responses, the 20-W transmitter was moved to the Blue Rock Street plant of the Crosley Manufacturing Company. Shortly after the move, Dorman Israel, now an undergraduate engineering student at the University of Cincinnati, was given the task of designing and helping to install a composite 50-W transmitter at the Blue Rock Street address. (Figure 11)

This transmitter was to become the first licensed WLW transmitter [100]. The license reads: "March 22, 1922; License issued to the Crosley Manufacturing Company, Baltimore and Ohio Railroad and Blue Rock Street, Cincinnati, Ohio; WLW 360 meters; Every evening, but no fixed time, music, lectures, news, and information."

This 50-W transmitter would only have one ten-thousandth of the power of the eventual 500,000 W WLW of 1934 but it was a step forward. Four UV 203 tubes were used; two as oscillators and two in the Heising modulator circuit [92]. The transmission frequency wandered and the sound quality was poor, but the growing number of radio listeners were astounded to be able to hear voices and music, and consequently they were not too critical. A dispatcher microphone mounted at the small end of a phonograph horn was used to modulate the transmitter. A specially designed motor generator, made by Robbins and Meyers of Cincinnati, supplied the 1,000 VDC needed for the transmitter operation. The antenna, mounted on the roof, consisted of a four-wire flat top suspended between two forty-foot downspout masts.

Just before the start of the first WLW broadcast on March 22, 1922, Powel Jr. told his brother, Lewis, he would like to have the antenna raised to sixty feet. There was a quick rush to the roof where two ten-foot downspout sections were added to each mast. In addition, a counterpoise was added six feet above the roof to improve the rather poor ground system. The studio was a small, heavily-curtained, upstairs room in which there were only two windows and plenty of heat coming from the transmitter in the same room. This location next to the B & O Railroad was interesting because

Figure 11. *Powel Crosley Jr. and Dorman Israel, his assistant, testing the 50-W transmitter, 1922.*

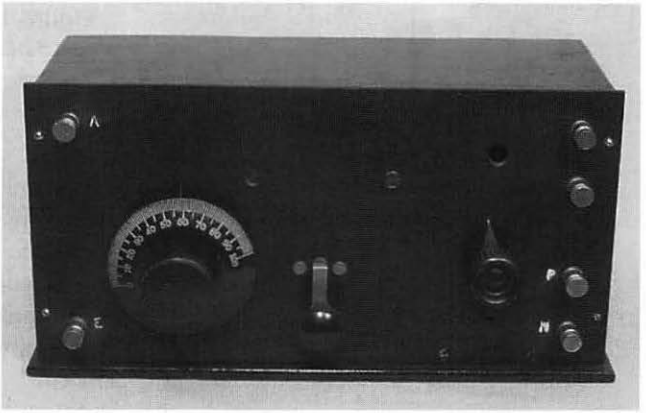


Figure 12. *The Crosley Harko Senior receiver, 1922.*

the locomotive engineers delighted in making the sounds of their bells and whistles a part of the WLW programs [92].

Broadcasters in the early days of radio were required to share frequencies and to cease broadcasting for three minutes out of every fifteen minutes in order to listen for distress calls from ships at sea. There was also a fifteen-minute period of silence at the end of each hour of night programming. This allowed both the announcer and transmitter to recuperate. The announcer was usually Powel Crosley Jr., and the programming was usually phonograph records with some announcements. Within a short time the WLW programming became somewhat more varied and the hours increased to include morning, afternoon, and evening broadcasts. Broadcasting times varied from fifteen to twenty-five hours a week. Radio advertising, as we know it today, was not done; but Crosley was always thinking of other sources of revenue and he came to embrace radio advertising at a later date.

The Harko crystal set proved to be a great success. It was followed by the Harko Senior which was developed shortly thereafter. (Figure 12) This was a one-tube vacuum tube detector receiver and, with its companion two-stage audio amplifier, it became a very popular radio because of its superior performance. Immediately after Christmas, real volume production began on the Harko Senior. The Harko Senior sold for $16, the companion two-stage amplifier sold for $25, and it quickly became the best selling radio set in the world, with five hundred produced each day. Crosley was manufacturing more than ten models of radio receivers in 1922 and all were sold for under $70, except for the Console XX, which sold for $100. (Figure 13)

Competitors rushed to meet the challenge, but Crosley had stolen the low-priced market. His initiative had brought radio within the reach of the average American family. His next goals were to give radio listeners better programming and more coverage for the WLW transmitter. He also wanted to produce and sell better radio receivers.

The Crosley Manufacturing Company had outgrown its location on Blue Rock Street. In May 1922 it was moved to a new home on Colerain and Alfred Streets in the Camp Washington area of Cincinnati [80]. (Figure 14) Most of the large building with its 30,000 square feet of space was devoted to the manufacturing of radio apparatus. Offices and the WLW

Figure 13. *Crosley receivers of 1922.*

operation occupied much of the third floor. With the increased floor space, the manufacturing of Crosley radios and accessories became a major factor in the radio-related business of this country. (Figure 15)

Soon Powel Crosley Jr. became known as the "Henry Ford of Radio." Hundreds of women and men were employed at the factory, working under a system designed by Crosley himself. This system was actually an assembly line similar to Henry Ford's automobile assembly line. It may have been the first time that an assembly line was needed in order to produce such large numbers of radios. Sales of radios and accessories had grown to make Powel Jr. one of the leading radio manufacturers in this country.

Chapter Four
The 500-Watt Transmitter

Crosley was never satisfied with the power level and programming of his WLW station. He applied to the Department of Commerce, Bureau of Navigation and was granted a power increase to 500 Watts (W) on September 22, 1922 [74, 92]. The license allowed operation on 360 and 485 meters. Again Dorman Israel was asked to design and help to assemble the 500-W transmitter. The circuitry was the same as the 50-W transmitter but used UV 204 tubes in place of the UV 203s.

Finding a 2,000-V plate power supply presented a real problem but it also created a situation which was amusing for the next six months. The Glow Electric Company of

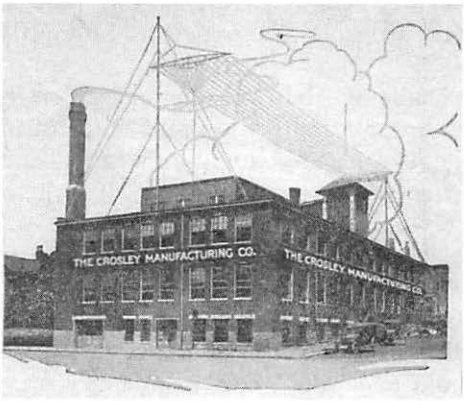


Figure 14. *Crosley's first factory at Colerain and Alfred Streets, 1922.*

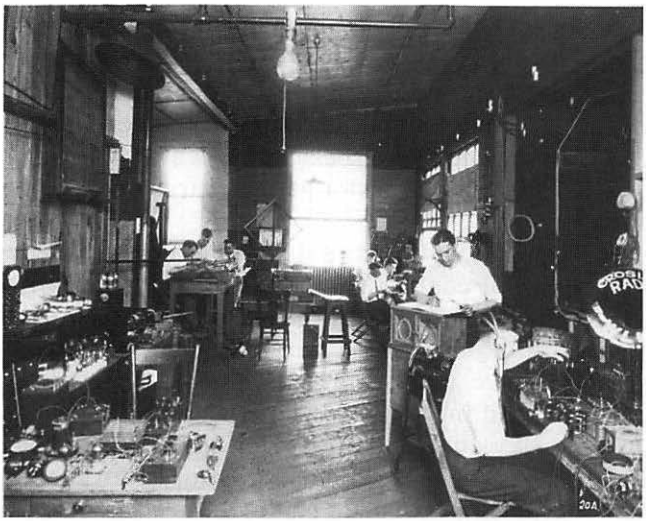


Figure 15. *Crosley Manufacturing Company radio laboratories.*

Cincinnati designed an elaborate system that used a 440-V, 3 phase AC streetcar motor. Two 500-VDC double commutator generators were coupled to each end of this motor. This made four generators with a combined output of 2,000 V for the plate supply. However, the ripple output of the power supply modulated the transmitter about 2% and this unique sound automatically identified the station. This transmitter, with its inherent hum, was used until the Western Electric transmitter replaced it in April of 1923 [13]. Indications are that the transmitter had an output of 300 W instead of the desired 500 W. The antenna had an unorthodox design. It used a multiple-tuned 12-wire, 140-foot flat top, supported by a 100-foot guyed mast at each end.

Powel Jr. was amazed by all the reception reports that were mailed from many distant locations. Reports came from the east and west coasts and foreign countries. He was especially pleased by the many reports which told of the use of Crosley receivers to listen to his station.

At this time, his morning and afternoon programs consisted of weather reports, the opening and closing of the New York Stock Exchange, bond reports, grain and livestock quotations, and general financial conditions. Evening programming was broadcast on Tuesday, Thursday, and Friday beginning at 8 P.M. Central Standard Time. These evening broadcasts included music, lectures, news, and local interest information.

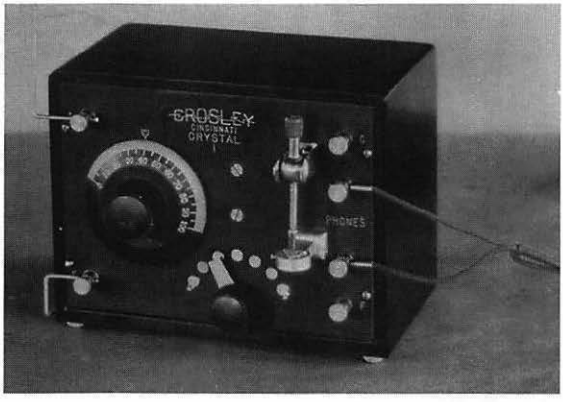


Figure 16. *Crosley Crystal receiver Model I, 1922.*

In less than two years, the Crosley Manufacturing Company had demonstrated tremendous growth and was producing several different models of radio receivers. These included crystal radios, 1½-V tube radios, tuned radio frequency (TRF) radios, audio amplifiers, and experimental units, along with accessories which included tube sockets, condensers, switches, rheostats, binding posts, couplers and transformers of various types, and radio cabinets. (Figure 17)

The "Henry Ford of Radio" [35, 45, 84, 85] was building and selling radios which the average family could afford. However, in the fall of 1922, Powel Crosley Jr. realized that in order for him to be competitive in radio receiver sales, he had to produce more sensitive radio receivers by using the Armstrong regenerative circuit. (The Armstrong regenerative patent 1,113,149 had been issued in 1914.)

In November 1922, Crosley considered entering into an agreement with the Pennsylvania Wireless Company of New Castle, Pennsylvania, which had the Armstrong patent rights to manufacture regenerative radio receivers. Instead of this agreement, Crosley announced in late December 1922 that a partnership had been formed with the Tri-City Electrical Supply Company located in Davenport, Iowa. They also had the Armstrong patent rights. The basic agreement with Tri-City was to manufacture the Harko Senior regenerative receivers in sufficient numbers to permit their sale at a cost which would be within the financial reach of everyone. (Figure 18) Advertisements in several publications indicated that Tri-City Radio Electrical Supply Company would manufacture the Harko Senior regenerative receiver for The Crosley Manufacturing Company. Just three weeks later, on January 15, 1923, the Crosley Manufacturing Company announced that it had purchased the Precision Equipment Company, 2437 Gilbert Avenue, Cincinnati, for $40,000 [81]. His new company retained the Armstrong regeneration patents rights. It also operated radio station WMH and manufactured radio receivers and accessories

Figure 17. *Crosley Manufacturing products of 1922.*

Figure 18. *Crosley Model V built by Tri-City Electrical Supply. (Courtesy of Robert White)*

under the name "ACE." Until now, WLW and WMH had shared program time. Now WLW programming could be increased. Although WMH was one of the first radio stations in this country, Powel Crosley Jr. decided to return the license back to the Department of Commerce. Later WMH became a part of WKRC in Cincinnati.

The identification tag on the Tri-City sets included the Armstrong patent number and the phrase: "manufactured exclusively for the Crosley Manufacturing Co., Cincinnati by Tri-City Radio Electrical Supply Co." (Figure 19 and 20)

The Precision Equipment Company's "ACE" advertisements appeared in publications for the next year. Sometimes they even appeared on pages opposite the Crosley advertisements. In January 1924, the Precision Equipment Company and The Crosley Manufacturing Company merged into the Crosley Radio Corporation. (Figure 21)

By 1923 the words, "Better Costs Less," had become internationally known as the motto for The Crosley Manufacturing Company, manufacturers of radio equipment and operators of WLW. This motto was not only used in advertisements and publicity, but was the motivational slogan instilled in new employees. This slogan impressed every member of the Crosley organization.

Lewis Crosley convinced his brother Powel Jr. that the composite transmitter installed in September 1922 needed to be replaced as soon as possible. The sound quality was very poor in comparison to other transmitters in use at that time because of the noisy plate power supply. On the advice of Lewis, Powel Jr. ordered a new Western Electric Type 101A 500-W transmitter, [82] which used low level modulation with linear operation of the radio frequency amplifier stages. (Figure 23) The high-power tube complement consisted of four type 212s and one type 211. The modulation system was designed by Heising and called either "constant current" or "plate current" modulation. This transmitter was in service for 20 months beginning in April of 1923.

WSAI, a local radio broadcasting station in Cincinnati, also had ordered one of the same models of transmitter. Now there was a local race to get the transmitters on the air. Crosley won the race.

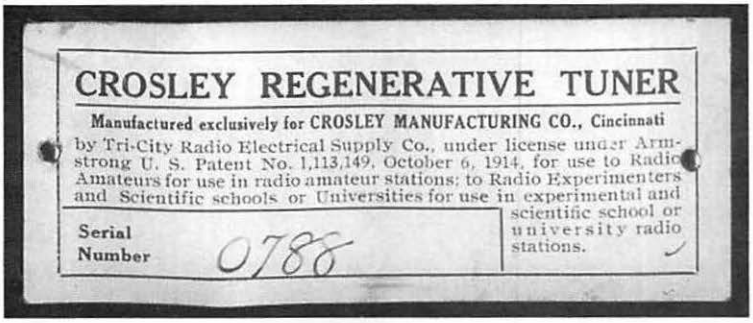


Figure 19. (Above) *Crosley Model V Tri-City nameplate. (Courtesy of Robert White)*

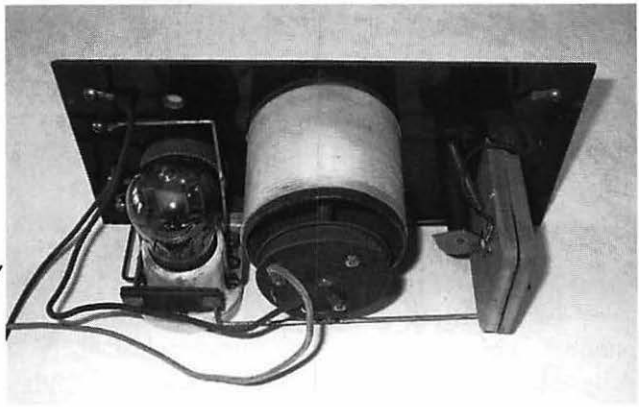


Figure 20. (Right) *Crosley Model V Tri-City inside cabinet. (Courtesy of Robert White)*

Headlines soon followed; "*World's Most Powerful Broadcasting Station Being Installed by Crosley Manufacturing Company To Replace Old Equipment.*" They also proclaimed: "*The new transmitter, which has all of the new refinements and improvements in radio broadcasting, when put into operation, will give WLW greater coverage and more power than any station in the United States.*"

The inauguration of the new station was a local and national affair. Messages from President Harding, governors, and national and local leaders were broadcast. There was also a musical concert with performances by the best musical artists of Cincinnati.

WLW was honored in June, 1923, for becoming a Class B station. With this new classification, the station's frequency of operation was changed from 360 meters to 309 meters (833 kHz to 970 kHz). All "canned music" was barred; therefore, all programming on WLW had to be live.

These changes caused some confusion; however, listeners soon adjusted to the new frequency. They were glad when the interference caused by so many stations operating on or near the same frequencies was eliminated.

One day in November of 1923, as the clock was striking six and most employees had gone home, a few had gathered in the office of the advertising manger to talk over the events of the day. Powel Crosley Jr., president of the company, walked in, democratically sat on the advertising manager's desk, crossed his legs, lit a cigarette and proceeded to ask a few questions. When he was finished, one of the fellows said, "Well, Mr. Crosley, are you satisfied with the way the company is growing?"

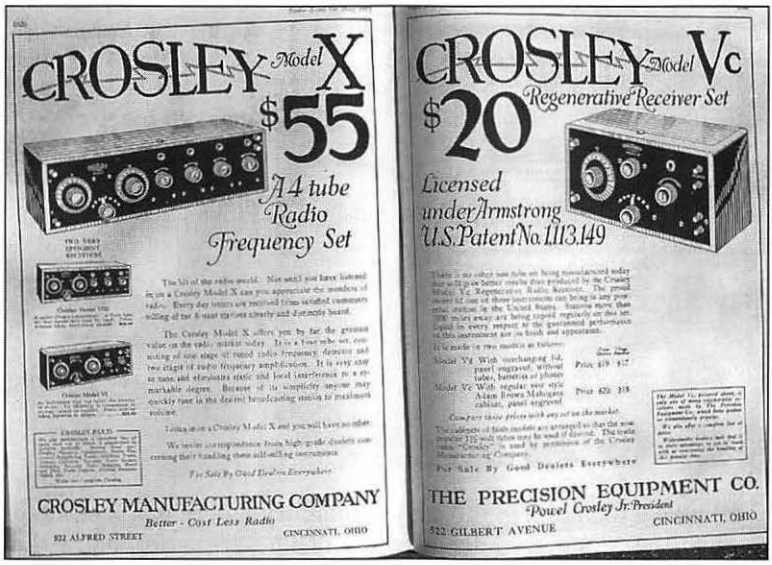


Figure 21. *Crosley and Precision Equipment advertisements side-by-side.*

The reply was lengthy, but in part it follows: "It was just about two years ago that I built my first radio set for my son. We sort of built it together. When I realized I had paid something over $130 for a few parts with which the thing was constructed, I realized there must be a lot of people, who, like myself wanted a radio set but were not willing to pay that amount for it. We were making phonograph cabinets at our woodworking plant and had the necessary machinery to make some radio parts.

"We started by making a little crystal set that sold for a few dollars, but really my aim was to sell a complete set for about $5. Our first effort for a vacuum tube set was the old Harko Senior. When I see how that set has been supplanted by those in front you, I can only marvel at the rapid strides of this business. From that one set a day, a few years ago, we have grown until now our factory is making 1,000 radio receivers a day. They range in price from $20 for a single-tube receiver to $150 for a four-tube receiver with a self-contained loudspeaker.

Figure 22. *Precision Equipment Company advertisement, 1922.*

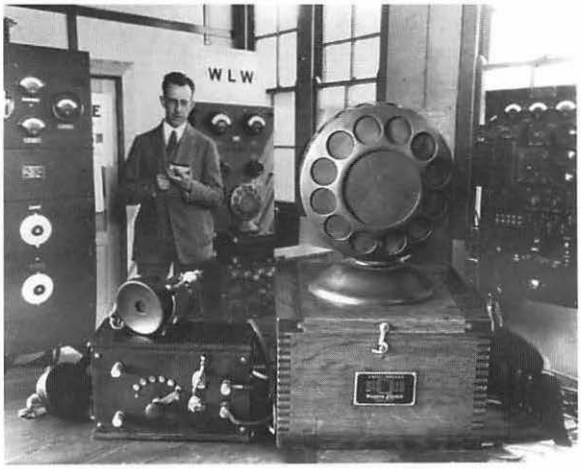


Figure 23. *Powel Crosley Jr. and the 500-W Western Electric 101-A transmitter, Western Electric microphone and Harko crystal receiver used by station WLW.*

We will take a mental trip through the factory where my brother, Lewis, is in charge of the production departments. There are more than a thousand workers, or one worker for each receiver we build. The receivers are made on the plan of the Ford factory and assembled as they pass from one department to another. The assembly is started on the second floor and the receivers are sent through until they receive the final test tags and are boxed and shipped.

"To give you some idea of how much material we need for our receiving sets, this report sheet will show we require 1,000 cabinets daily. In order to make these, our woodworking department uses one carload of mahogany and one carload of poplar each week. A carload of cardboard cartons is required to box the sets while many pounds of paper and string are used in tying them. We can't forget the wooden boxes used for shipping. Our own printing plant is kept busy with circulars, instruction sheets, and literature of all descriptions.

"Three million screws and five million nuts are used weekly in the assembly of the sets and accessories, while six tons of bus wire are required each month.


ANNOUNCEMENT

CROSLEY ACE *Regenerative Receivers* $20.00 and Up

CROSLEY MODEL V REGENERATIVE RECEIVER

ACE TRU REGENERATIVE RADIO RECEIVER

ACE AV-2 TWO-STEP AMPLIFIER

ACE TRANSFORMER

ACE CONDENSER

ACE TUBE SOCKET

The Precision Equipment Company

2500 GILBERT AVE. CINCINNATI, OHIO

Figure 24. *A Precision - Crosley - Ace advertisement from 1923. Note the box in the upper left corner of the page which announced that Crosley has purchased The Precision Equipment Company.*

This means that six men are kept busy bending 500 pounds of cut bus wire every day. 12,000 binding posts are used daily and 3,000 pounds of Formica (500,000 square inches) are used each week. 10,000 book-type condensers are made each week. 1,500 multistats, 15,000 sockets, and 15,000 coils of the basket-weave type for our Varind inductors are used each week. The Varinds use a ton of double cotton-covered wire a month and hundreds of pounds of insulated material are also used for forms upon which wire is wound. It might be interesting to note that 6,000 audio transformers are made each week and that 60,000 silicon steel laminations, each about three inches long, are used in their construction. This would be about 1.5 million laminations per month. 1,100 coils are used to go inside of these audio transformers, and there are 20,000 turns of fine wire on each coil or about 22,000,000 turns a day. Five punch presses are used to make the laminations, and five extra dies are kept around at all times.

"The factory is paid on piece-work time basis and could keep going all day and night if we wanted to, but I do not believe in night work.

"We send out 2,000,000 sales letters annually and tons and tons of printed matter. *The Crosley Weekly* is sent to 25,000 persons each week.

"With such tremendous business, I cannot help but to be pleased with the growth of our company."

The "Henry Ford of Radio" had spoken.

Another Crosley motto was: "Crosley apparatus is cheap because it is good."

One of the questions, often asked was, "How can it be so good at that price?" Powel Jr. replied, "We purchase in large quantities, purchase raw materials by the carload, make our own parts, own a large fully-equipped woodworking plant, use efficient production, and keep the overhead expenses low." It is clear that Powel Jr. was an excellent businessman.

Judging from the many reception reports, 1923 was a very successful year with at least fifteen different models of radio receivers being manufactured and sold. This was the only year that The Precision Equipment Company radio receivers and accessories were manufactured and sold under the Crosley name. (Figure 24) The Precision Equipment Company had two addresses during this year: 2500 Gilbert Avenue, and Blue Rock and B. & O. Railroad. (Figure 25) The highest priced Crosley receiver in 1923 was the Model XXV, which sold for $150. (Figure 26) This price did not include the tubes, batteries, headphones, or a Magnavox speaker. This radio

Crosley Manufacturing Feburary 19, 1923	CROSLEY MANUFACTURING COMPANY Powel Crosley, Jr., President 200 Alfred Street Cincinnati, Ohio *BETTER - - COST LESS* SEND ORDERS NOW TO **Crosley Manufacturing Co.** 200 ALFRED STREET CINCINNATI - - - - - OHIO
First Precision ad February 19, 1923	**The Precision Equipment Company** POWEL CROSLEY, JR., President 2500 GILBERT AVENUE CINCINNATI, OHIO
First ad for Precision on Blue Rock August 20, 1923	THE PRECISION EQUIPMENT COMPANY POWEL CROSLEY, Jr., President
Last Precision ad April 28, 1924	**THE CROSLEY RADIO CORPORATION** POWEL CROSLEY, JR., President Formerly The Precision Equipment Company and Crosley Mfg. Co. 200 ALFRED STREET CINCINNATI, O.
First ad without Precision May 5, 1924	THE CROSLEY RADIO CORPORATION Powel Crosley, Jr., President 200 ALFRED STREET CINCINNATI, OHIO
First ad for Sassafras July 28, 1924	**THE CROSLEY RADIO CORPORATION** 200 SASSAFRAS STREET CINCINNATI, OHIO

Figure 25. *Various business names and addresses used by Crosley.*


CROSLEY MANUFACTURING COMPANY

MODEL XXV

UNIT COST $150.00

COMPLETE COST $271.00

Figure 26. *Crosley Model XXV receiver, 1922.*

receiver was designed so that it would match the finest piece of furniture in any home. All the other radio receivers were priced under $65, except for the Ace 3C which was priced at $125. Crosley prices were very competitive. (Figure 27)

Chapter Five
The 5,000-Watt Transmitter

The radio industry had grown rapidly in 1921 and 1922 and it now compared very favorably with many of the long established industries. It was reported that the American people would spend approximately $350,000,000 for radio equipment in 1924.

Powel Jr. once said, "A home is not a home without a radio." Now that radio sales had increased so dramatically, what would Crosley do next?

In January of 1924, in response to the increasing demand for Crosley radios, Powel Crosley Jr. decided to purchase a larger manufacturing plant [46]. He eventually wanted to have the capability to produce 5,000 sets a day. To accomplish this, he was compelled to seek a much larger factory. The Thomas Corcoran Lamp Company had formerly occupied the building that he purchased at the corner of Colerain Avenue and Sassafras Street in the Camp Washington area of Cincinnati [105]. The building had 100,000 square feet of floor space compared to the 30,000 at the Colerain and Alfred street plant. The cost of the Corcoran building was $150,000. It was estimated that another $150,000 would be needed to make the plant the finest radio manufacturing plant in the Midwest. With plants such as this, the radio industry could no longer be considered just a passing fad. After renovation, the plant opened for production in the summer of


CROSLEY

JUNIOR CRYSTAL RECEIVER

This is the new Crosley Junior Crystal Receiver, the ideal radio set for use in listening to local broadcasting stations and those within a radius of about 25 miles. Clear, undistorted reception is assured, this new set providing perfect reproduction of radio signals. No batteries or tubes are required, nothing to become disconnected, nothing to be damaged by the children.

With the advent of summer, the demand for crystal sets has increased tremendously. Crosley dealers and jobbers will find that this new set will meet immediate approval, and we suggest that you get your orders to us as soon as possible.

Price, without phones or aerial equipment, ...$4.00

THE CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

200 ALFRED STREET CINCINNATI, OHIO

Figure 27. *Crosley Junior crystal receiver, 1923.*

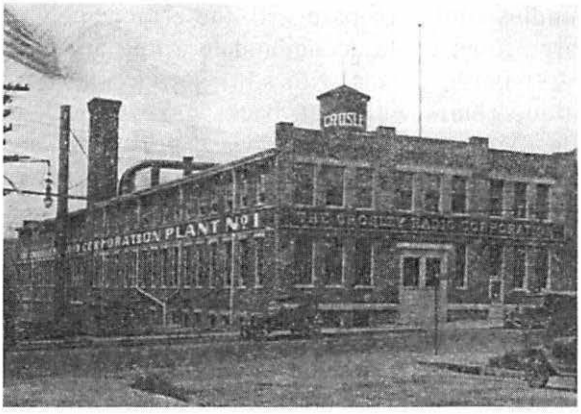


Figure 28. *Crosley's third factory at Colerain and Sassafras Streets, 1924.*

1924 and was known as Plant No. 1. (Figure 28) This was now the third facility that Crosley used in the production of radio receivers. This plant had the advantage of a railroad siding to facilitate reception of raw materials and delivery of finished products.

The entire top floor was devoted to office space and the new WLW studio with its engineering, and experimental departments. The assembly of receiving sets was done on the second and third floors while the first floor contained the stock rooms, shipping and receiving departments, etc. Additional buildings were added in the general area as needed.

New studios and an auditorium were built late in 1924. They were very beautiful and surpassed anything of their kind in radio broadcasting. The solo studio and office of the director was large enough to hold a small group of musicians and an announcer. The studio even contained a Baldwin piano and xylophone. The walls were covered with tapestries and the hardwood floors were covered with oriental rugs. The woodwork was mahogany. Swinging doors led to the large studio, the auditorium and the control room.

Figure 29. *A studio at Crosley's broadcast station WLW in 1924.*

No other broadcasting studios could compare with the arrangement of his ensemble studio. This large room could accommodate a military band or large orchestra. (Figure 29) Large divans with soft, springy cushions lined the walls. Several antique chairs with high backs gave a touch of elegance to the draped walls. A large chime clock was both useful and ornamental. A Baldwin concert grand piano was located in one corner of the room and tapestries were used as part of the decorative scheme.

Monk's cloth covered the walls of this studio and a deep fringe at the bottom of the cloth reached to the floor. These wall draperies were designed to eliminate reverberation but the monk's cloth could be drawn back in places when certain types of voices required a different acoustical quality. The ceiling was covered with a specially treated membrane material to minimize reverberation. The microphones in both studios were controlled from a triangular-shaped room located between the studios. Special telephone lines carried the programs to the station and relayed the incoming broadcasts from remote places such as churches, dance halls, sporting events, and other special events.

The familiar red studio "ON THE AIR" signal light was replaced by a new microphone stand developed by Crosley engineers. (Figure 30) There was a system of illuminated words in the stand which informed the artist when to "PREPARE" and when to "BROADCAST." This was part of a system that also allowed rapid microphone switching between the two studios.

With the completion of these new studios, WLW was now ready to become a super-power station, with an increase in power to 5,000 W.

By late 1924, Western Electric had developed a new 5,000-W transmitter. Powel Jr., following his policy of increasing power as the state of the art advanced, ordered one of these new 5,000-W transmitters. Several smaller broadcast stations set up a loud clamor about the coming "Super Power" competition and mournfully cried that they would be forced off the air by the higher-powered stations.

A new license was granted by the Department of Commerce in January, 1925. The license read, "WLW Crosley Radio Corporation, 500 W regular and 5,000 W experimental, 422.3 meters." The license application for renewal, filed in 1927, indicated that this was the first remotely-controlled station in America.

Figure 30. *The WLW double-button carbon microphone in 1924.*

Another Crosley motto was: "Doing it first, that's Crosley." and his remotely-controlled station lived up to this motto.

The Crosley Radio Weekly had this as a headline on September 22, 1924: "New Super Power Station soon to be in operation; Beautiful studios planned. Five-killowatt transmitter to be the latest radio achievement and may send Yuletide greetings around the world. Station to be miles from studio." [49, 50, 53, 54, 57, 60].

After a careful survey of the topography of the area surrounding Cincinnati, WLW engineers selected a site for the transmitter. (Figure 31) The new site was near Harrison, Ohio, about 25 miles from the studios in Cincinnati. The site selected was out in the country on a high hill.

Powel Jr. was a firm believer that broadcast transmitters should be located as high as possible and in remote areas. He believed that this kind of location would eliminate local interference and absorption of the transmitted signal by electrical wires, steel structures, buildings, and trees.

Plans for the construction of the new transmitter building and antenna system were completed and construction began in the early fall of 1924. The original design of the transmitter building changed drastically and it was eventually designed to have the appearance of a farmhouse. The first floor was used for the transmitter operation, while the second floor contained the living quarters for the resident operator.

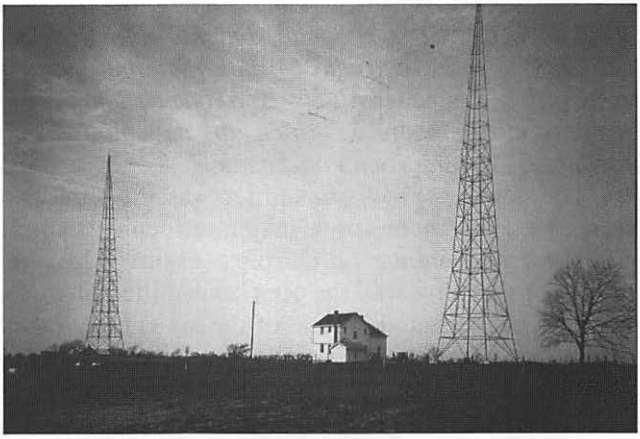


Figure 31. *Site of 5-kW transmitter for Crosley radio station WLW at Harrison, Ohio, 1925.*

Two 200-foot towers were erected to support the 300-foot long six-wire flat-top antenna at one of the highest points around the Cincinnati area. From the 30-foot wide square base, the tower width decreased to 14 inches at the top, forming a massive pyramid of fabricated steel. The towers rested upon four concrete supports that were embedded seven feet into the ground. Only one of these towers' eight concrete supports can be seen today. It is at the intersection of Carolina Trace and Marvin Road near Harrison, Ohio.

The first remotely-controlled, super powered broadcast station was officially opened by Powel Crosley Jr. at 8 PM on Tuesday evening, January 27, 1925 [55, 56]. The broadcast was controlled from the WLW studios on Colerain Avenue in Cincinnati.

Many prominent men and women in the radio industry were present at the dedication, and telegrams and letters were received from numerous noteworthy people who could not attend.

Herbert Hoover, Secretary of Commerce and chief government supervisor of radio, sent the following telegram: "*I extend to you my heartiest congratulations upon the opening of your new station. Experiments which you and others are conducting are of the greatest interest. If successful, it will mean high efficiency in service to the listening public - and this must be the final purpose of all broadcasting. You have my very best wishes for your success.*"

Edwin H. Armstrong, whose regenerative circuit was used in the Crosley radios, sent the following message: "*Believe that the higher the power of WLW, the greater will be its success. Best wishes and success.*"

From William Dubilier, a radio pioneer came this message: "*Again you have placed radio science and invention under obligation to you by your commercial genius and success. You are making it possible for the public to get the benefit of research and the engineer and inventor to be properly compensated. It is through men like you, that they get together, thus rendering a much needed service. You certainly deserve the title 'The Henry Ford of Radio'.*"

E. F. McDonald, president of the National Association of Broadcasters, sent this message: "*Most sincere congratulations to 'The Henry Ford of Radio' on his latest accomplishment. Here's to continued prosperity for WLW, The Crosley Radio Corporation and yourself.*"

Colin B. Kennedy wrote: "*As a staunch admirer of your past achievements, it is my most sincere wish that this new station may be the means of still further spreading your good name.*"

The new 5,000-W transmitter was the first of the Western Electric 5 series [101] to incorporate major refinements in circuitry that performed automatic sequencing on startup. (Figure 32) Serial number 101, which indicated that this was the first transmitter of this type made by Western Electric, was located on one of the six cabinet panels. Even though it was better than any other transmitters available at the time, it still used low-

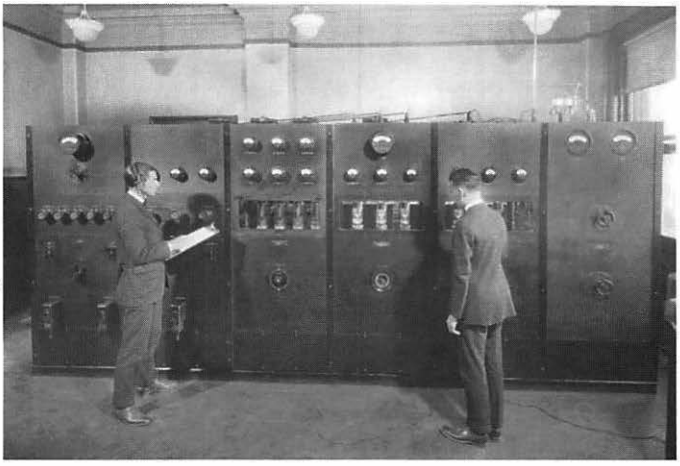


Figure 32. *The Western Electric 5-kW transmitter for Crosley radio station WLW at Harrison, Ohio, 1925.*

level Heising modulation with linear operation of the radio-frequency amplifier stages. The tube complement consisted of a 211, 212s, 220Bs and 222s. The final linear amplifier used two 220B tubes in parallel, and the high voltage rectifier tubes were 222s. Motor-generators were used to supply the filament voltages for all the tubes except the rectifiers and to supply plate voltage for the low power stages. The high-voltage rectifier filaments were transformer powered. The rectifier and the power amplifier tubes were water-cooled. The water used for cooling the tubes was run through cast iron steam radiators with electric fans to help dissipate the heat. One feature of this transmitter was the ability to put it in operation by activating a single switch which started various motor generators, lighted tube filaments and started the water cooling system. After a time delay, the plate voltages were automatically applied to the various stages of the transmitter.

After a few years, a new 50,000-W transmitter began operation at Mason, Ohio, and this "old" 5,000-W transmitter at Harrison was sold to a company in Mexico. The transmitter building was also sold and the following winter it burned to the ground [92].

From the time Crosley began to manufacture radio equipment until the end of 1924, fifty-four different models of receivers had been built. Nearly half of these were built in 1924. The Super VI, XJ and XL models were all tuned radio frequency (TRF) receivers. The XL was the most costly at $140. The popular 50 series were all regenerative receivers with the Model 52SD Special Deluxe selling for $37.50, and the Model 50 selling for $14.50. There were twelve models for the public to select from in the lower price range. The 50P, 51P, and 52P portable receivers, which had become very popular, were also included in this price level. The 50P was the first to be built and

Figure 33. *The Crosley 50P portable receiver, 1924. (Courtesy of Robert Sands.)*

it sold for $18.50. (Figure 33) A short time later the price was reduced to $14.50.

Eight models of the Trirdyn [59] with the reflex-regenerative circuit were introduced that year. (Figure 34) These receivers, with only three tubes, had the efficiency and volume of a five-tube receiver. They were priced from $50 for the panel model 3R3, to $110 for either the Newport or Biltmore models. All receivers manufactured in 1924 used batteries as the power source.

Crosley radios were very competitive in price compared to other manufacturers, and Crosley offered a large selection of models. Sears Roebuck had an agreement with Crosley to supply radio receivers and accessories with Sears model numbers such as the Model SR2. Several models were built, but this association did not last very long because Sears Roebuck found another supplier for their radio sets.

In late 1924, Crosley acquired a large interest in the Canadian-Deforest Radio Corporation to help him expand the distribution of his Crosley radio receivers. This was a step in the fulfillment of his plan to have "A Radio in every American Home" including those in Canada, Mexico, and Central and South America. The Deforest-Crosley receiving equipment was the same type as the receivers being sold in the United States and the sets were constructed with standard Crosley parts. The receivers produced in Canada were advertised as the Deforest-Crosley Models 50, 51, and 52. In August of 1924, production also began on an audio amplifier. In July of 1925, the Canadian-Deforest advertisements no longer included the standard Crosley radio receivers, so, apparently, the Deforest-Crosley Company had started to manufacture its own radio receiver models.

Powel Crosley Jr. made a special request to the Department of Commerce to allow him to change of the wavelength of WLW broadcasting to 423 meters, (710 kHz). The wavelength change solved the problem of shared program times with WSAI, a local station which broadcast on 309 meters, (970 kHz). Starting on June 30, 1924, WLW would share program times on the new frequency with two other stations; WBAV in Columbus, Ohio and KPO in Oakland, California. Friday nights were silent. KPO would not be an interference problem because of the time difference and the distance separating the two stations. This was the third wavelength change since the beginning of the WLW programming on March 22, 1922.

During 1924, programs were broadcast for approximately sixty hours each week. In addition to the usual programming there were special programs

Figure 34. *The Crosley Trirdyn receiver, 1924.*

such as election results, sports (including the opening game of the Cincinnati Reds), zoo broadcasts, local concerts, orchestras, plays, and educational activities.

1924 was certainly a challenging year for Powel Jr. He changed the company name, purchased a new plant, and increased production to his goal of 5,000 radios per day. He also constructed new studios, purchased a 5,000-W Western Electric transmitter, produced 24 models of radios and numerous radio accessories, and made plans for the new 5,000-W Super-Power station. He was also successful in employing high quality management and engineering people who made 1924 such a successful year. The company ended the year with a profit of nearly $2,000,000.

Another Crosley motto was: "Tomorrow may come -What are you going to sell today?"

From the beginning, the idea of radio broadcast advertising was opposed by some broadcasters, receiver manufacturers, wholesalers, and retailers. Radio was in its infancy and most on-air entertainment was done without pay. Therefore, it did not seem to be fitting for any commercial intrusions to interfere with the pleasure of the listener.

From 1922 to 1925, WLW did not sell commercial advertising. Powel Crosley Jr. was the only sponsor of his station. He wanted it to succeed because it would help him sell more radio products. Westheimer and Company received on-the-air credit for supplying the stock market reports. Baldwin was mentioned for supplying the piano. Drama schools that provided talented performers received credit. Any individual or group that performed on WLW received free advertising for their efforts. WLW listeners heard the Crosley name mentioned frequently in such contexts as the Crosley program schedule, the Crosley orchestra, and, information about Crosley products. So, when it came time to buy a new radio, the Crosley name had already become very familiar. Radio advertising became a nationwide phenomenon in 1925. By 1926, Crosley believed it was time for him to enter the radio advertising business. Cincinnati, with all its manufacturers and businesses, was ready for radio advertising on WLW because of the wide coverage and variety of programming.

The Crosley Pup has a Pedigree

"Radio for the Millions" had always been the motto of the Crosley Radio Corporation. In July 1925, the Crosley Pup was introduced and immediately became one of the most popular receivers ever manufactured by Crosley [65, 66, 67, 68, 69, 70, 71, 72]. (Figure 35) It sold for the ridiculously low price of $9.75. The receiver was a redesigned Model 50 in a small metal cabinet.

A contest was held from September 1, 1925 to March 1, 1926. A $1,000 grand prize was offered to the owner of the "Pup" with the best reception results. The same contest also offered six pedigrees of live pups as prizes for reception reports. Another part of the advertising for the Crosley Pup featured the famous cartoon dog Bonzo wearing a pair of Crosley headphones [40]. (Figure 36) Five weeks after production started on September 1,

WORLD'S SMALLEST RADIO SET UTILIZING VACUUM TUBE

THE life ambition of Powel Crosley, Jr., is about to be realized. Four years ago, before he was referred to as "the Henry Ford of Radio," he wanted to buy a one-tube radio receiver for his son to play with. He was informed it would cost $130.00. Feeling that was entirely too much money to spend for a boy's toy and also realizing there must be other fathers who would like to give radio sets to their children, he made up his mind to someday build a radio set which would be within the pocket-book reach of everybody.

Success has crowned the efforts of the inventor of the new single-tube regenerative receiver which he has called the "pup" because it is the smallest real radio set in the world. The tremendous production facilities in his Cincinnati plants makes it possible to sell the set for $9.75. A radio of this kind makes it possible to "take your entertainment with you." It weighs about a pound and is only 3¾ by 4⅛ by 4⅝ inches.

Experiments have demonstrated this single-tube receiver will pick-up signals from distant broadcasting stations with excellent volume and the super-power stations "pound right in." Its inventor believes that it will not be long until foreign high-power stations will be heard with a one-tube receiver

Figure 35. *Crosley Pup receiver advertisement from 1925.*

1925, 14,000 "Pups" had been made and delivered. Sales of the popular Crosley Pup and the Trirdyn were the main factors that allowed Crosley to stay in business in the hard times of 1925 [73].

After a careful survey and study of various methods of merchandising, Crosley announced a new sales plan. Authorized Crosley sales and service stations were established throughout the country. This created a very profitable source of increased sales and income for the distributors and dealers who held a Crosley franchise. Crosley limited his dealer outlets to the "higher end" merchants, thus improving service to the buying public and inspiring confidence in the Crosley products. The new sales plans were praised by all of the distributors and dealers who said, "This will be the salvation of radio." [62].

Powel Crosley Jr. was always enthusiastic about the development of high-powered broadcasting stations which he thought would be beneficial to people who lived in small towns and rural areas. As a member of the Hoover Commission, he attended a radio conference in Washington and fought strenuously for what he believed to be in the best interest of radio listeners. Thus he became known as "High Power Crosley." This name stayed with him because of his attitude

Figure 36. *Powel Crosley Jr., Bonzo, and the Crosley Pup, 1925.*

about broadcasting, and also because of his great mental powers and his ability to reach the very pinnacle of fame. In 1924 he predicted power levels of broadcast transmitters would eventually reach 200,000 W.

Powel Crosley Jr. was a very active member of the Hoover Commission and other organizations. He was past president of the National Association of Broadcasters and the National Association of Manufacturers. He had always been very concerned about the regulation of broadcasting, including wavelength assignments, receiver radiation, interference between stations, licensing of broadcasters, programming, etc.

In December, 1925, Powel Jr. attended the fourth National Radio Conference and was elated when Herbert Hoover, Secretary of Commerce, was designated the "czar of the radio industry." This complete transfer of power to the Secretary of Commerce was approved by Congress and Herbert Hoover eventually served as President of the United States from 1928 to 1932. Needless to say, Powel Jr. had considerable influence with President Hoover.

The Crosley receiver models of 1924 were in such demand that only the Crosley Pup and three new models of the Trirdyn receivers were introduced in 1925 [64].

The radio world had been waiting for a reasonably-priced loudspeaker to replace the uncomfortable head phones and hollow-sounding horn speakers. Crosley introduced the Musicone speaker [41] and it quickly became popular with the rapidly increasing number of radio listeners. (Figure 37) The Musicone speakers were attractive [16, 61]. Batteries were not needed for their operation, and they were easy to connect to most radio receivers. "Good broadcasting and a good receiving set were worthless without a good reproducer." The Musicone sold for $17.50, and the Musicone Deluxe in a mahogany case sold for $27.50. This was a very competitive price compared to other available loudspeakers.

In June of 1925, a baseball game between the Cincinnati Reds and the Chicago Cubs [63] was interrupted by the sale of a Trirdyn Special Receiver. (Figure 38) Tommy Griffith, a player for the Cincinnati Reds and a Crosley dealer, sold the radio and a Musicone speaker to Cliff Heathcote, a player for the Cubs. The sale was completed between the second and third innings. The crowd watched in astonishment but realized later that it was a great way to advertise Crosley radios.

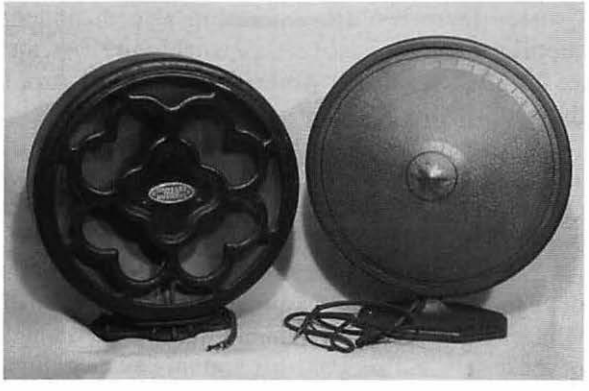


Figure 37. *Crosley Musicone loudspeakers, 1925.*

Figure 38. *Crosley Trirdyn / Musicone special, 1925.*

Amrad, the American Radio and Research Corporation, was purchased by Powel Crosley Jr. in December of 1925. Amrad had been a pioneer in the radio industry dating back to before World War I. Amrad had always been foremost among radio manufacturers in fostering research. They developed such products as the "S" tube, used extensively for rectification of alternating currents. Amrad was licensed under the basic patents for Mershow electrolytic condensers and the Hazeltine Neutrodyne circuits. Overproduction during the broadcast craze caused some financial difficulties for Amrad during the succeeding years. The operation of Amrad was entirely separate from the Crosley Radio Corporation. With the purchase of Amrad, Powel Crosley Jr., president and owner of The Crosley Radio Corporation and controller of the Canadian - Deforest Corporation, became an even more prominent figure in the radio industry [51].

Chapter Six
The 50,000-Watt Transmitter

Cincinnati had been referred to as "The Radio City" [98] and this title was well earned. More radio receivers were manufactured in Cincinnati than any other place in the world. Not only was there a tremendous output of receivers, but broadcasting was done from the first remotely- controlled, super-power broadcast station in this country. Powel Crosley Jr. had become the leader in producing-low priced receivers and was widely referred to as "The Henry Ford of Radio."

In 1926 Crosley was producing approximately 5,000 radio receivers per day and this provided employment for 3,800 women and men in the Crosley factories. His operation also provided employment for numerous suppliers locally, as well as worldwide. As an example, lumbermen from as far away as South America and Africa supplied the solid mahogany for the radio cabinets.

Crosley always had confidence in the growing radio industry and in 1926 a six-story addition to Plant No. I at Colerain and Alfred Streets was completed. The studios remained in the original building which had been purchased in February, 1924.

Several of the nine receivers introduced in 1926 had the "Crescendon" or regeneration tickler control and another control called the "Accuminator," which consisted of switchable auxiliary condensers for sharp tuning. Some of these sets had six controls and this made adjustment and operation difficult.

However, in one month in 1926, 2,200 of the Model 5-50 sets were manufactured each day.

There was a period between 1926 and 1927 when many consumers were waiting for radios that did not require batteries. Crosley officials realized that there was a demand for batteryless radio receivers, but they refused to enter the field until they could sell those receivers at reasonable prices. (Figure 39) In 1927 Crosley introduced models AC-7 and AC-7C, which used the Crosley alternating current supply unit [17, 43]. This battery eliminator was designed to operate on ordinary 110-V 60 Hz lighting or power circuits [42].

By late 1926, Crosley believed that 85 percent of the six million radio receivers in use around the world were obsolete and would be replaced in the near future. Again, he believed that he had to be ready to meet the demand. Therefore, new radios were designed which used the neutrodyne circuit in a metal cabinet with an illuminated dial and other innovative features. Nine of the twelve new models were AC operated and used new AC tubes such as the UX226 and UY227. These receivers included various models such as the Bandbox, Gembox, Jewelbox, and the Showbox.

Crosley spent one-half million dollars in just a few months on advertisements for these new models. To meet production demands, another half million dollars was invested in machinery, equipment, and tools. These receivers proved to be very popular and sales and profits in 1928 were the highest in company history.

A Crosley motto at that time was: "You're there with a Bandbox and then some."

Prior to the organization of the National Broadcasting Company (NBC) in November, 1926, WLW presented a series of Sunday afternoon musical broadcasts sponsored by Powel Crosley Jr. They were aired over radio station WEAF's network from the Crosley studios in Cincinnati. The WEAF network consisted of 20 stations, including WSAI in Cincinnati [97]. This became the new NBC network, with WEAF in New York City as the key station. There were 19 affiliated stations that used more than 3,500 miles of special telephone lines for programming

Figure 39. *Crosley AC-powered receivers in 1927.*

The "Crosley Hour" over the Red network of NBC was among the first of the many programs that Crosley fed to NBC [20] over the coming years. Later on, many other stations became affiliated with NBC [97].

Powel Crosley Jr. was very successful in the radio business. After just four years of manufacturing radio receivers and broadcasting on WLW, he was offered six and one half million dollars for his business but he refused to sell. He was just 38 years old and certainly not ready to give up his future opportunities in radio. At that time he had already become one of the wealthiest men in Cincinnati.

A new act of Congress established the Federal Radio Commission and gave it the authority to allocate commercial frequencies and hours of operation as well as to prescribe and supervise radio discipline. The bill was passed by Congress and signed by President Coolidge on February 27, 1927.

After the Federal Radio Commission was established, Congress immediately proceeded to make it a political football. Broadcasters who wanted better frequencies and other favors began to ask their Congressmen and their listeners for support. Listeners were asked to write letters to the Federal Radio Commission and their Congressmen requesting favorable consideration for their favorite stations.

Soon after the Federal Radio Commission was established, Powel Jr. submitted an application to have WLW's operating frequency moved to 700 kHz. This frequency change was granted on June 1, 1927, but WLW had to share the frequency with WMAF in Massachusetts and KFBU in Wyoming. Later, WMAF stopped broadcasting and KFBU moved to another frequency, leaving WLW with a clear channel. This led to more programming and less interference for the WLW signal.

The time of transition had ended. Powel Jr. believed that a new period of radio growth had begun, with the addition of network programming and hopefully better regulation of the radio industry. To be a success in radio broadcasting, Powel Jr. believed it was important to have broad coverage, listener loyalty, good programming and sales power coupled with product integrity. He felt that broadcasting that was poorly handled was a liability rather than an asset. If a station maintained a high quality of service and gained the approval of the listening public, the goodwill would be commercially valuable.

Figure 40. *WSAI at Mason, Ohio was purchased by Crosley in 1928.*

To keep up with the growing radio industry, Powel Jr. believed that higher power was the answer. He applied to the Federal Radio Commission to increase the WLW power to 50,000 W.

Powel Jr. began to look closely at radio station WSAI which had a proven transmitter location at Mason, Ohio. (Figure 40) The station was owned by the U.S. Playing Card Company in Norwood, a Cincinnati suburb, and had begun broadcasting in June of 1923. WSAI had moved to a new building in Mason in February of 1925, with a new Western Electric 5,000-W transmitter, Model 5C. WLW had made a similar move to a new building in Harrison, Ohio in January of 1925, with the same model transmitter.

On May 8, 1928, *The Cincinnati Enquirer* published the news that station WSAI, operated by the U.S. Playing Card Company, had been acquired by the Crosley Radio Corporation, under the terms of a lease with privilege to purchase [18]. Twenty days later, on May 28, 1928, the Crosley Radio Corporation was authorized to build a 50,000-W transmitter. "Here we go again!" Construction of a new building adjacent to the WSAI building, a new antenna, and the installation of a new 50,000-W transmitter had to be completed. (Figure 41) Powel Jr. was always ready for a power increase, so installing and putting the 50,000-W transmitter on the air as soon as possible was nothing new for the WLW engineers [19].

Excavations for the new building and antenna tower foundations were begun in June with a goal of making the new WLW 50,000-W transmitter operational by early fall of 1928. (Figure 42 and 43)

A newly designed 50,000-W transmitter, the Western Electric Model 7A, [90, 101] was ordered. (Figure 44) This was a crystal-controlled, low power

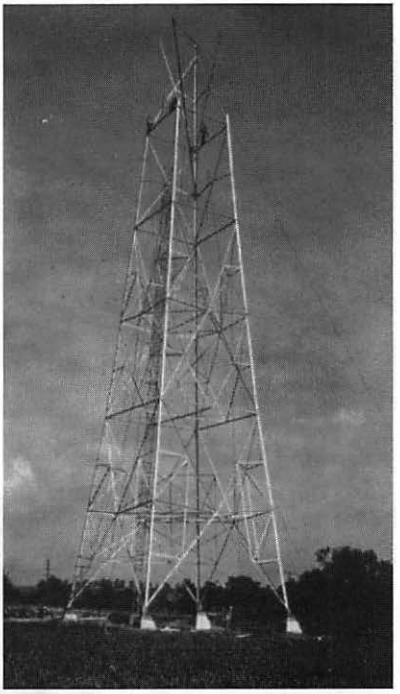


Figure 42. (Above) *300 foot self-supporting tower under construction.*

Figure 41. (Below) *WLW building, rear view, during construction for installation of the 50-kW transmitter, 1928. Notice horse and wagon.*

oscillator/modulator transmitter with its output driving three stages of power amplification. The 700-kHz crystal oscillator used a WE-248A tube. That tube was followed by another WE-248A buffer amplifier driving a modulated WE-248A amplifier. The modulated radio signal at 700 kHz, was amplified in three successive stages to the final output power. The first power amplifier consisted of two radiation-cooled WE-212D tubes connected in push pull with an output of 500 W. The second power amplifier had two WE-232A water-cooled tubes connected in push pull with a power output of 10,000 W. The third power amplifier had six WE-232A water-cooled tubes, connected in push pull parallel, with a final output of 50,000 W and a peak power of 200,000 W. The transmitter output could be switched to either the antenna coupling unit or to the artificial antenna.

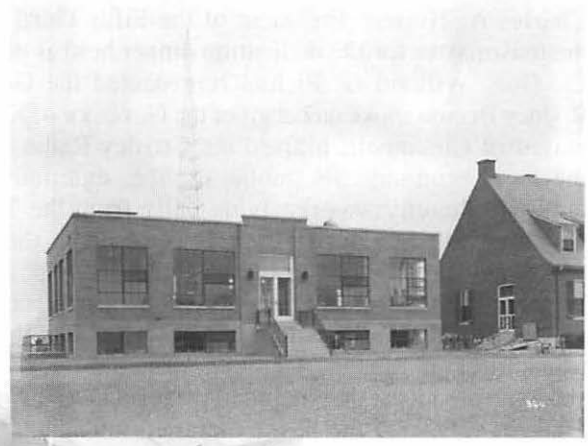
Seven panel units were needed with a screen enclosure at the rear of the units for the transmitter and an artificial antenna. The power supplies for the transmitter required three panel units. One of these units had the necessary power distribution and control facilities. The model 7A transmitter required a three-phase input of approximately 250 kW at 440 V. Voltage for the air-cooled tubes was supplied from a 1,600-V, three phase, half-wave rectifier which used three WE-234A tubes in another panel unit. This unit also had the necessary metering, filament rheostat controls, and switching and overload protection for the equipment. Another panel unit contained the high-voltage rectifiers that supplied the 17,000 VDC for the water-cooled WE-232A tubes. This rectifier consisted of six tubes in a three-phase circuit. Like the 1,600 V supply, this unit also had the necessary metering, switching, filament rheostat controls, and overload protection. Some of the power and filament transformers, filter chokes and filter capacitors were located in another area along with the water cooling system and the direct current generator for the filament circuits.

The new two-story transmitter building was designed by Crosley broadcast engineers using brick, concrete, and steel construction. It included several windows and a flat gypsum roof.

Two 300-foot towers were constructed 400-feet west of the transmitter building. (Figure 45) These towers supported the "T" wire cage antenna which measured about 0.75 wavelength. The antenna was oriented in a north-south direction. Directly under the antenna, a tuning house was built. A ground system was installed which consisted of several miles of copper wire buried ten inches underground. Interestingly, the lumber which had been used to pack and crate the new transmitter was used in the construction of the tuning house.

On October 29, 1928, [20] the new 50,000-W WLW transmitter at Mason, Ohio [21] was dedicated. This was only five months after authorization for its construction was received. The new transmitter was located 25 miles away from the studio and the day of the dedication was a busy day for many of the WLW personnel. At 10 o'clock, on a Monday morning, a large group of guests gathered at the Crosley Radio Corporation office and studio and then were taken by motor bus to Mason, Ohio. There they toured the new WLW site and learned about its operation. Following a luncheon buffet, the guests returned from Mason and were given a tour of the Crosley factory.

Figure 43. *WLW transmitter building completed in 1928, front view.*



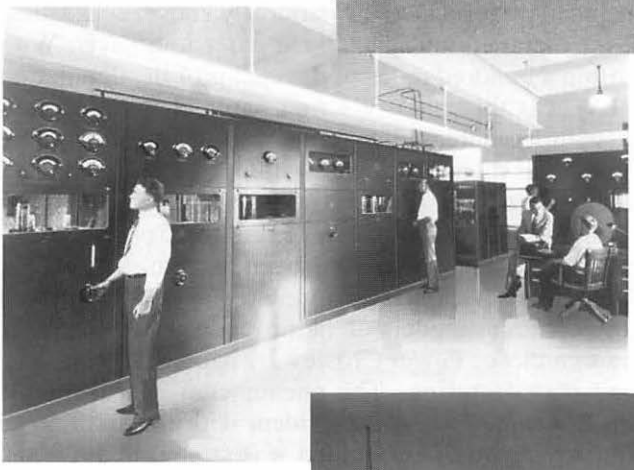


Figure 44. *Western Electric Model 7A 50-kW transmitter at Mason, 1928.*

Figure 45. *WLW "T" antenna west of the transmitter building, 1928.*

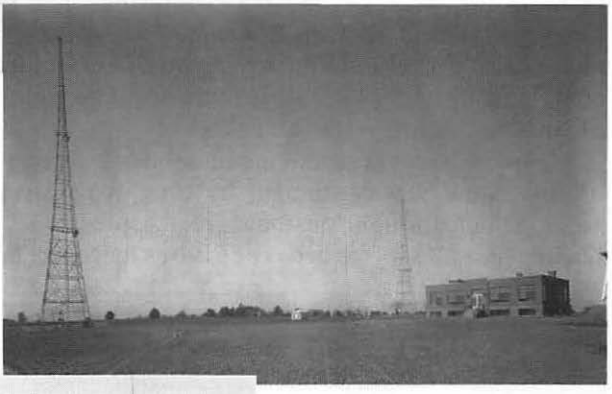


Figure 46. *New manufacturing facility and WLW / WSAI studio building at Gilbert and Arlington Streets, 1929.*

Charles A. Hinsch, President of the Fifth Third Union Trust Company, was the toastmaster for the dedication dinner held at the Hotel Gibson that evening. Lt. Gov. William G. Pichtel represented the Governor of Ohio, and Judge Rodney Bryson spoke on behalf of the Governor of Kentucky. Murray Seasongood, mayor of Cincinnati, praised the Crosley Radio Corporation for its effect on the local economy, its public service, entertainment, information, and the publicity the city was receiving daily from the WLW broadcasts [22].

After all the construction and testing of the 50,000-W transmitter was completed, it was time to increase the WLW power from 5,000 W to 50,000 W. At 9 PM the transmitter at Harrison was turned off and Powel Jr. operated a switch in the ballroom at the Hotel Gibson that turned on the new WLW transmitter at Mason. Dedication ceremonies were started with a special six-hour broadcast that included performances by nationally known celebrities, a large orchestra, the best Cincinnati musicians, and other radio acts. With the transmitter located within a hundred miles of the center of the population of the United States, WLW was this country's first national radio station. In a few months, WLW, with its increased coverage and local and national programming, became known as "The Nation's Station." [8, 12, 27].

Only a little more than seven years had passed since the first Crosley station went on the air with a power of only 20 W. From the first WLW 50-W transmitter, in March, 1922, the power had been increased to 1,000 times its 50 W level. Also in that seven-year period, Crosley had introduced and sold more than eighty different models of radio receivers.

As the twenties came to a close, Powel Crosley Jr. had become an icon in radio broadcasting and manufacturing. The phenomenal growth of the Crosley Radio Corporation became even more evident with the addition of an eight-story building on Arlington Street, which was started in 1928 and completed in 1929 [23, 24]. (Figure 46) The eighth floor became the location of the studios for WLW and WSAI.

While Crosley was moving into the new eight-story building, the economy of this country was stunned by the "Wall Street crash" of October 29, 1929, which brought on the "great depression." The depression caused a decline in sales of radio receivers because most people just could not afford to purchase a new radio at this time. Crosley had planned to introduce more than 25 models of radio receivers in 1929.

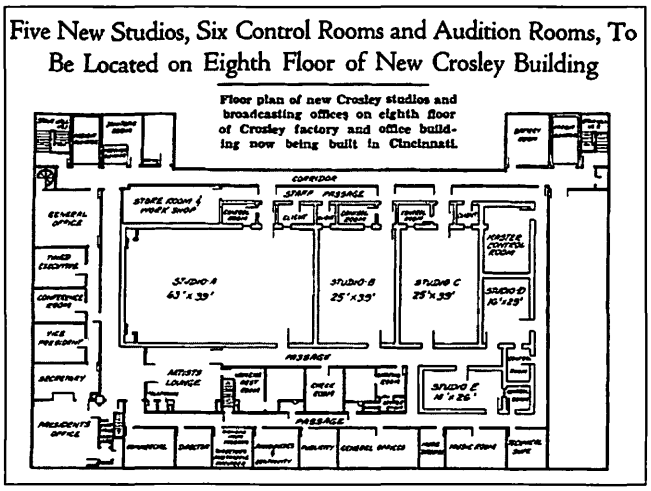


Figure 47. *WLW / WSAI studio floor plan at Arlington Street.*

This was the year of another new motto: "You're there with a Crosley."

During the depression, Crosley employees, city officials, the public and friends were wondering once again, what Powel Jr. would do next. To save time at management meetings, the theme always was, "Let us find out how to do it - rather than why we can't do it." Powel Jr. felt that the length of the depression was unpredictable. Therefore, he did not wish to change his plans for the operation of the Crosley Radio Corporation because he felt that a change in plans could make the economic situation worse in Cincinnati and elsewhere. In the light of this uncertainty about the economic situation, he decided to "tinker" with some new ideas about the future operation of the corporation. One idea was to start manufacturing refrigerators.

Part of the addition to the new building included new studios on the eighth floor for both WLW and WSAI. (Figure 47) With construction completed, the new studios were opened for regular programming on Sunday, March 23, 1930 [25]. The new studios, offices, and control rooms were arranged to permit the most efficient operation of the equipment and the easiest movement of entertainers and musicians. There were five studios with different dimensions for different types of programs. The acoustics were as perfect as the most advanced sound engineering methods could make them. The walls, floors, and ceiling of the studios were completely floating in felt so that no contact was made with metal or wood. Crosley engineers made up a jingle, which sounded like a nursery rhyme: "*The top girder rests on felt, which rests on steel, which rests on felt, which rests on wood, which rests on steel, which rests on concrete.*"

There were five studios. Studio A (63 feet by 39 feet by 21 feet) contained a new organ and could accommodate a full symphony orchestra. (Figure 48) Studios B and C were smaller and were used for dance orchestras, group broadcasts, etc. The still smaller studios D and E would accommodate song teams, speakers, solo artists, etc. Each studio had its own monitoring, control, and client rooms. In conjunction with the new studios, the space included a large, luxurious lounge, rest rooms, and executive and departmental offices. To many people, these studios became known as just "Arlington Street" when speaking of WLW. The new studios, the most complete in the world, were formally dedicated on the evening of June 24, 1930 [26]. Many guests were invited to hear the dedicatory address given

Figure 48. *Studio A (largest) at Gilbert and Arlington Streets.*

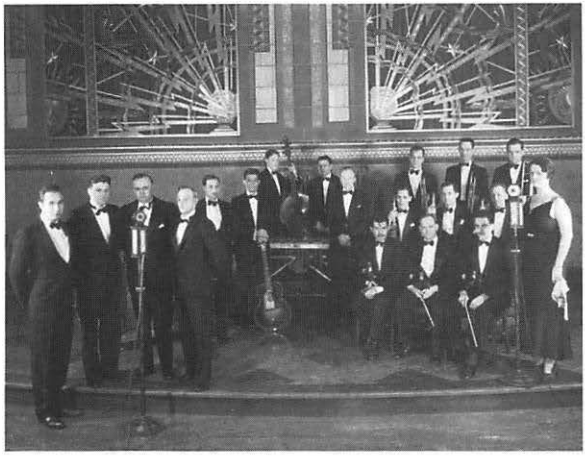


Figure 49. *Musicians in Studio A using Crosley condenser microphones.*

by Myers Y. Cooper, Governor of Ohio. The program also included speeches and performances by the finest artists available. It was impossible to calculate the immense number of people who listened to the dedication program over the radio.

WLW, with its midwest location, new studios, 50,000-W transmitter, and then in 1934 the 500,000-W transmitter, played a major role in the growth of radio networks in the early thirties. Through local programming and NBC network programming, WLW had a tremendous influence on the culture of its listeners during the depression years. Radio provided the same entertainment to rural listeners as to city dwellers; comedy, soap operas, news, music, drama, and market reports, etc.

The tremendous amount of programming on WLW in the early thirties required a very large number of writers and performing artists. (Figure 49) The Arlington Street studios were like a revolving door with so many entertainers, writers, and program people coming and going. Many of these radio programs were fed to NBC's Red and Blue networks.

Serialized stories were popular in newspapers and magazines so Crosley thought a weekday daily-dramatized serial on radio would appeal to housewives. "Ma Perkins," a weekday serial, began in 1930. The broadcasts were accompanied by ads for Procter and Gamble soap products. Soon, other weekday programs of this type began to be dubbed "soap operas." WLW also originated "The Mad Hatfields," and "The Life of Mary Southern," the first soap opera to appear on the Mutual network in 1934. The "soaps" were very popular, increasing from 1½ hours per day in 1934 to 4½ hours per day in 1937. Oxydol continued as a sponsor of "Ma Perkins" for 27 years.

But surely the most memorable of WLW's programs was "Moon River," a late night broadcast of romantic poetry and organ music which became legendary among lovers from coast to coast. Singers on "Moon River" included Doris Day, the Devore sisters, and later the Clooney sisters. Eddie Byron was the writer-producer on "Moon River," and the very popular program "Crosley Theater of the Air." Eddie later became the creator of "Mr. District Attorney" in New York City. Another program which originated at WLW was "Singing Sam the Lawn Mower Man." He went to New York,

where he became "Singing Sam the Barbasol Man." Jane Froeman, Little Jack Little, the Mills brothers, the Ink Spots, and Red Barber were a few of the people who got their start at WLW in the 1930s. Other radio personalities, such as Red Skelton, came to do their shows for the network but were never employed by WLW. Farm programs were very popular, with grain, cattle and hog market prices broadcast at noon on weekdays. Another popular farm program was called "Everybody's Farm" broadcasting from an actual Crosley owned and operating farm located near the WLW transmitter at Mason.

Although more than twenty-five different models of radio receivers were produced in 1929, the volume of sales was not high as expected because of the depression. Other manufacturers were starting to produce good quality radios that were both attractive in the home and relatively inexpensive. Crosley met the competition with such models as the New Buddy, (Figure 50) Playmate, Chum, Comrade, Crony, Director, (Figure 51) Pal, (Figure 52) Mate, etc. [28]. Some of the cabinets had the very ornate and exclusive Crosley-designed "Repwood" carving on the front of the radios. Crosley's production of radio receivers had declined since the beginning of the depression, and by 1932 it was fifth in the number of sets built.

Figure 50. (Left) *Crosley "New Buddy" receiver, $64.50, 1930.*

Figure 51. (Above) *Crosley "Director" receiver, $107.50, 1930.*

Figure 52. (Left) *Crosley "Pal" receiver, $69.50, 1930.*

To help boost the sagging sales, an automobile radio called the "Roamio" was introduced in 1930 [29, 30]. (Figure 53) The market for these sets was unlimited at the time, and Crosley made the most of it by providing at least three models of the "Roamio" with prices ranging from $37.50 to $75. Not only did the "Roamio" boost sales with its popularity, but it helped to create many new installation and servicing jobs for automobile radio technicians.

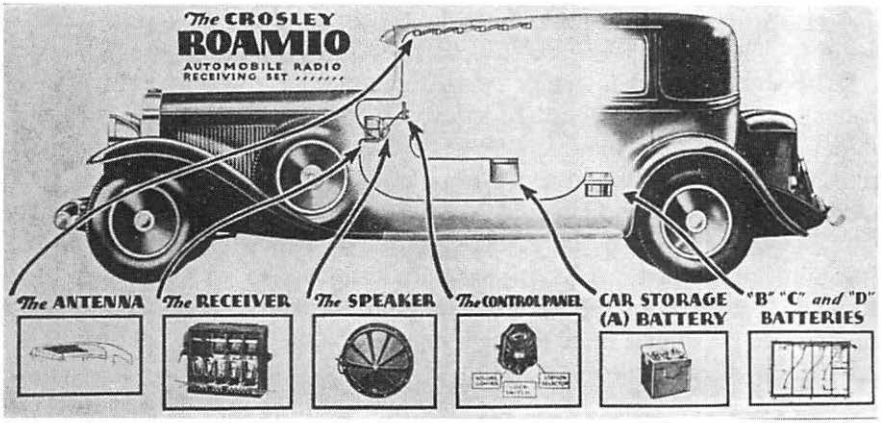


Figure 53. *Crosley "Roamio" automobile radio, $75.00, 1930.*

According to Crosley advertisements, "Where There Are People In The USA, There You Will Find Crosley Radios." In 1928, out of 3,068 counties in the United States, Crosley distributors were located in 2,550.

Powel Crosley Jr. was never satisfied with the coverage of WSAI in the Cincinnati area. He wanted to make WSAI a "true community station." An application was submitted to the Federal Communications Commission to move the transmitter to the Clifton Heights area of Cincinnati. This location on Warner Street, between Chickasaw and Wheeler Streets, was closer to the center of the city. Authorization to relocate was granted on January 10, 1936. A building was constructed and a Western Electric 5,000-W transmitter installed. The operating power was 2,500 W during the day and 1,000 W at night. The antenna was a triangular 230-foot steel tower. Situated on a high bluff, this location of the WSAI transmitter provided excellent coverage of Cincinnati and the surrounding area. Listeners could now have an audible "picture" of the daily life of the area and hear much of the fine talent available in Cincinnati. The programming continued to originate from the WLW and WSAI Arlington Street studios.

In 1937 and 1939, the Federal Communications Commission granted permission for the power of WSAI to be increased to 5,000 W full-time. In 1939 the transmitter was moved to Mt. Healthy, a northern suburb of Cincinnati. This eliminated the interference problems in the heavily-populated Clifton Heights area. A three-tower directional antenna was designed by Crosley engineers and is still in use today.

In the summer of 1944, WSAI was sold to the Marshall Field Company of Chicago. The station is now owned by Clear Channel, and the call letters are WCKY.

Chapter Seven
The 831-Foot Vertical Antenna

The design of broadcast antennas was going through a change, at this time, from the flat-top and horizontal designs to the vertical antenna designs. Justification for a change from horizontal to vertical depended on the amount of money invested in the transmitter, the frequency being used, the desired coverage area, and the local ground characteristics. With the large amount of money that had been invested in the transmitter and other existing conditions at the WLW transmitter location, it was determined that a large investment in a new vertical antenna was justified. This type of vertical antenna was developed at Bell Laboratories, and the structural design was created by engineers of the Blaw-Knox Company of Pittsburgh [7]. The construction contract was given to Blaw-Knox Company to erect the 831-foot, 5/8 wavelength, cantilever-guyed, vertical antenna [3]. The estimated cost to build the antenna was $50,000, and it is generally believed that no more than five antennas of this design were erected in the United States.

Since the "T" type antenna for WLW was located on the west side of the transmitter building, the location for the Blaw-Knox 831 foot antenna was to be approximately 800 feet east of the building. The base for the new antenna was put in place on March 25, 1933. Three months later in June, the new antenna was put in service and driven by the 50-kW transmitter. (Figures 54 and 62)

On the south side of the tower a neon-illuminated sign with the call letters "WLW" was installed by the Hartman Sign Company of Cincinnati. The sign was 35 feet wide and it was placed slightly above the widest point on the tower, at 350 feet. With its metal framework and the necessary electrical equipment to illuminate the ten-foot WLW letters, the weight of the sign was nearly a ton [108].

The airplane warning lights which were required on tall towers, consisted of two 1,000-W red Fresnel beacons mounted at the top of the tower, along with a number of 100-W red obstruction lights at various levels on the tower. The Fresnel beacons and the illuminated WLW sign were flashed off and on with a control mounted at the base of the tower. In addition to the lights on the tower, a 24-inch red revolving beacon was located at the base of the tower. This was required at that time to indicate a dangerous area to airplanes. At night, the WLW tower could been seen for many miles. A small plane did hit the tower in the mid-thirties. The pilot was killed, but no damage was done to the tower.

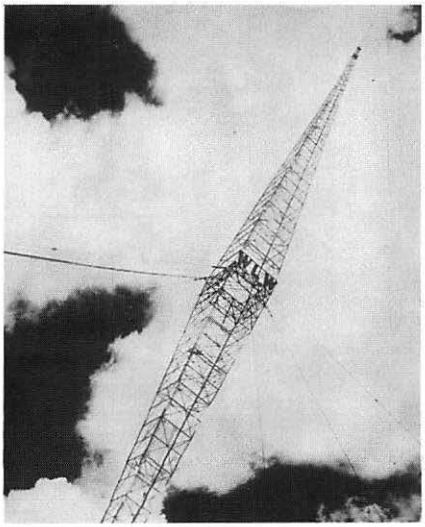


Figure 54. *The WLW 831-foot vertical antenna, 1933.*

The antenna coupling house was located at the base of the 831-foot tower, and a coaxial transmission line of nearly 800 feet was custom fabricated to feed the signal to the antenna. (Figure 55) The 100-Ohm air dielectric coaxial line was ten inches in diameter, with a two-inch center conductor. Both center and outer conductors were made of ALCOA aluminum. Small openings were spaced at intervals along the bottom to permit the drainage of moisture. These openings were screened to keep out field mice and insects. The 100-Ohm transmission line was coupled through an "L" network to the 390-Ohm base impedance of the tower. Operating at 500 kW, the unmodulated radio frequency current was nearly 36 A, which produced an RF field intensity of at least 6 V per meter at a distance of one mile from the tower. The 0.5 mV/m contour was 300 miles from the transmitter site and, at night, the normal signal strength in Mexico and southern California was 0.1 mV/m.

Interesting facts concerning the antenna:

- The height was 831 feet or 5/8 wavelength at 700 kHz - 295 feet taller than the Washington Monument. It was later shortened to 1/2 wavelength. (Figure 64)
- The tower is 35 feet across at the 350-foot level.
- The antenna rests on two cup-shaped two inch thick porcelain insulators. (Figures 56 and 63)
- The insulators are not rigidly joined but are connected by a large pin to allow the antenna to sway. (Figure 57)
- The antenna can withstand a 112 mile-per-hour wind, twice the velocity of any wind ever recorded in the area.

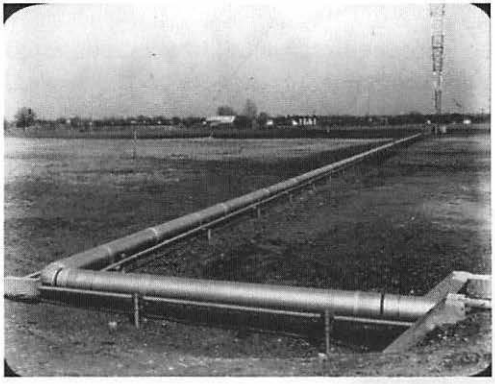


Figure 55. (Left) *100-Ohm coaxial transmission line to vertical antenna.*

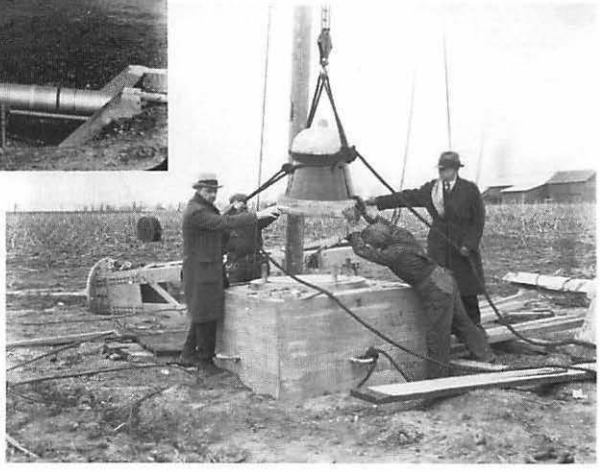


Figure 56. (Right) *Bottom half of the antenna base insulator which supported the vertical antenna.*

- The tower is held in place by eight 2-inch guy cables that are separated into sections by seven insulators. (Figure 58)
- The steel in the tower weighs 136 tons. The additional weight of the guy wires and wind load can produce a peak weight of 450 tons on the base insulators.
- One source indicates that there are twenty-four piles driven to a depth of seventy feet to support the foundation that spreads out under the tower. Another source indicates that there are sixteen piles driven to forty feet.
- Approximately 60,000 feet of copper radials were buried 22 inches deep around the tower to act as a ground plane. (Figure 59)
- The antenna was constructed while in a vertical position. Each piece of the structural steel was hauled up into place and bolted together. The structure was held in place by the use of guy cables that were moved upward as the work continued. When the 350-foot level of the structure was reached, the guy cables were permanently attached and the work continued piece by piece above that point [96].

After the erection of the new antenna, the efficiency of the "T" type and vertical antennas could now be compared. With all conditions (frequency, power, and location) remaining the same, field strength measurements were taken with calibrated instruments. Compared to the "T" type antenna, the use of the 831-foot vertical antenna resulted in an increase of signal strength equivalent to the doubling of the transmitter power.

Soon after the new antenna was installed and operating on the 50-kW transmitter, WLW engineers had a terrifying experience. The huge tower started to twist at the wide section in the center of the antenna, and an oscillating motion was observed in the guy cable system. A guy cable on one side would move upward, and at the same time the opposite guy cable would move downward. A hurried call to Blaw-Knox brought assurance that the antenna would stand the abuse. The only suggestion was to throw ropes across the moving guy wires to dampen the oscillations. The oscillations finally stopped but occurred again about a year later. The guy cable oscillations have not been reported since [92].

An excerpt from Lowell Thomas's broadcast on March 13, 1934, states, "*Although I am actually broadcasting from a special studio in the Netherland-Plaza Hotel, every word you are hearing jumps out at you from a metal ball eight hundred and thirty-one feet in the air atop that Mae Westian tower.*" (Figure 60) Lowell Thomas was the dean of newscasters for NBC at that time and for many years afterward. He was comparing the shape of the tower to Mae West the actress who was rather well endowed in her upper sections [7].

Shortly after the 500-kW transmitter went on the air, a serious signal coverage problem existed in the surrounding areas 100 miles from the station. This included the highly populated areas of Columbus, Ohio; Indianapolis, Indiana; and Louisville and Lexington, Kentucky. Engineers determined the problem to be selective-fading, the result of a station sky wave signal interfering with its own ground wave signal. Engineering analysis of the vertical plane of a 5/8 wavelength antenna indicated the presence of a minor

Figure 57. (Right) *Top half of the base insulator which supported the vertical antenna.*

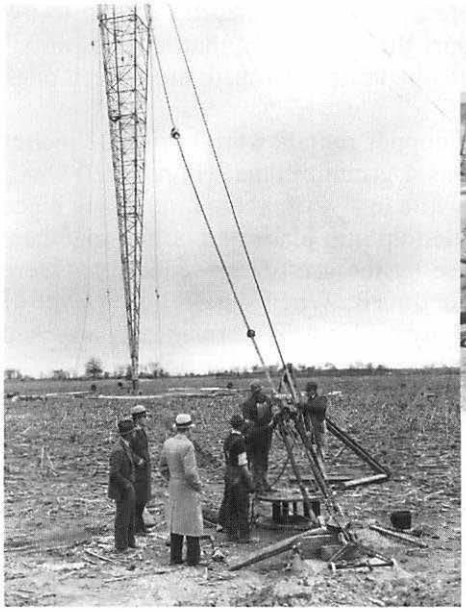


Figure 58. (Left) *Guy cable installation used to support the veritcal antenna.*

Figure 59. (Left) *Ground radial installation for the vertical antenna.*

Figure 60. (Right) *Announcer Lowell Thomas in 1934 using the Crosley spherical condenser microphone.*

high angle lobe. The signal from this lobe could refract from the ionosphere back to earth about 100 miles from the station and cancel or interfere with the gound wave signal [93].

To correct the situation, the antenna was reduced in height to 708 feet by the removal of the 123-foot mast at the top of the antenna. The mast had sometimes been called the "flagpole." The tower became a 1/2 wavelength antenna. This eliminated the high-angle lobe and slightly reduced the horizontal radiation. The area of selective fading was moved out beyond the major markets and reduced in size.

A chromium-plated ball had been mounted at the very top of the mast for lightning protection. (Figure 61) When the mast was removed and the ball examined, it was noted that lightning had burned numerous holes in the lower half of the ball. This indicated that the lightning strikes approached the ball from below. Tests done by General Electric Corporation indicated that the largest hole in the ball was caused by a lightning strike with a current of approximately 40,000 A. The original lightning-scarred ball was put on display by the author at the 2000 Annual Conference of the Antique Wireless Association and it generated a great deal of interest.

After nearly 70 years, "The Big Tower" is still in use. The original WLW sign has been replaced but the tall tower is still a landmark and conversation piece for the area around Mason. The actual cost of $46,243 is now unbelievable, and 70 years of continuous service is remarkable.

Chapter Eight
The 500,000-Watt Transmitter

Each time a new WLW transmitter was installed, Powel Jr. was already planning and obtaining engineering advice for the next power increase. 1930 was the first year that WLW made a profit and it amounted to $44,000. The next year was even better, and profits increased to nearly $150,000 [11]. In 1932 our country was in financial chaos, but Powel Jr. applied to the Federal Radio Commission for permission to use a 500-kW transmitter and a new vertical antenna.

Powel Jr. and the technical staff of WLW had been planning for the 500-kW transmitter for five years before receiving authorization in June of 1932 [32, 33]. Since it was an experimental transmitter of entirely new design, it rapidly developed into an engineers' picnic. Crosley wanted to incorporate as many new ideas as possible. New pieces of equipment were designed to make this transmitter the most sophisticated of its day, and the design incorporated many new features.

Figure 61. *Ball removed from the top of the tower showing lightning strikes on top and bottom.*

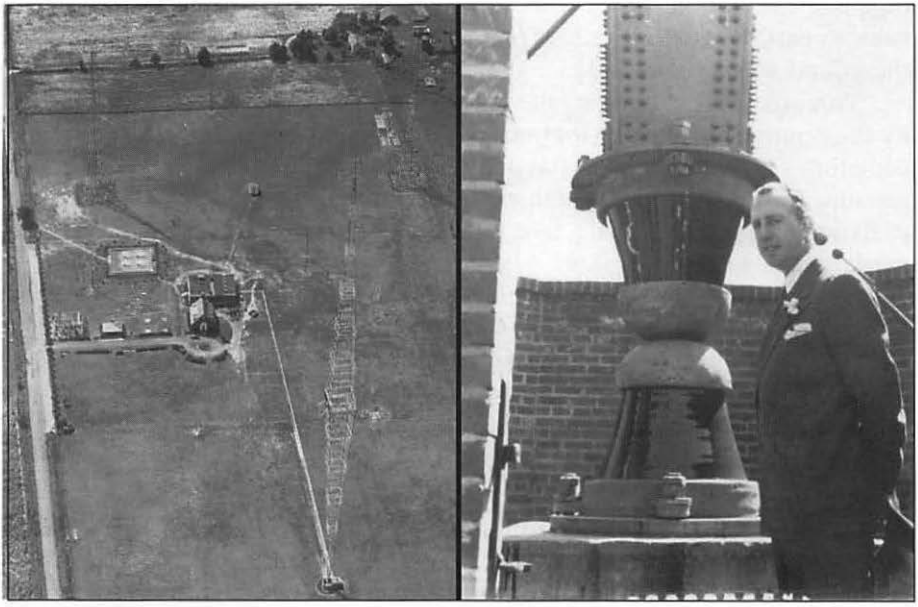


Figure 62. (Left) *Aerial view of station WLW showing the vertical and the "T" antennas.*
Figure 63. (Right) *Powel Crosley Jr. at the tower base insulator.*

In May of 1932, an application was filed with the Federal Radio Commission for a construction permit to build a 500-kW transmitter using the 50-kW transmitter as the driver. A switching arrangement would allow either the 50-kW transmitter or the 500-kW amplifier to feed the vertical antenna. The application was granted the next month in June of 1932. This began a very busy time for Powel Jr. and his company leading up to the dedication ceremonies on May 2, 1934.

The contract for the installation of the largest broadcast transmitter in the world was awarded to the RCA Victor Company of Camden, New Jersey on February 1, 1933. (Figure 67) RCA did not build transmitters at this time, so they subcontracted the installation to General Electric, Westinghouse, and other subcontractors [93, 102].

Westinghouse was responsible for: audio frequency amplifiers, modulators, modulation transformers, filament supplies, isolation switching,

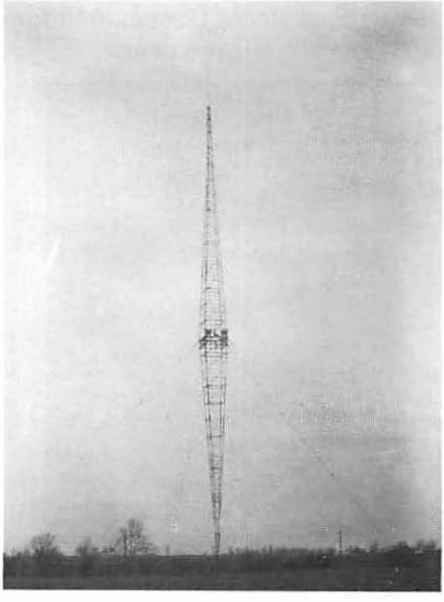


Figure 64. *The WLW tower seen from a distance.*

water pumps, motor generators for control circuits and bias, heat exchangers and the entire cooling system.

General Electric was responsible for: the radio frequency amplifiers, DC power supplies, high voltage rectifiers, harmonic filters, the RF transmission line, antenna tuning equipment, control systems and the control console.

RCA was responsible for: coordination of all the subcontractors (which numbered more than 50) and completion of the project within a year [93, 102]. After completion, the new WLW transmitter would have 10,000 times more power than the WLW transmitter of 1922.

The cost of the installation of the transmitter, the necessary addition to the building, and the vertical antenna totaled nearly $500,000. This did not include the additional expenses incurred for the studio expansion. Design and preparation for the big transmitter began in January, 1933. Components were shipped to the WLW site near Mason in August of 1933. By December, 1933, the equipment had been installed and testing was started during the experimental hours of 1 AM through 5 AM. Shortly after the testing began, the power was increased to more than 500 kW with 100% modulation. The design of the transmitter required no major changes or additional expenditures and this was a surprise to all concerned. Installation of the transmitter progressed as scheduled, an achievement that was seldom seen in broadcasting at that time.

The following is a brief summary of the transmitter performance in typical operation [102]. With a normal power output of 525 kW, the input power to the transmitter, including all the auxiliary equipment, was 1150 kW without modulation. Input power required was 1600 kW for 100% sinusoidal modulation, and 1250 kW was necessary for the average or normal modulation. This excluded the 50-kW driver. The audio frequency response of the transmitter varied only one decibel from 30 Hz to 8,000 Hz, and was just two decibels down at 10,000 Hz. The transmitter could achieve 100% modulation at all frequencies from 30 to 10,000 Hz. The performance characteristics of the transmitter exceeded the requirements and represented a great engineering success.

Prior to this time, WLW had always maintained its position as one of the most

Crosley Continues To Lead The World In
RADIO VALUES
with the
NEW 1934 CROSLEY RADIOS

● MILLIONS of radio buyers are mindful of the Crosley policy to offer the utmost in quality and performance at the lowest possible price. Never has this policy been more clearly manifested than in the new 1934 Crosley Radios, shown below and on the two following pages. Even Crosley never before equalled these outstanding values. Measure these receivers by any standard and you will find they offer such great value that they are beyond all competition.

4-Tubes . . . AC-DC SUPERHETERODYNE
CROSLEY TRAVO & DUAL CASA
$16.00 $18.00

4-TUBES SUPERHETERODYNE
Crosley DUAL FOUR
$17.50

DUAL RANGE
80 to 200 Meters 200 to 550 Meters
3500 to 1500 Kilocycles 1500 to 540 Kilocycles

5-TUBES . . . AC-DC SUPERHETERODYNE
DUAL TRAVETTE & DUAL COMPANION
$25.00 $25.00

5-TUBES . . . DUAL RANGE SUPERHETERODYNE
DUAL FIVE & DUAL FIVE LOWBOY
$22.00 $36.00

Battery Five (less batteries) $22.00
Battery Five Lowboy (less batteries) $36.00
(Dual Range feature is not included in the Battery Models)

WESTERN PRICES SLIGHTLY HIGHER

August 15, 1933 7

Figure 65. *New Crosley receivers introduced in 1934.*

14-TUBES . . . DUAL RANGE SUPERHETERODYNE
THE CROSLEY DUAL FOURTEEN
Dual Range, Automatic Volume Control, Class "A" Parallel Push-Pull Output, Meter Tuning, Static Control, Tone Control, Auditorium Type Full Floating Moving Coil Electro-Dynamic Speaker. This is the finest radio receiver that can be built, incorporating every essential development for excellent performance.
Dimensions: 41¼" high, 26" wide, 15" deep.
$100.00

REMOTE SPEAKER . . . AC-DC 4-TUBE SUPERHETERODYNE RECEIVER
THE CROSLEY REPOSE, JR.
A remote speaker designed for use only with the Crosley Repose, Jr., receiver. Large size Electro-Dynamic Speaker. Receiver operates on any 110-Volt Circuit, employs Dual Range, 20-Foot Extension Cord, Attached Antenna.
Dimensions of Speaker cabinet: 31" high, 17¾" wide, 13" deep. Dimensions of Receiver cabinet: 7¾" high, 10¾" wide, 7" deep. Price includes both Speaker and Receiver.
$37.50

REMOTE POWER SPEAKER . . . ELECTRO-DYNAMIC
Crosley REPOSE & REPOSE FIRE SCREEN
Large Size Theatre Type Electro-Dynamic Speaker. For use with Dual Transette, Dual Companion or Dual Six . . . Employs Automatic Shut-Off. 20-Foot Extension Cord. Two 2525 rectifier tubes in a power pack furnish 20 watts of DC for the speaker.
Dimensions of Repose: 22½" high, 21½" wide, 13½" deep. Dimensions of Fire Screen: 33" high, 35¼" wide, 14½" deep.
$50.00 $50.00

5-TUBES . . . SYNCHRONODE POWER
CROSLEY THIRTY-TWO D. C. & LOWBOY
Superheterodyne, All-Electric, New 6.3 Volt Heater Type Tubes, Illuminated Dial, Full Floating Moving Coil Dynamic Speaker. Designed for use with 32 Volt DC supply.
Dimensions of Thirty-Two D. C.: 16½" high, 14" wide, 10½" deep. Dimensions of Thirty-Two D. C. Lowboy: 42" high, 24¼" wide, 13½" deep.
$39.95 $49.95

5-TUBES . . . CLASS "B" AMPLIFICATION
CROSLEY BATTERY "8" & "8" LOWBOY
Superheterodyne, Continuous (Stepless) Tone and Static Control, Push-Pull Output, Neon Dial Lamp, Moving Coil Permanent Magnet, Dynamic Speaker. Low Battery Drain.
Dimensions of Battery "8": 17¾" high, 17" wide, 9¼" deep. Dimensions of Battery "8" Lowboy: 42" high, 24¼" wide, 13½" deep.
$39.95 $49.95

2-TUBES . . . OPERATES ON ANY 110 VOLT CIRCUIT
CROSLEY SHORT WAVE CONVERTER
Single Dial Control, Dial Calibrated in Megacycles (range of 1.5 to 22); Two Speed Dial. Three Position Band Selector Switch. Can be used in connection with any radio receiver not equipped with dual range.
Dimensions: 7½" high, 10⅝" wide, 5" deep.
$20.00

WESTERN PRICES SLIGHTLY HIGHER

August 15, 1933 9

Figure 66. *More new Crosley receivers introduced in 1934.*

powerful broadcast stations in the United States. It had been the first station to utilize successive stages of increased power levels at 50, 500, 5,000, 50,000 and now 500,000 W. Powel Jr. believed that increasing the power of a broadcast transmitter was the most effective way to reduce receiver static. The transmitter became a high-power "Static Eliminator."

By the 1930s, radio listeners had changed their listening standards. They now wanted high quality, strong, easy-listening signals rather than stations from a great distance. With improved receiver designs, adjacent-channel interference was reduced by making receivers more selective. (Figures 65 and 66) Fading of the transmitter signal was reduced through the addition of automatic volume controls in receivers. Therefore, an increase in transmitter power could now improve the coverage area and reduce fading without creating appreciable interference.

To accommodate the space required for the new transmitter, the length of the building and basement that housed the WLW 50-kW transmitter was extended by 36 feet. (Figure 68) This addition matched the appearance of the existing building and increased it to 80 feet long by 63 feet wide. This building is still in use for the current 50,000-W WLW transmitters. Physically, the 500-kW transmitter on the first floor is still in place, but some tubes and parts have been removed. Most of the supporting equipment necessary for its operation that was located in the basement has been removed.

Figure 67. *Nameplate from the front of the 500-KW transmitter, 1934.*

Transmitter Physical Layout and General Design

The new 500-kW transmitter contained a radio frequency amplifier capable of 2,000,000-W of peak power output [104]. The audio frequency amplifier was large enough to modulate the radio frequency amplifier to 100 percent.

This transmitter was certainly unusual because of its size. (Figure 69) It actually became an integral part of the building since the steel uprights in the cabinets supported the building roof. Most of the metal in the transmitter cabinets was ALCOA [5] aluminum and the power amplifier plate tuning capacitors were also made of aluminum tubing [9].

Additional space on the first floor was necessary to allow the installation of three power amplifier cabinets, two modulator cabinets, and one rectifier cabinet. (Figure 70) The transmitter was 54 feet 7 inches wide, 13 feet 2 inches high, and 17 feet deep. This powerful transmitter required a total of nearly 935 square feet of space.

To make the transmitter more reliable, the power amplifier was divided into three cabinets and the modulator was divided into two cabinets [102]. With this design, a cabinet could be automatically isolated by a switching arrangement when a tube or any component in that cabinet became defective. This allowed the transmitter to continue in operation at reduced power and modulation capabilities. The motor-driven "isolation switch" was nearly 44 feet long and it was located directly below each radio frequency amplifier and modulator cabinet at the basement ceiling level. This kept the connecting leads as short as possible.

A platform, sometimes called the "catwalk," 4-feet above the transmitter floor and with covers 3 feet wide, ran the entire length of the front of the transmitter assembly. (Figure 72) These easily-removable platform covers provided access to parts such as internal water piping, hose reels, water

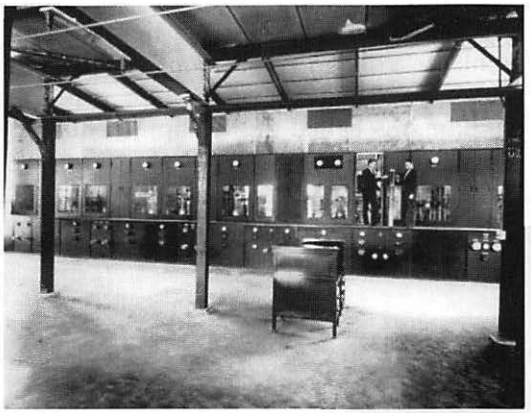


Figure 69. (Above) *Front of the 500-KW transmitter during construction, 1933.*

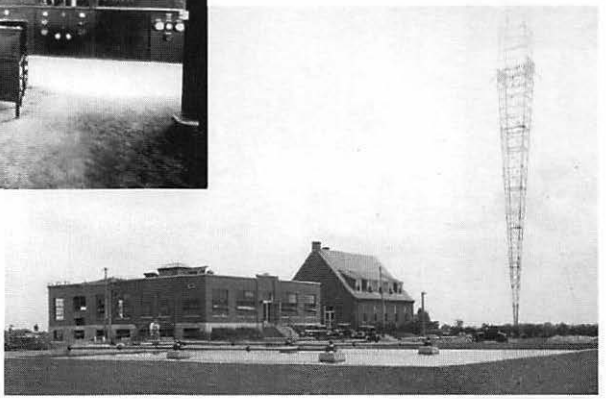


Figure 68. (Below) *Building the addition on the north side of the 50-kW transmitter building for the 500-kW transmitter, 1933.*

flow instruments, and mechanical tuning adjustments, etc. This water piping arrangement provided a degree of accessibility that was heretofore unknown in most broadcast transmitters. A platform 22 inches wide and at the same level as the catwalk was installed inside each cabinet to facilitate tube changes and other necessary maintenance.

Fitted plate glass windows at eye level, and entrance doors at the platform level, were a major part of the frontal surface of the transmitter. Pairs of metal-lined wooden doors provided access to the back of each cabinet.

Each cabinet was entirely shielded and electrically bonded at numerous locations to the other cabinets. For safety purposes, all audio and radio frequency amplifiers and the high voltage rectifier were located behind interlocked doors and panels. A safety switch was provided at each cabinet entrance to ground all high voltage leads and condensers. The opening of any door to the power amplifier or modulator cabinets would also isolate that cabinet permanently. Low power audio stages were located in the rear of the modulator cabinets. All of the power amplifier main tuning controls, water valves, flow meters, thermometers, emergency shut down switches, tube hour and overload indicators were located on the front of each cabinet where needed.

The control console, located to the front right of the transmitter, was the first one of its kind [102, 107]. (Figure 71) The console contained control switches, indicator lights, relays, and other devices associated with the automatic sequence and protective control circuits. Various voltmeters, an antenna ammeter, and an over-modulation indicator were also centralized at the console. Relays and contactors located on a control panel directly behind the main rectifier 870 tubes were also associated with the console and its operation. During transmitter operation, the control panel and its equipment were completely accessible since this area was not interlocked. Normal operation was indicated by a red light above the corresponding control switch for each unit. If any light went out or did not light on start-up, it was an indication of a problem. Voltage for the operation of the control circuit was 100 VDC, which was supplied by a motor generator located in the basement. The generator was called the "Shop Machine."

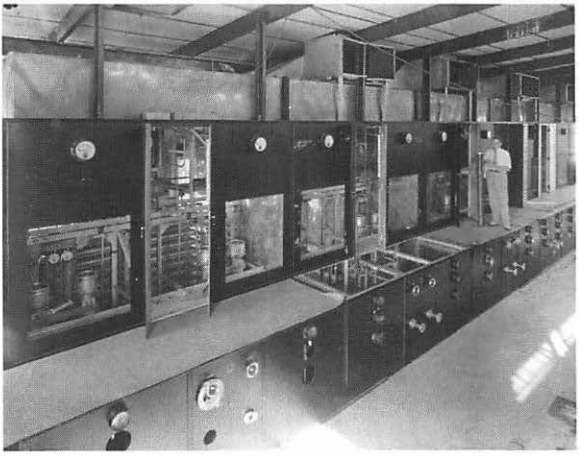


Figure 70. *RF power amplifiers for the 50-kW transmitter prior to the installation of the UV-862 tubes, 1934.*

Figure 71. *Control console for the 50-kW and 500-kW transmitters, 1934.*

All of the rotating equipment, heat exchangers, two large modulation transformers, filter capacitors, oil circuit breakers, the isolation switch, harmonic filter, and electrical input and switching panels, etc., were also located in the basement area of nearly 2200 square feet. Three transformers and a filter reactor for the high voltage rectifier were located outside at the rear of the building in a fenced-in area.

To operate the 500-kW transmitter, it was necessary to operate two change-over switches. One switch dissipated the Western Electric 50-kW transmitter output into a load resistance. (Figure 73) This excited the grids of the tubes in the three radio frequency amplifiers of the 500-kW amplifier. The other change-over switch allowed the output of either the 50- or the 500-kW transmitter to be switched to the input of the harmonic filter, with its output going to the coaxial transmission line and the antenna.

RCA was the first supplier of UV-862 tubes with pure tungsten filaments [107]. Twelve were required in the radio frequency amplifiers and eight in the modulators. These tubes were water and air-cooled and had a plate dissipation of 100 kW each. Each tube was rated at 90-A of peak emission with an amplification factor of 45. The filament voltage was 33 V with a

Figure 72. *These five stars of radio were heard on the dedication broadcast for the new 500-kW transmitter. Each is holding one of the twenty 100-kW tubes used in the transmitter. Left to right are Margaret Carlisle (Chicago) who starred in "Showboat," "Bittersweet," and in London in "Words and Music;" Mary Alcott (Chicago) Paul Whitman discovery; Ethel and Dorthea Ponce (New York) harmony duet; and Flo Golden, actress.*

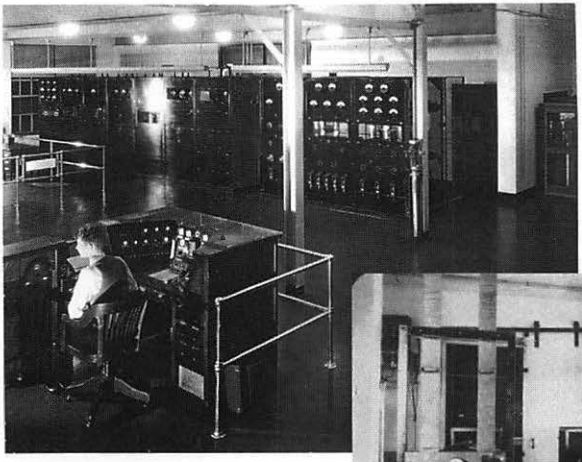


Figure 73. (Left) *Another view of the Western Electric 7A 50-kW transmitter used as the exciter for the 500-kW transmitter. Engineer Dick Walker is seated at the console which controlled the operation of both transmitters, 1934.*

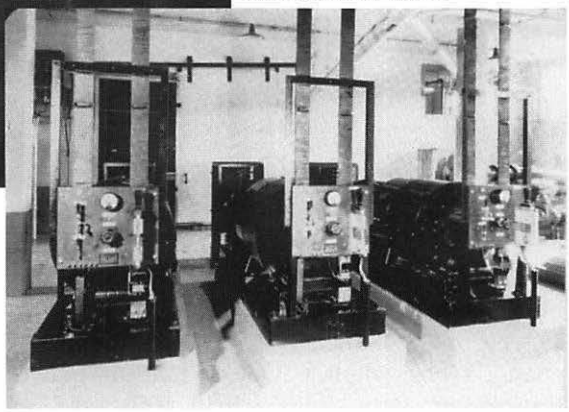


Figure 74. (Right) *The three 1500-Ampere DC motor/ generators for the UV-862 tube filaments, 1934.*

current of 207 A. Total filament current for the twenty tubes was approximately 4150 A or about 137 kW just to light the filaments. The tubes were 5 feet in length and each weighed 30 pounds, for a total weight of 600 pounds. The cost for each tube was $1625, and the total cost for the twenty tubes was $32,500. Three 1,500-A motor generators connected in parallel provided the necessary 33 V for the filaments. (Figure 74) They were driven by three 75 horsepower, 2,300-V motors. Normally these motor generators were controlled individually or as a unit from the control console.

To eliminate the three 1,500-A motor generators for the UV-862 filament power, the tubes were eventually replaced by the more modern 898A tubes [86, 93]. The filaments of the 898A tubes were multi-strands of tungsten, consisting of three sections that could be operated on DC or single, or three phase AC. The filament voltage and current for each section required 33 V at 70 A. Other than the filament specifications, the operating and physical characteristics of the two tubes were nearly identical.

The conversion to the 898A tubes required three single-phase high reactance transformers with a primary of 240 V and a secondary of 16.5 V at 140 A for each tube. High reactance transformers were used to limit the filament surge current to 200 A. There were 60 such transformers; each was 13 inches high, 10 inches wide, and 8 inches deep, and weighed approximately 150 pounds. To support the five-ton weight of these transformers, a structural steel bridge was built in the basement. It was located directly under the transmitter cabinets to keep the filament leads as short as possible. [94].

Two cooling systems, one using water, and one using air, were required to cool the transmitter. Each UV-862 tube required 30 gallons of distilled water flow per minute. High temperature water stills were operated continuously

to maintain the necessary amount and quality of distilled water in the system. The water cooling system was also designed to be adequate for the existing 50-kW WLW transmitter. The heated distilled water was pumped at the rate of 700 gallons per minute through two Westinghouse heat exchangers. (Figure 75) The waste heat was transferred to raw water which was pumped at 1,500 gallons per minute to the 75- by 75-foot spray-cooling pond located outside the building. (Figure 76)

To isolate the nearly 12,000-V anode voltage for each of the UV-862 tubes, cooling water was circulated through special rubber hoses wound on a cylindrical form [102]. The length of the hose was sufficient for an isolation of 50,000 V. These hoses were mounted under the catwalk for each radio frequency amplifier and modulator. This hosing arrangement was eventually changed to a network of 1.5-inch Pyrex™ pipes for the inlet and outlet of each tube. Nearly 900 feet of Pyrex pipe was needed for this conversion [86].

A single, 3-horsepower centrifugal blower was used to blow air through the main air duct which had branches leading to the filament and plate seals of the twenty UV-862 tubes.

Power Amplifiers

The three radio-frequency power amplifiers, designed by the General Electric Company, were identical. (Figure 77) Each had an output of 170 kW of carrier power and they combined to make the 500 kW. Each amplifier was complete in itself with its own radio frequency and power circuits. Another first occurred when it was decided to use the existing 50-kW transmitter, running at reduced power, to drive the 500-kW transmitter. When operating

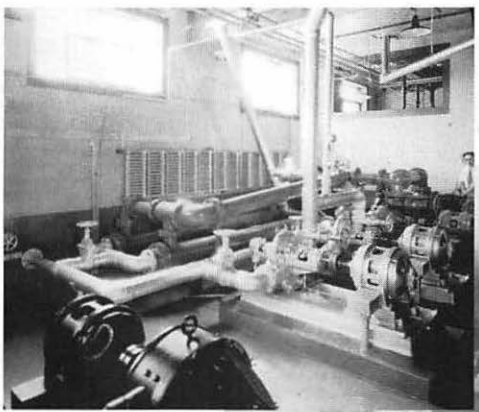


Figure 75. (Left) *The pumps and heat exchangers for the 500-kW transmitter were located in the basement of the transmitter building and used to cool the 862 tubes, 1934.*

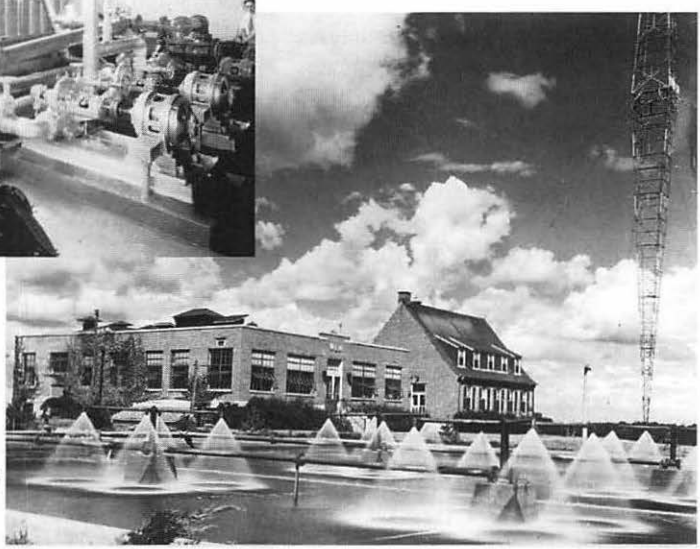


Figure 76. (Right) *Heated water from the 500-kW transmitter was pumped to the outdoor spray pond to cool the 862 tubes, 1934.*

the 500-kW transmitter, the output of the 50-kW transmitter was fed into a load resistance and used to drive the grids of the three radio frequency amplifiers in parallel. Approximately 20 kW of power was required to drive the 500-kW amplifier. Each amplifier had four type UV-862 triode tubes, operating in push pull parallel Class C mode. The three amplifier outputs were combined in series. The radio frequency amplifiers were high-level plate modulated. (Figure 78) The modulator of the 50-kW transmitter was disabled when operating the 500-kW transmitter.

The normal operating parameters for each amplifier were: plate voltage of 11.8 kV, plate current of 20 A, bias voltage of -630 VDC, grid current of nearly 4 A, and a PA (power amplifier) tank current of nearly 95 A. The input power to the three amplifiers was nearly 700 kW and it produced 500 kW of output power. The power amplifier efficiency was slightly over 70%.

The grid circuit design was unusual [102]. Fixed mica-dielectric neutralizing capacitors were used in a conventional balanced neutralizing circuit. It is believed this was the first use of fixed neutralizing capacitors in a broadcast transmitter. With the grids driven in parallel, the balanced grid line was shielded and split into 3-equal lengths leading to the grid tank circuits. This put the grid excitation voltages in phase, which simplified tuning and loading of the amplifiers. The three grid tank circuits were permanently tuned to be resonant at 700 kHz. The total rectified grid current was measured with a General Electric meter which had a scale of 0-10 A. There was one grid current meter mounted on the front of each amplifier.

The plate voltage of 11.8 kV was applied to each tube through its associated plate choke, which was wound on a glass form. The plate current for each tube was measured by a specially-designed, highly-damped meter in the plate circuit. These meters were used for balancing the operating parameters of the four tubes in each amplifier. A General Electric DC ammeter with a scale of 0-150-A was mounted on the front panel of each amplifier and designated the plate tank ammeter. For insulating purposes, the meter was mounted behind a special glass enclosure. Under normal operation, the meter would indicate approximately 95 A. The antenna current was nearly 70 A while operating at 500 kW

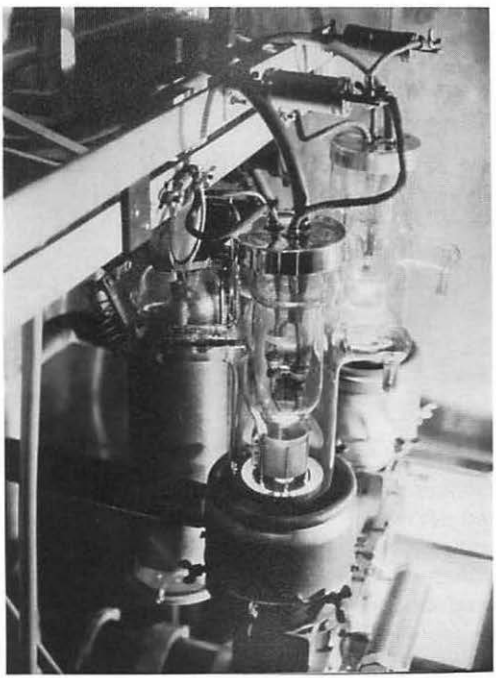


Figure 77. *Two of the twelve UV-862 tubes in the RF power amplifiers of the 500-kW transmitter, 1934.*

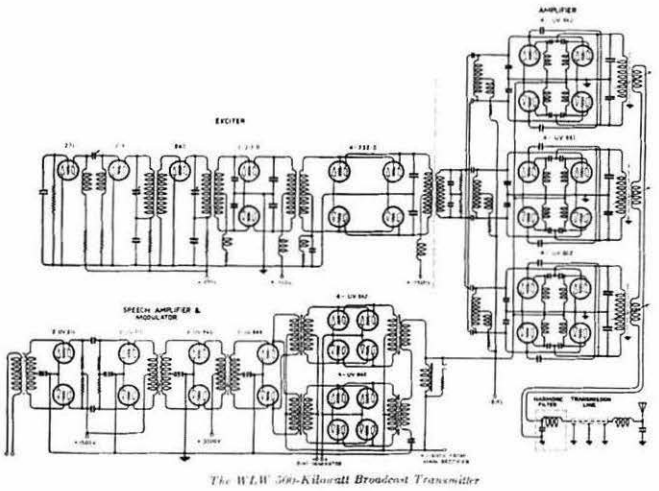


Figure 78. *Simpllified circuit diagram of the WLW 500-kW transmitter.*

output power. Normal antenna current was approximately 20 A while operating at 50 kW output.

The plate tuning of each RF amplifier was accomplished by varying the inductance rather than the capacitance in the plate tank circuit [102]. (Figure 79) The plate tank inductor consisted of copper tubing bent into a spiral or "pancake" coil. It had a Q of over 1,200. For the output of each amplifier, a similarly wound spiral coil was used to couple to the plate tank circuit. An electrostatic shield (Faraday shield) was placed between the power amplifier tuning inductance and the output coupling coil to reduce electrostatic coupling between the two coils. The plate tank capacitor was fixed and had a very unusual design. The capacitor consisted of two identical air dielectric capacitors with their center points grounded. This capacitor was made of grids of aluminum tubing and was unique in broadcast transmitter practice. The capacitors were tested at voltages up to 50,000 V.

The outputs of the three radio-frequency amplifiers were connected in series, feeding the harmonic filter and transmission line to the 831-foot vertical antenna. The three radio-frequency amplifiers on the first floor required 510 square feet.

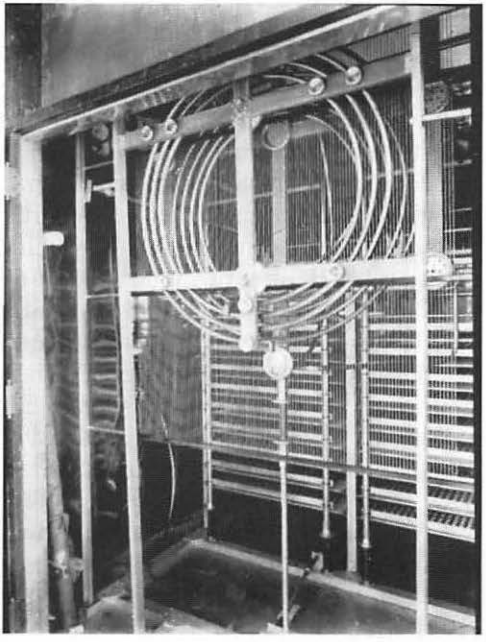


Figure 79. *Output coupling link, Faraday screen, and plate tuning capacitor for the WLW 599-kW transmitter.*

Low Power Audio and High Power Modulator Stages

The design of the low-power audio stages incorporated standard audio amplifier circuits. However, the design of a modulator for the 500-kW transmitter presented a real challenge [102]. First, the audio power required from the modulator was more than ten times greater than ever before obtained from any audio amplifying system. Also, the fidelity of the modulator had to equal or surpass current standards. Furthermore, the power efficiency had to be as high as possible.

Several possible circuits were analyzed. It was decided that the use of high-level class B plate modulation could best meet the design requirement. This choice also offered important advantages such as lower initial construction and maintenance costs.

The entire low power and modulator system consisted of five stages, with the first four connected in push pull. Power for the plate circuit of the first three stages was supplied by a 3,000-V, 2.5-A rectifier which used six UV-872 tubes. This rectifier was located within one of the modulator cabinets. The audio input circuit employed two UV-211 tubes. The plate circuit was coupled by a resistance-capacity network to the grid of the second stage, which also used two UV-211 tubes.

The output of the second stage was transformer coupled to the grid circuit of the third stage, which used two UV-849 tubes. The third stage was transformer-coupled to the grids of the fourth stage, which used two water-cooled UV-848 tubes. The fifth stage, or modulator power amplifier, was divided into two cabinets. Either modulator cabinet could be isolated when necessary. Separate inter-stage transformers were used to drive the modulator grids from the output of the UV-848 tubes. These inter-stage transformers weighed at least two tons each.

The fifth stage, or modulator output, required eight UV-862 tubes. (Figure 80) These were divided into two cabinets and operated in push pull-parallel as a class B amplifier. Two identical modulation transformers were required to develop the 350 kW of audio power to modulate the 700-kW input power of the radio frequency amplifiers. The outputs of the two very large modulation transformers were connected in series to modulate the plate voltage of the three radio frequency final amplifiers. Direct current was blocked out of the modulation transformer secondaries by the use of a modulation reactor and a 50 microfarad, 15,000-V audio coupling capacitor. The reactor was rated at 4.5 Henrys of inductance at 60 ADC. The modulation reactor was similar in shape to the modulation transformers, but weighed only 12 tons.

Because of their rating and size, the two modulation transformers were of enormous interest. (Figure 81) They were rated at 180-kVA each at any frequency from 30 to 10,000 Hz. The transformers were immersed in 725 gallons of oil and, with their cases, they weighed approximately 19 tons each. The elliptical-shaped transformer cases were 11-feet high, seven-feet wide, and 5-feet deep.

A horn gap, with a series resistor, was installed across the modulation reactor. A horn gap is a spark gap designed to self extinguish a high voltage arc. This protected the modulation reactor in case of a loss of excitation [102]. Had this not been done, it was calculated that 60-80kV could appear

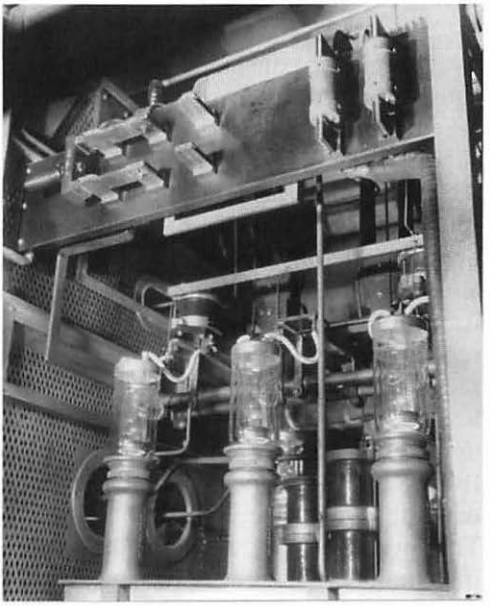


Figure 80. *Three of the eight modulator tubes used in the 500-kW transmitter.*

across the reactor. Other protection circuits included the addition of a surge limiting resistor in the plate circuit of each modulator tube to prevent damage to the bias rectifier. These surge-limiting resistors were bypassed with electrolytic lightning arresters.

The normal operating parameters for each modulator were: 11.8-kV of plate voltage and 1.5-A of static plate current for each of the UV-862 tubes, and a bias voltage of -1,400 V. A Westinghouse 0-50 DC Ammeter was mounted on the front of each modulator cabinet and used to monitor the total current drawn by each modulator.

One hundred percent modulation required an audio power output of 350 kW. Interestingly, however, the power input required to 100% modulate the transmitter was only 12.5 mW. In order to increase this input level to the required output level, a power amplification factor of 28,000,000 was realized. The two modulators on the first floor required a total of 238 square feet.

Figure 81. *The lovely Honey Adams, diminutive star of the "Heatrolatown Gang" series over WLW with Lloyd Shaffer who directs the Heatrolatown Dance Orchestra, inspect the new 500-kW transmitter plant for WLW. In the photograph they are seen next to the giant audio transformers, the largest ever built at that time. Mr. Shaffer is holding in his hand the smallest audio transformer used at WLW. It is less than two inches high and weighs six ounces.*

Power Equipment

All power consumed by the transmitter was supplied from a 33,000-V substation built by the Union Gas and Electric Company of Cincinnati [107]. (Figure 82) Two 33,000-V transmission lines from Oakley and Elmwood supplied the substation with an uninterrupted power source [31]. (Figure 83) All switching was automatic; so if trouble occurred on one line, that line was automatically disconnected from the substation by an oil circuit breaker. Power entered the transmitter building through 2,300-V, 440-V and 220-V underground cables [102]. From the terminal points inside the transmitter building, each cable distributed power to the various motors, rectifiers, and transformers that were essential to the operation of the three radio stations that were located in the building.

The main rectifier was of great interest and it was probably the most unique part of the entire transmitter installation. This rectifier used six RCA 870 hot-cathode, mercury vapor tubes. (Figure 84) These tubes were developed and specially built for this particular transmitter installation. They were the only tubes of their kind ever built when the transmitter was installed. These tubes were nearly 25 inches long. It was believed this rectifier could easily handle 1250 kW and they had a higher output current rating than any rectifier previously installed to operate at 12,000 V.

The 870 tubes had an indirectly heated cathode, which required 65 A at 5 V single phase. The filament had to be energized at least 30 minutes before applying the plate voltage to insure adequate cathode emission and correct operation of the mercury vapor. A time-delay relay prevented the application of plate voltage until the filaments had been heated for the full 30 minutes. Thermostatically controlled preheated air was supplied to the chamber around the base of each rectifier tube. This insured that the tube would always operate at the nearly constant temperature for which it was designed. During operation, a spare 870 tube was kept warmed up and ready for use to replace any active tube that failed [102]. The total filament power for the seven tubes was 2,275 W, and, to prevent high filament inrush current for the 870 tubes, the filament voltage was applied in two steps. The peak inverse rating of these tubes was 16,000 V. The maximum instantaneous plate current was 450 A, with the average rating being 75 A. When they were being used as rectifiers in the 500-kW transmitter, these tubes were

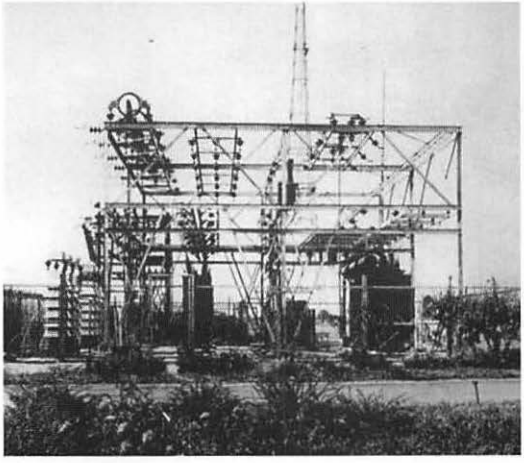


Figure 82. *Outdoor power substation for the 500-kW transmitter, 1934.*

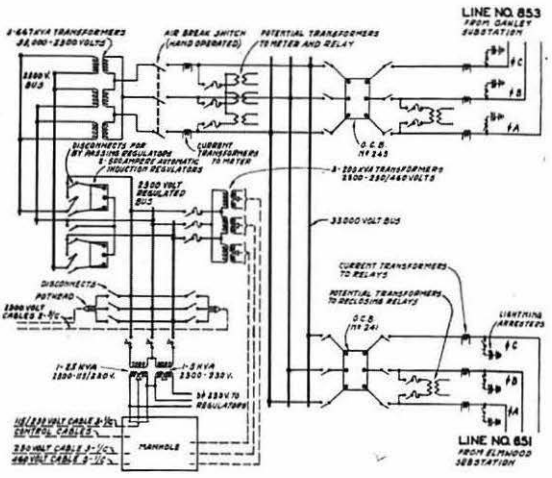


Figure 83. *Circuit diagram of the power substation, 1934.*

operating considerably under their maximum ratings.

The high voltage full-wave rectifier used three single-phase transformers. (Figure 85) Each had a rating of 430-kVA and weighed about 7,000 pounds. The 2,300-V primaries could be switched to either a "Y" or "delta" connection by the operation of two solenoid oil circuit breakers. With the primaries connected in a "Y" configuration, the plate Voltage was 7,000 V and this was used for start-up, tuning and some maintenance periods. A reactor of 0.25 Henry at 125-A was used as a filter in the power supply. It weighed 3,190 pounds and was cooled by 160 gallons of oil. The filter capacitor was 171 microfarads rated at 15,000 V. The capacitor consisted of 114 paralleled 1.5 microfarad Pyranol™ capacitors. To absorb switching transients, a starting resistor was installed in each of the transformer's 2,300-V primaries for a short period and then automatically shorted out for normal operations [102].

Since the rectifier supplied a highly variable load, it had to be designed with a very low internal reactance to keep the plate voltage as constant as possible. This meant that if a fault such as a tube flashover or rectifier "arc back" occurred, the rectifier would supply almost unlimited power to the fault. Safety steps were taken to cut the power to the rectifier immediately after such a fault occurred. A specially developed, high speed, solenoid-operated oil circuit breaker was designed for this purpose. From the time a fault occurred, this circuit breaker would open in an average of a little over 2 cycles of the 60-Hz current.

When plate voltage was applied, all the UV-870 rectifier tubes had a very nice blue glow that would vary in intensity with modulation.

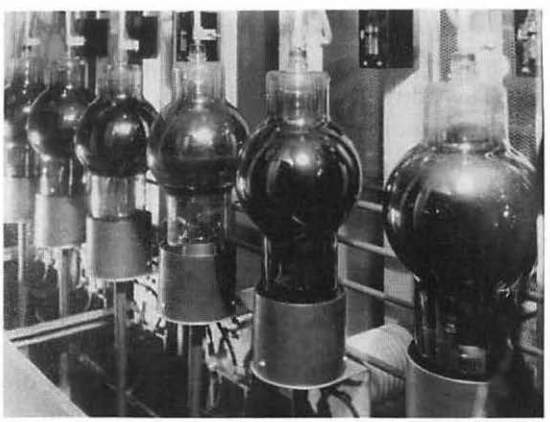


Figure 84. *870 mercury vapor rectifier tubes mounted in the rectifier cabinet of the 500-kW transmitter, 1934.*

Figure 85. *500-kW transmitter plate supply single-phase transformers installed outdoors on the north side of the building. Also shown are the filter reactor and the modulation reactor.*

This blue glow added attractive colors to the all black-paneled 55-foot long transmitter.

At times, the UV-870 tubes would arc back, causing a power dip. The local power company and the entire electrical network could tell when this occurred in the big transmitter at WLW. An arc-back was produced when the current in one or more of the UV-870 tubes passed in the wrong direction, causing a huge peak inverse current surge. It was estimated that the peak inverse current surge could be as high as 4,000-A at times.

With the transmitter operating at 500 kW, the normal output voltage from the main rectifier was 11.8 kVDC. The load current would vary from approximately 75 ADC to 110 ADC depending on the modulation percentage and the power drawn by the high-level class B modulator. General Electric meters mounted on the front panel of the rectifier cabinet constantly indicated the power supply voltage and load current. Approximately 175 square feet of space on the first floor was needed for the main rectifier.

"The completion of the new 500,000-Watt WLW is a matter of great gratification to all of us of the Crosley Radio Corporation. The remarkable engineering achievement involved in the successful design and construction of a radio broadcasting station ten times more powerful than any ever built in the United States and, by far, the most powerful in the world at the present time, is in itself gratifying. But more than this is the gratification coming with the knowledge that with this tremendous increase in power, WLW multiplies many fold its service to the people of America, providing a regular uniform radio service of high quality to thousands, if not to millions, heretofore, with such service."

The above quote is attributed to Powel Crosley, Jr., President of the Crosley Radio Corporation, April 30, 1934.

THE CINCINNATI POST, WEDNESDAY, MAY 2, 1934
Giant of the Ether
WLW To Begin Radio Broadcasting on 500,000 Watt Power Tonight.
Roosevelt to press key to Open Initial Program

DEDICATION

Powel Crosley Jr. had always been a daydreamer. Unlike most daydreamers, however, Mr. Crosley's daydreams had a way of materializing into realities.

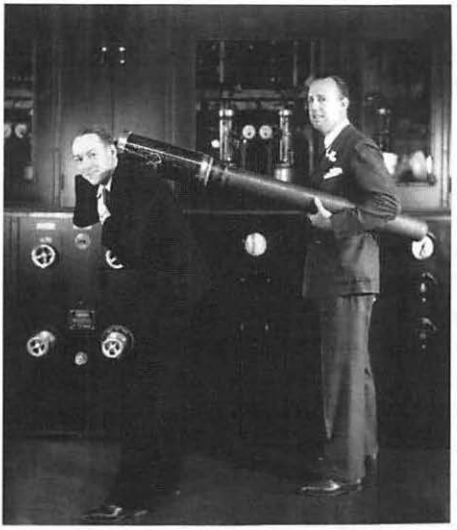


Figure 86. *Powel Crosley Jr., and Joseph A. Chambers, WLW Technical Supervisor, hefting one of the UV-862 triodes used in the 500-kW transmitter, 1934.*

The realization of one of these dreams came true on the evening of May 2, 1934. On that day the formal dedication exercises for the new, giant 500-kW WLW transmitter were conducted. It was the world's most powerful broadcasting station. Ever since he began experimenting with his first radio transmitter (8CR in 1921), Powel Jr. had envisioned a time of super-power broadcasting. He slowly developed his daydream over the next 13 years. With his station WLW, he led the way toward super power through successive transmitters of 50-, 500-, 5,000-, 50,000-, and now 500,000-W.

A formal dedication program for the world's most powerful radio station was conducted on May 2, 1934. Except for a half-hour congratulatory NBC program originating from New York at 10:30 PM EST, the entire program originated from the "Hall of Mirrors" in the Netherland Plaza Hotel in downtown Cincinnati [10, 11, 14]. (Figure 86)

President Roosevelt had promised to press a telegraph key at 9:03 PM EST on May 2 to formally open WLW's new 500-kW radio broadcasting transmitter. (Figure 87 and 88)

May 2, 1934 The Big Night

The 500,000-W transmitter had been tested for about an hour, starting at 6:00 PM, to make certain of its operation for the big night.

At 9:00:30 PM the studio announcer said, "This is WLW, Cincinnati, Ohio. We will now shift our transmitter to 500,000 Watts of power."

Chief Engineer Joe Whitehouse, at the control console, turned off the 50,000-W transmitter. Engineer Dick Duncan switched the audio line from the low level Heising modulation of the 50,000-W WLW transmitter to the new 350,000-W high-level modulator. Engineer Bill Schwesinger operated the transfer switch, located on the harmonic filter, to move the 50,000-W transmitter output from the antenna transmission line to the input of the 500,000-W transmitter. Engineer Fritz Leydorf checked the operation of the main line clapper switch. Joe Whitehouse turned on the 50,000-W transmitter, supplying drive to the grids of the 500,000-W transmitter. Les Petry, in the audio room at the transmitter, sent a cue signal to Washington, D.C. and President Roosevelt closed a key at the White House. By direct wire 700 miles away, in Mason, the world's largest radio station started to function. (Figure 90)

The closing of the key by the President inaugurated a six-hour program dedicating the new 500,000-W transmitter. Notables in the world of politics, business, and entertainment flooded the station with congratulatory messages as the big transmitter went into operation.

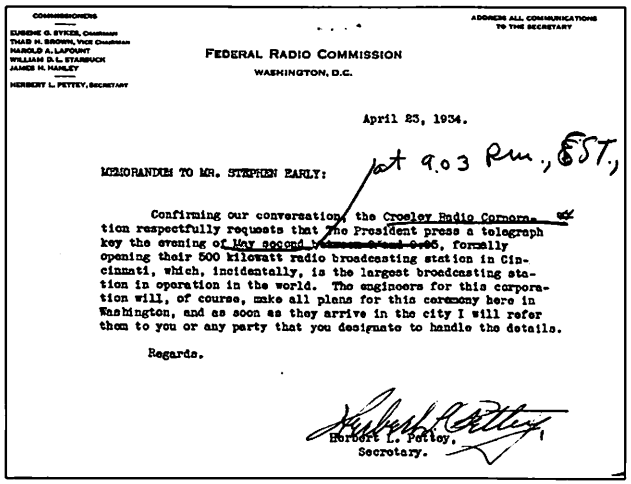
President Roosevelt, in a message to Powel, Jr., said: "*I have just pressed the key to formally open station WLW. It has been a pleasure to do this. May I take this opportunity to congratulate you and your staff upon the inauguration of this new radio service. I feel certain that WLW will give the people of our country and those of our neighboring nations a service managed and conducted for the greater good of us all.*" (Figure 89)

From Rome, Guglielmo Marconi, inventor of wireless communication, cabled Mr. Crosley,

"It affords me genuine pleasure to be present in spirit at the inauguration of your powerful broadcasting station. You may well be proud of the addition you are bringing to American broadcasting and of your own contribution to the further development of the use of the most powerful and practical means of spreading news, education and enjoyment throughout the civilized world. We cannot but feel more and more united as radio waves encircle our globe, bringing us tidings of friendship and good will."

Other telegrams were received from John Nance Garner, Vice President; Henry T. Rainey, Speaker of the House of Representatives; Merlin H. Aylesworth, President of RCA; William S. Paley, President of CBS; Albert Einstein; and Senator Clarence C. Dill, long active in radio legislative affairs. Telegrams were also received from many other congressmen, senators, radio executives, and radio and movie stars.

Among those who spoke briefly at the ceremonies, in addition to Mr. Crosley, were Thad Brown, Vice Chairman of the Federal Radio Commission; George White, Governor of Ohio; Russell Wilson, Mayor of Cincinnati; and John L. Clark, General Manager of WLW. Charles Sawyer, Lieutenant Governor of Ohio, was supposed to be toastmaster. However, he asked to be relieved because of the death of his long time friend Colonel William Cooper Procter, former Chairman of the Board of the Procter and Gamble



COMMISSIONERS
EUGENE O. SYKES, Chairman
THAD H. BROWN, Vice Chairman
HAROLD A. LAFOUNT
WILLIAM D. L. STARBUCK
JAMES H. HANLEY
HERBERT L. PETTEY, SECRETARY

ADDRESS ALL COMMUNICATIONS TO THE SECRETARY

FEDERAL RADIO COMMISSION
WASHINGTON, D.C.

April 23, 1934.

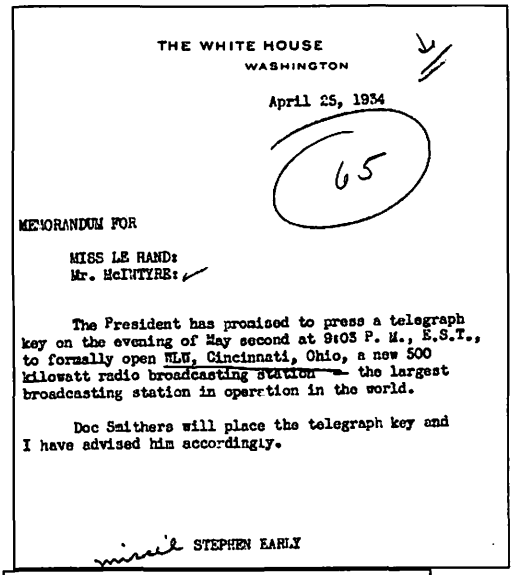
MEMORANDUM TO MR. STEPHEN EARLY:

Confirming our conversation, the Crosley Radio Corpora- tion respectfully requests that the President press a telegraph key the evening of May second [illegible] 9:05, formally opening their 500 kilowatt radio broadcasting station in Cincinnati, which, incidentally, is the largest broadcasting station in operation in the world. The engineers for this corporation will, of course, make all plans for this ceremony here in Washington, and as soon as they arrive in the city I will refer them to you or any party that you designate to handle the details.

Regards.

Herbert L. Pettey,
Secretary.

Figure 87. *Letter of authorization to operate the 500-kW transmitter, from the Federal Radio Commission to Mr. Early, 1934.*



THE WHITE HOUSE
WASHINGTON

April 25, 1934

65

MEMORANDUM FOR

MISS LE HAND:
Mr. McINTYRE:

The President has promised to press a telegraph key on the evening of May second at 9:03 P. M., E.S.T., to formally open WLW, Cincinnati, Ohio, a new 500 kilowatt radio broadcasting station — the largest broadcasting station in operation in the world.

Doc Smithers will place the telegraph key and I have advised him accordingly.

STEPHEN EARLY

May 2, 1934

My dear Mr. Crosley:

I have just pressed the key to formally open station WLW. It has been a pleasure to do this.

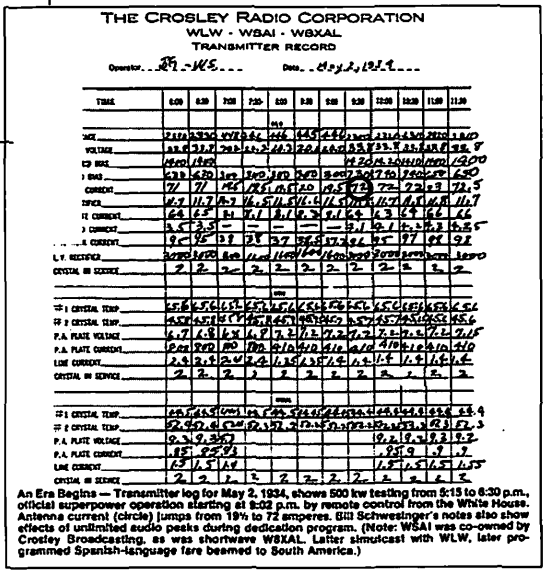
And may I take this opportunity to congratulate you and your staff upon the inauguration of this new radio service.

I feel certain WLW will give the people of our country and those of our neighbor nations a service managed and conducted for the greater good of us all.

Very sincerely yours,

Mr. Powell Crosley, Jr.,
c/o Station WLW,
Cincinnati, Ohio

Figure 89. (Above) *President Roosevelt's letter of congratulations to Mr. Crosley, 1934.*



THE CROSLEY RADIO CORPORATION
WLW - WSAI - W8XAL
TRANSMITTER RECORD

An Era Begins — Transmitter log for May 2, 1934, shows 500 kw testing from 5:15 to 6:30 p.m., official superpower operation starting at 9:02 p.m. by remote control from the White House. Antenna current (circle) jumps from 19½ to 72 amperes. Bill Schwesinger's notes also show effects of unlimited audio peaks during dedication program. (Note: WSAI was co-owned by Crosley Broadcasting, as was shortwave W8XAL. Latter simulcast with WLW, later programmed Spanish-language fare beamed to South America.)

Figure 90. (Right) *Crosley radio station WLW transmitter log from May 2, 1934 showing 500-kW testing and operation. Note BG and WS, Bert Gregg and William Schwesinger.*

Figure 88. *President Roosevelt's agreement to inaugurate WLW's new transmitter, 1934.*

Co. Peter Grant, a WLW announcer, assumed the duties of toastmaster for the evening. The invocation was given by the Rev. Carl Olson, pastor of the First Universalist Church of Walnut Hills in Cincinnati.

The dedicatory banquet and ceremony is said to have been the most elaborate ever attempted in radio history. More than 200 people took part in the six-hour program, which required 28 radio engineers to complete. Several entertainers, several orchestras, and a male chorus performed at the hotel for the broadcast. The program continued into the small hours of the morning for the benefit of listeners on the Pacific coast, Hawaii, the Philippines, New Zealand, Australia, etc.

Some of the afternoon programs broadcast prior to the dedication were: Business News, Xavier Cugat, Jack Armstrong, Amos 'n' Andy, Crime Clues, Radio Court, Lowell Thomas, and Orphan Annie, etc. Listeners in rural and remote areas suddenly found these fine programs on their radio receivers and many life-styles were changed after the big transmitter went on the air.

With the arrival of the broadcasting boom, radio became a household necessity, and the commercial use of this medium outpaced its military uses. This required tighter government control, which resulted in the establishment of the Federal Communications Commission in 1934. The Communication Act of 1934 establishing the FCC was signed by President Roosevelt on June 9.

A real problem surfaced in the fall of 1934 when broadcast station CFRB in Toronto, Canada, operating on 690 kHz with a power of 10,000 W, complained about interference from WLW's strong signal at night [86]. Another complaint about interference came from WOR in New York, but eventually this complaint was dropped. (Figure 91)

The Canadian government communicated through the State Department to the Federal Communications Commission on December 13, 1934 regarding the complaint. According to an international agreement ratified by the United States and Canada, all stations must, so far as possible, be operated so as not to interfere with stations within any country subscribing to the treaty. The Federal Communications Commission on December 21, 1934, ordered a reduction in the power of WLW to 50,000 W at night. This would mean that 90% of the available power of the station would become useless during the important evening hours. This action was a terrible shock to Powel Crosley Jr., his company, and the radio world. Crosley Broadcasting resorted to legal action but the Federal Communications Commission action was upheld in court. Crosley engineers immediately began designing and installing a revolutionary new directional antenna.

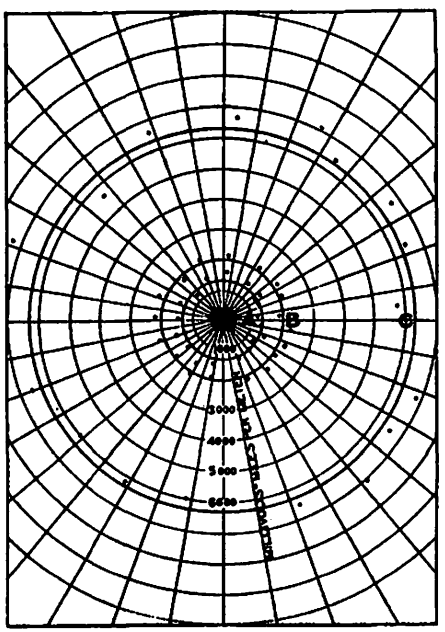


Figure 91. *Relative field intensities for the quarter wave antenna and vertical tower.*
Curve A: Field intensity, 50-kW input to horizontal "T" antenna
Curve B: Field intensity, 50-kW input to 0.58 wavelength antenna
Curve C: Field intensity, 500-kW input to 0.58 wavelength antenna

First, it was necessary to accurately determine the effective signal strength in the Toronto area with WLW operating at 50,000-W. Field strength recording equipment was set up in a cabin near Niagara Falls, New York and a series of recordings were made at all hours of the day and night while the station operated at 50,000 W. Then a second series of recordings were completed while the station operated at 500,000 W. (Figure 93)

Due to the location of WLW and the service it rendered to the community, a conventional directional antenna was deemed to be highly undesirable. A directional antenna that reduced the signal in the Toronto area would produce the same reduction over practically all of the state of Ohio. This would seriously reduce the coverage in some of WLW's most valuable service areas.

The Crosley engineers, therefore, set out to devise an antenna system that would reduce the signal in a given geographical area rather than in a certain direction. This was a distinct advance over previous methods of interference suppression using directional antennas. Due to the characteristics of the 5/8 wavelength vertical antenna, the radiation in the horizontal plane served the area for approximately 200 miles, but completely disappeared in Toronto, 400 miles away. [86, 89, 92]

The WLW engineering staff started with the fact that the signal that caused the interference in Toronto left the antenna at an angle of 20 degrees above the horizon. Refracted by the ionosphere, these signals were returned to the earth at approximately 400 miles from the antenna, depending upon the height and stability of the ionosphere. It was decided to suppress the signal at the vertical angle in the direction of Toronto. The engineers hoped to avoid suppressing the signal at any other angle or direction.

The problem was solved by the installation of two additional vertical suppressor antennas. They were fed with 85,000 W of power and spaced at a carefully calculated distance from the main antenna so that the signal strength was reduced at the required angle. (Figure 92)

The final design used the 831-foot main antenna and two symmetrically placed quarter wave suppressor antennas, each 326 feet high. The suppressor antennas were separated by a distance of 702 feet (one half wavelength). They were phased together so that the signal produced was a "figure eight," with its long axis pointing in the direction of Toronto. An imaginary line between these two suppressor antennas was located 1,850 feet behind the main antenna, which gave a space phase of 474 degrees. The current in the suppressors lagged the current in the main antenna by a time phase of 96 degrees.

Construction of the suppressor antenna towers was difficult and dangerous due to the induced radio frequency current from the nearby 500,000-W transmitter. For this reason, all of the steel tower sections had to be hoisted into place with rope and tackle. Members of the engineering department had to attach a flexible ground wire to each piece of steel as it was lifted into place. Without these grounding wires, the tower construction workers could not touch the steel pieces without receiving an RF burn. The cost of the suppressor array amounted to nearly $30,000.

Field test measurements conducted within the affected area by Crosley engineers and the Federal Communications Commission indicated that the

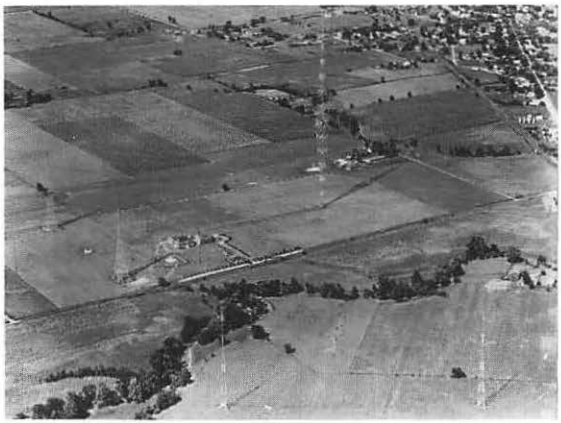


Figure 92. *The WLW suppressor towers in the foreground provided directivity and reduced the signal strength in areas where interference was a problem, 1934.*

interference had been eliminated. The tests showed that the signal strength at 500,000 W with the suppressor array in service was nearly the same as the 50,000-W signal strength without the suppressor array. As a result, the Federal Communication Commission approved WLW's return to normal operation at 500,000 W on May 9, 1935. (Figure 94)

This pioneering step in the development of the technical science of radio broadcasting was the first successful commercial attempt to obtain both horizontal and vertical antenna directivity. It was another brilliant achievement on the part of the Crosley Radio Corporation.

With the 500,000-W transmitter now back on the air, and with its large coverage area, Crosley products became more evident throughout the United States and in some foreign countries.

Each time there was a power increase at WLW, the number of Crosley distributors and dealers would also increase. More power led to more distributors which led to more dealers and more sales of Crosley products. Some of the local Crosley dealers had their own ideas about how to increase sales and they used them to help promote Crosley products. Dealer window displays were a very popular form of local advertising during the 1930s. (Figure 95)

Another Crosley motto was: "Make Every Day Count - Concentrate on Crosley."

The Crosley Radio Weekly, The Crosley Radio Broadcaster, and *The Crosley Broadcaster* were publications promoting Crosley radios, refrigerators and other Crosley products. Crosley distributors and dealers depended on these publications for new product descriptions, technical articles, local advertising ideas, the exchange of dealer ideas, and WLW programming, etc.

Powel Crosley, Jr. said, *"It goes without saying that two legs are better than one."* Crosley radios and refrigerators were ideal teammates; one helped the other in sales. Owners of Crosley radios remembered the splendid service that came with those products. Therefore, Crosley Shelvador refrigerators were chosen by many Crosley radio owners when they were purchasing a new refrigerator. Likewise, a satisfied Crosley Shelvador owner often concluded that a Crosley radio would measure up to the same standard of quality as his refrigerator [11].

Another Crosley motto was: " *Wherever there is praise, there is profit.* "

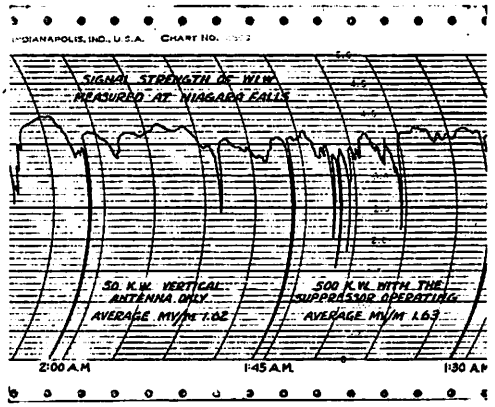
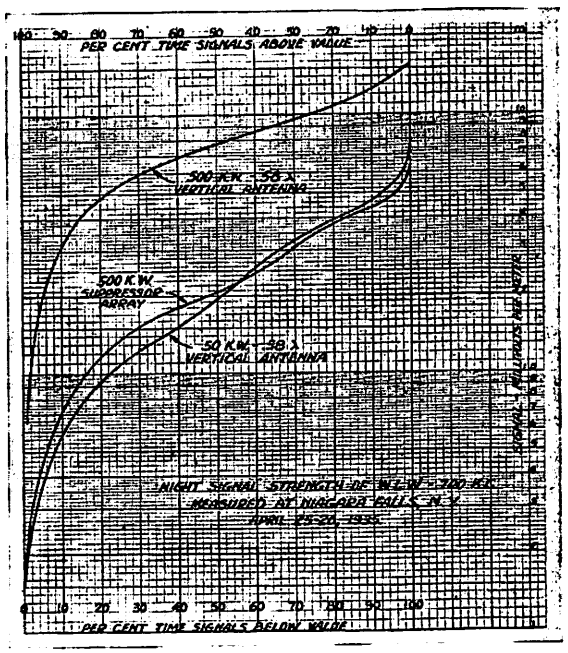


Figure 93. *On this chart are successive records of the field strength measurements of WLW at Niagara Falls, New York transmitting at 50-kW power and transmitting at 500-kW using the suppressor antennas. Note the night signal strength measurements with 500-kW power using the suppressor antennas is practically the same as with 50-kW using only the vertical radiator.*

Even after the stock market failure of Tuesday, October 29, 1929, competition for radio sales continued to increase through the 1930s. During this period, however, many smaller radio manufacturers went out of business. These included Doron Brothers, located in Hamilton, Ohio, and Kodel in Cincinnati. There remained more than 50 major radio manufacturers in the United States in the early 1930s. RCA, Philco, Montgomery Ward, Sear-Roebuck, Emerson, General Electric, and Zenith were Crosley's largest sales competitors.

As in the past, Crosley continued to be successful in meeting the competition during the 1930s. He manufactured radios that sold for an affordable price and many people soon came to have more than one radio in their homes. Radios were also used in automobiles, at the office, and they were even taken on vacation. Special radios, powered by wind chargers, were used on farms where there was no electricity.



In the 1930s, radios took on a more modern look and incorporated important new design features for excellent performance. Various models contained one or more of these features: a range switch for broadcast

Figure 94. *These curves show the relative field strength measurements of the signals at Niagara Falls from WLW using 50-kW, using 500-kW, and using 500-kW as modified by the suppressor towers, as well as the range of variation of the three, 1934.*

band and short wave listening from 1500 kHz to 18,000 kHz, an automatic volume control, a push-pull or triple-twin audio output, a neon tuning indicator, an airplane or other unique types of dials (some illuminated), a mystic hand for automatic tuning, various high fidelity and tone controls, remote speakers, permanent magnet and electro dynamic speakers, metal and glass tubes, static controls, and power supply noise filters, etc. The receivers in the early 1930s used the neutrodyne circuit, but after 1932 most receivers were superhetrodynes.

The Modern Radio is Ear Conditioned [11]

In 1934, the price range for Crosley receivers ran from $18.50 for the Travo model AC-DC superhetrodyne to $120 for the Dual Fourteen, 14-tube radio. Most of the 1934 radios were sold in the price range of $30 to $60. This was very competitive pricing with respect to the other manufacturers.

The price range for the 1937 models ran from $19.99 for the Crosley Fiver to $174.50 for the Crosley model 1516 console that had 15 tubes and a 15-inch speaker. Most of the nearly 40 models of the 1937 radios were sold in the price range of $35 to $70. From 1921 to 1940, Crosley manufactured more than 400 different models of his receivers.

Crosley introduced the "ultimate" in radio receivers in 1936 [39]. Because of its great size and power, it was named the "WLW Super-Power Model" by Powel Crosley Jr. (Figure 96) It was a deluxe model 37-tube receiver, equipped with six speakers and other features that placed radio reception on a level never before attained. In addition to the basic radio receiver, it was also provided with a public address system. Tuning was continuous from 540 kHz to 18,300 kHz using three bands. It had an audio output power of 50 - 70 W. One speaker was 18-inches in diameter to reproduce the bass or low frequencies, two more speakers handled the middle range audio frequencies, and three more provided the high audio frequencies. Four separate chassis were required for arrangement of the circuits which used all metal tubes. The audio frequency response was from 20 Hz to 20,000 Hz. The set was crammed with features such as a bass compensation control, a six-step tone control, and a separate volume control for each different audio range; bass, mezzo and treble. It had a 12-inch airplane type tuning dial, automatic tuning, and other features developed by Crosley engineers.

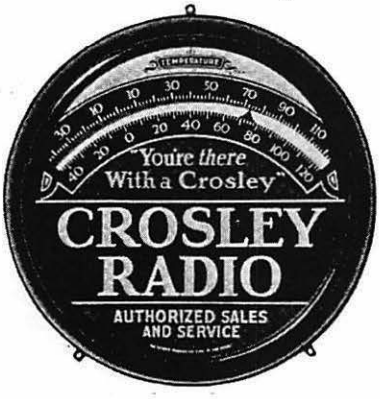


Figure 95. *In 1929, this combination thermometer/hygrometer was sold to Crosley dealers for their showrooms. This was one of many items, such as neon signs, banners, and clocks, etc. used by dealers to display the Crosley name. This one sold for $12.*

The cabinet stood four feet ten inches high, 42 inches wide and 22 inches deep. The complete radio weighed 475 pounds. The cabinet was a masterpiece of woodwork, surpassing the capacity of words to accurately describe it. The list price was $1,500. The order for the first WLW Super Power receiver was placed by Wheless Gambill, President of the Gambill Distributing Co. Gambill was the Crosley distributor in Nashville and Chattanooga, Tennessee.

Chapter Nine
The Other Crosley Products

Powel Crosley Jr. was very aware of the uncertain climate of the radio receiver business in the late 1920s. He decided to concentrate in two areas; increasing the coverage area of WLW and manufacturing refrigerators. Crosley had manufactured a refrigerator called the Icyball in 1927 [35]. (Figure 97 and 98) These thermal type units required no gas or electricity for operation. They were popular in remote areas of the United States and the world, but were impractical in areas that had electrical power due to the complex daily ritual necessary to keep them cold. The Icyball was manufactured, advertised, and sold throughout the 1930s. There was still a great potential for Icyball sales in 1936 as 10,000,000 homes in the U.S. still did not have electricity.

The freezing unit consisted of two special metal balls joined together by a strong metal tube. The smooth ball was the cold ball, and the ball with fins was the hot ball. These hermetically-sealed balls contained ammonia, a harmless liquid refrigerant. The icyball required daily regeneration. To do this, the cold ball was submerged in a tub of water while the hot ball was heated, most commonly by a kerosene heater. (Figure 100) The hot ball was "cooked" for about 1.5 hours to force the refrigerant into the cold ball, which was then placed inside the Icyball cabinet. The refrigerant gradually vaporized and returned to the hot ball while simultaneously cooling the cold ball. This action kept the inside of the Icyball cabinet uniformly cold. It was suggested that the Icyball always be heated in the morning to keep it coldest for daytime use. Heating of the hot ball required approximately a pint of kerosene at a cost of about 2-cents a day for the kerosene.

The Icyball was also made in a double unit for restaurants and stores, etc. (Figure 99) These

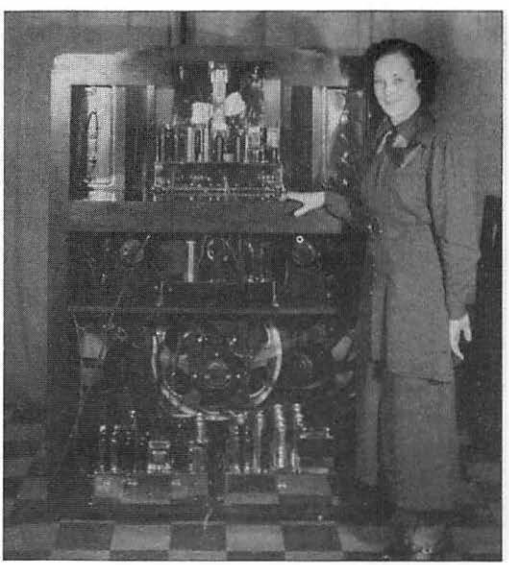


Figure 96. *The Crosley "WLW Super Power" duluxe 37-tube radio receiver from 1934.*

units created some humor since some law enforcement officials thought they might be used as stills to produce alcoholic liquors. A form of Icyball refrigeration is still being used in the 21st century in remote areas of the world.

Publicity in late 1931 indicated that Crosley would soon manufacture an electric refrigerator, and it was introduced just before Christmas sales began to pick up in December, 1932. (Figure 101) The advertising theme was centered around the idea that the average family could now enjoy the advantages of an electric refrigerator. Three models were introduced with prices ranging from $89.50 to $139.50. Crosley concentrated on the electric refrigeration market in the spring and summer when radio sales were normally down.

In January of 1933, the Crosley Shelvador refrigerator was introduced [36, 95]. This one appliance contributed greatly to the profits of the company over a period of many years. Crosley was noted for taking time to talk with any inventor, tinkerer, or gadget maker who wanted to discuss his ideas or inventions. One day in 1932, a young man who wanted to sell the rights to an idea came to see Powel Jr. He had patented the idea of placing shelves on the inside of the door of a refrigerator. Crosley liked the idea and believed it would increase sales of Crosley refrigerators. Powel Jr. offered the young man a twenty-five cent royalty on every refrigerator Crosley would make with a shelf on the inside of the door. The young inventor wanted $15,000 and would not listen to Crosley's advice regarding the royalties (which would have made him rich). Crosley even offered the young inventor a combination of cash and royalties but again, he refused. Powel Jr. finally wrote him a check for $15,000.

The Crosley Shelvador refrigerator was an instant success. (Figure 102) Many thousands of units were sold in the next few years. Other refrigerator manufacturers were forced to wait years until the Crosley patent rights for the shelf-in-the-door idea had expired. The Crosley Shelvador became one of the most popular household appliances in America and increased the Crosley profits to new heights.

Other models of refrigerators that Crosley sold in 1933 for home and business use included the Kool-Rite (Figure 103) and the Kool-Draft beer dispensers. (Figure 104) A few years later the Crosley Koldrink electric bottle cooler was introduced [37]. (Figure 105)

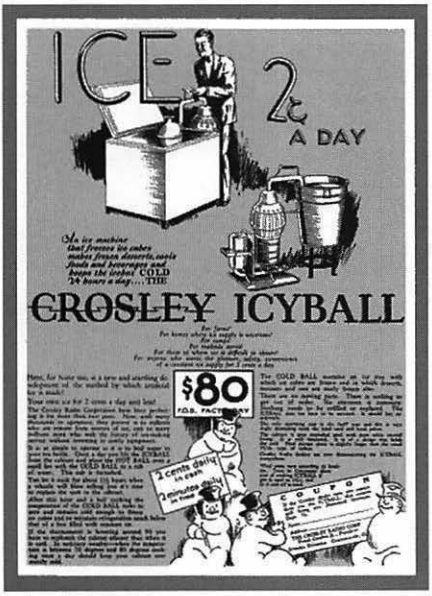


Figure 97. *Crosley Icyball Refrigerator advertisement.*

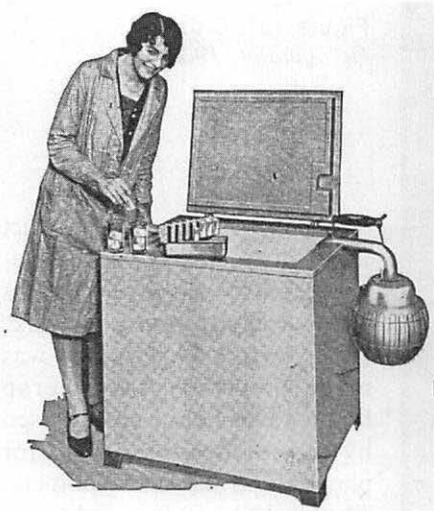


Figure 98. *Single unit Crosley Icyball Refrigerator, 1928-29.*

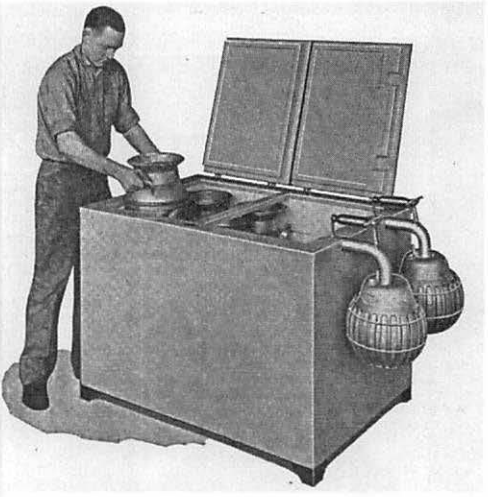


Figure 99. *Double unit Crosley Icyball Refrigerator, 1928-29.*

By 1936, Crosley was also manufacturing electric washers (Figure 106) and ironers which went by the trade name of Savamaid. (Figure 107)

In the line of least resistance, one Crosley dealer remarked, "*It is better to sell Crosley products than to compete with them.*"

At the peak of the Great Depression, Crosley was also manufacturing many other products. These included an electric bug killer, an ozone generator for use as a deodorizer, a furnace oil burner, kitchen cabinets, a physical exerciser, (Figure 108) and a space heater that was thermostatically controlled and called the TEMPERATOR [38]. His other products included a camera, motor scooter, wind charger, head set for radio reception, ice cube generator, copper oxide rectifier, and a moisture meter, as well as antennas, wet electrolytic capacitors, and fishing tackle, etc. In the 1930s, Crosley's largest volume of business was attributed to radio broadcasting, radio receivers, and refrigerators.

The Ideal Stove For Heating The Crosley Icyball

Big Demand For Kerosene Burning Perfection Crosley Icyball Heater---Model 151

To insure the most ideal service from the Crosley Icyball Refrigerator, it is important that the unit be heated according to directions. The ideal means of heating the Crosley Icyball unit, where gas is not available, is the kerosene burning Perfection Icyball heater shown above.

This heater has been developed by the Perfection Stove Co., of Cleveland, Ohio, under the guidance of suggestions made by Crosley engineers, and is endorsed by The Crosley Radio Corporation as the most ideal kerosene heater for heating the Crosley Icyball.

The Perfection Stove, Model 151, is sold through your Crosley distributor. Prices are as follows:

Heater without stand, $9.00.
Heater with stand, $10.25.
Stand alone, crated in lots of eight, $1.50 each.

Figure 100. *Ideal Stove used to heat the Icyballs to prepare them to continue cooling the Crosley Icyball refrigerators, 1928-29.*

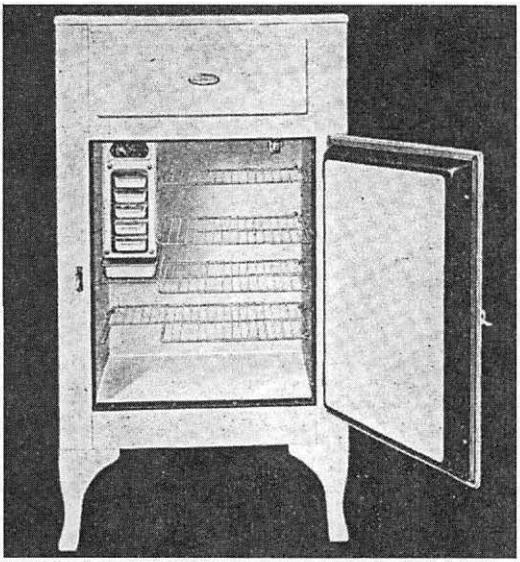


Figure 101. *Crosley Model C-55 Refrigerator, 1932.*

Probably the first side product that Crosley made was the Go-bi-bi, a scooter for little tots who were too young to walk. (Figure 109) This scooter was made primarily from scrap lumber that could not be used by the woodworking shop for phonograph and radio cabinets. The Go-bi-bi was sold to a Mr. Taylor in 1925, and he eventually changed the name to Taylor Tot [47, 79].

Crosley's interest in aviation was almost as well known as his interest in broadcasting and manufacturing radios. He became president of the Crosley Aircraft Company of Cincinnati in the late 1920s. This was a private venture that concentrated on the development of radio equipment for aviation use [44].

In 1927-28, there was a flurry of activity in building airplanes [94]. Powel Jr. built a plane called the Moonbeam in one of his radio manufacturing buildings on the north side of Cincinnati. (Figure 110) Crosley eventually built five planes that were never fully certified and the selling price was never established because of the stock market failure in October of 1929. Experimental work continued for about a year, until it became evident to Crosley that he could not build airplanes as successfully as he could build radios.

By May, 1929, Crosley had acquired 193 acres in Sharonville for a flying field. It became known as the Crosley Airport and was used by private airplanes. Another airplane, called the Crosley Flea, was built at the airport by Crosley's pilot. This airplane was assembled in 1934 in a large hanger that Crosley had

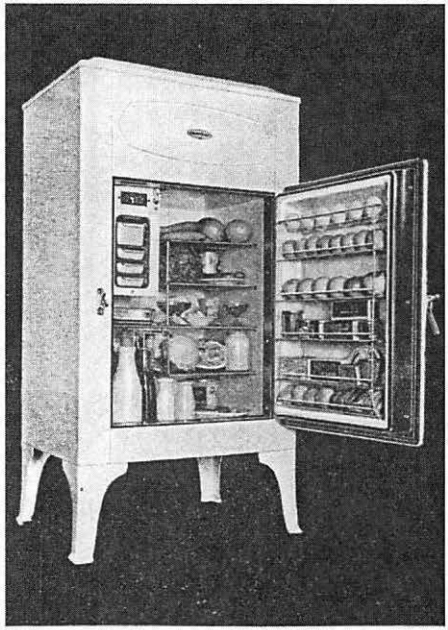
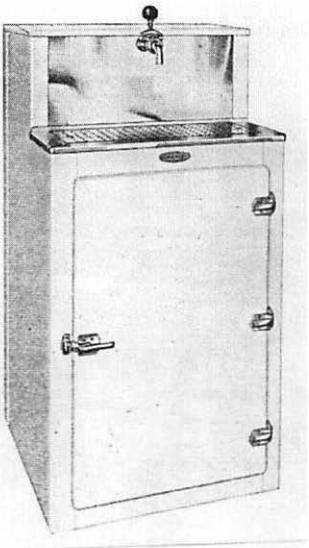


Figure 102. *Crosley Model D-60 Shelvador Refrigerator, 1933.*



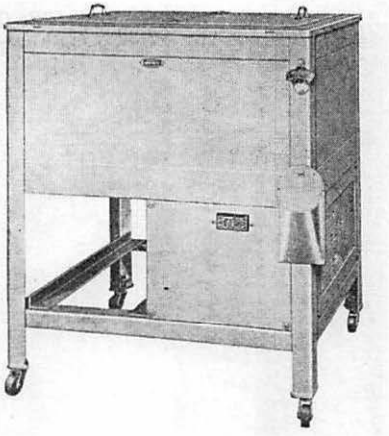


Figure 103. (Above) *Crosley Kool Rite Cooler, 1933.*

Figure 104. (Left) *Crosley Kool-Draft Cooler, 1933.*

constructed at the airport. It was supposed to be the affordable airplane for the common man. Planes of similar design experienced a series of crashes in Europe, however, and the Bureau of Commerce, forerunner of the FAA, grounded the plane. It was never flown again. From the late 1920s until 1941, Crosley traveled in at least 13 different aircraft. These included the Moonbeam, Waco, Lockheed-Vega, Sikorsky, Grumman Goose, Fairchild 45, etc.

The Crosley Airport property was sold to the Ford Motor Company in the 1950s for the construction of a transmission plant, which is still in operation in 2003.

Powel Jr. used small planes, including the Moonbeam, for short trips to his farm in Indiana and for business trips to the larger cities in the Midwest. The Grumman Albatros was a larger amphibian plane that had the capacity to carry eight passengers. This plane was used for longer trips (such as Florida and Canada) to save time. Powel Jr. had a personal rule that he would not be away from the office for more than two weeks at a time. However, he made exceptions for a houseboat trip and a family vacation to Europe which each exceeded two weeks.

Figure 105. *Crosley Koldrink Cooler, 1933.*

Figure 106. (Left) *Crosley Model 63 Savamaid Washing Machine, 1936.*

Figure 107. (Right) *Crosley Model 60 Savamaid ironer, 1936.*

Figure 108. (Left) *Crosley Autogym exerciser, 1929.*

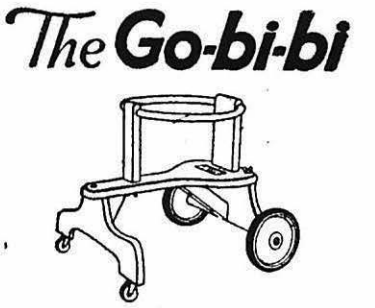


Figure 109. (Right) *Crosley Go-bi-bi scooter, 1922.*

Powel Crosley Jr. never had more than a student pilot permit [94]. He took off, flew, and landed planes, but always accompanied by a licensed pilot because he did not want to spend the time to earn a pilot's license. In the late 1920s, Powel Jr. used smaller planes such as the Waco and the Moonbeam for advertising. The Crosley name, painted on the wings, could be seen from a great distance. (Figure 111) Photographs of the Crosley airplanes appeared in *The Crosley Broadcaster* as well as other radio publications, newspapers, and magazines [11]. This type of advertising was continued into the 1930s when Crosley purchased a Wasp-powered, Lockheed-Vega high wing monoplane. (Figure 112) This plane, known as the "New Cincinnati," set a round trip transcontinental record of 31 hours and 58 minutes with Captain Brock as the pilot. The plane was entered in the National Air Races and carried a receiver and a 150-W transmitter which operated on 457 kHz. The call letters of the flying transmitter were KHILO. At 6,500 feet in the air, with Robert Brown as the announcer, a half-hour program was broadcast on the local frequency. This program was picked up and rebroadcast over WLW.

Figure 110. *Crosley Moonbeam airplane, 1927-28.*

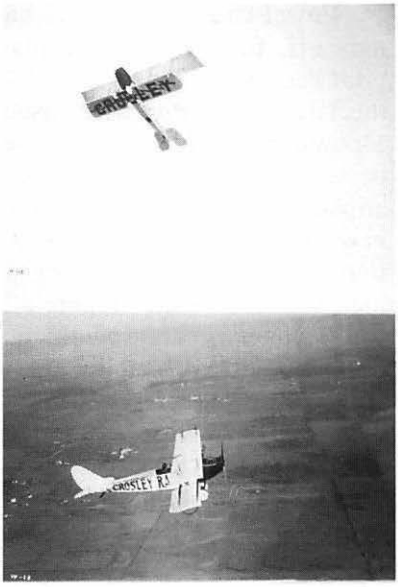
The Crosley airplane took part in other National Air Races. One such race between Los Angeles and Chicago was won by Wiley Post with a time of 9 hours and 9 minutes. The New Cincinnati finished in fourth place, perhaps due to carrying the additional 765 pounds for the transmitter and the announcer.

When the racing season was over, the plane took part in the National Air Tour for the Edsel B. Ford Trophy. Broadcasts were made from the plane during the International Balloon Races in Cleveland which were held to determine the winner of the Gordon Bennett Trophy. During the National Air Reliability Tour, the New Cincinnati visited more than 30 cities in the United States and Canada.

While the plane was in the air, a running account of the races, tours and special broadcasts could be picked up by radio stations along the route and rebroadcast. Thus, for the first time, it was possible for radio listeners to hear what was happening in an airplane during a record-breaking flight and other flight-related activities.

The New Cincinnati established three firsts in the records of aeronautics; the first broadcast from a racing plane, the first broadcast of an International

Figure 111. *Crosley advertising airplane, 1924.*



Balloon Race from the air, and the first broadcast of the National Air Reliability Tour from a flying radio station.

Unprecedented levels of publicity enhanced the prestige of the Crosley products each year that Crosley participated in these aeronautical events. Again, this was another way that Powel Jr. continued to be known as a genius in advertising. Of course, the New Cincinnati had large Crosley letters on its exterior so nobody who saw it could mistake what company was sponsoring it.

In 1928, Powel Jr. and Gwendolyn Crosley started construction on a 21-room mansion in Manatee County Florida on the pristine Sarasota Bay. (Figure 113 and 114) When it was finished in 1929, it was named "Seagate." For many years, Powel Jr. and his family, friends, and business associates traveled by airplane from Cincinnati to Sarasota Bay to vacation at the mansion. One airplane used by Powel Jr. was a Douglas Amphibian Sikorsky, which he named "Lesgo." In 1933 this plane covered the distance of 825 miles from Cincinnati to the Sarasota Bay in the record time of six hours and 40 minutes. The house was used regularly until Gwendolyn died on February 26, 1939. After her death, Powel Jr. used the house infrequently.

The Crosley boat dock which was used for the Crosley yacht named the "Sea Owl" was located near the mansion. Powel Jr. donated his luxury yacht to the Coast Guard at the beginning of World War II.

In August 1991, the Manatee County Commissioners paid $1.57 million for the mansion, 16.2 acres of land, and the harbor. The mansion had been vacant for 15 years. The Florida Board of Regents agreed to purchase the remainder of the 44-acre estate for the University of South Florida at Sarasota. The property is on the border of Manatee and Sarasota counties and is located next to the John and Mable Ringling Museum of Art.

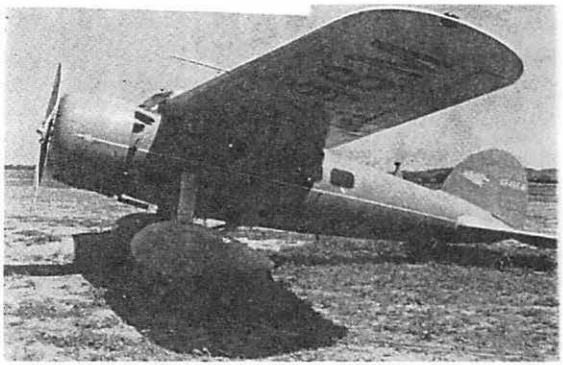


Figure 112. *Crosley "New Cincinnati" Lockheed-Vega airplane, 1930.*

Figure 113. *Seagate, the Crosley mansion in Manatee County, Florida, 1928.*

With the help of the Crosley Foundation and other fund raising activities, the exterior and interior of the mansion are being restored. Special events and tours of the mansion and grounds began shortly after the county acquired Seagate.

In 1936, several other stations began applying for super-power operation, like that of WLW's 500,000-W transmitter. WHO in Des Moines, Iowa was one of the stations that applied. In 1938, the United States Senate adopted the "Wheeler" resolution which stated that it was the sense of the Senate that allowing more stations to operate with power in excess of 50,000 W was against public interest.

Since an experimental license had to be renewed every six months, the operation at 500,000 W could become a political problem. Regional and local stations protested against the super power of WLW and other super power applicants on economic grounds. They alleged that more super-power stations would result in the degradation of smaller stations to mere local status, which would eliminate their national business.

WLW, with its extended coverage provided by its exclusive 500,000-W operation, was very vulnerable. In the Federal Communications Commission hearings, accusations were made that Crosley had deleted news of Ohio valley strikes and other personally distasteful events from his broadcasts. He was also accused of denying broadcast time to certain politically active individuals. One Senator said that he "understood" WLW to be under the sway of "powerful business interests." These charges were denied.

The FCC ordered WLW to reduce power to 50,000 W after one of the hardest-fought legal battles in radio history. Crosley appealed the FCC's decision. At 5 PM, February 28, 1939, the United States Court of Appeals heard oral arguments on the plea for a restraining order to allow operation to continue with 500,000 W during the time of appeal. For an hour, the Court heard arguments between the FCC and the WLW counsel. Shortly before 7 PM it was announced that the stay was denied [6]. This was just a few hours before the FCC's order reducing the WLW power to 50,000 W was to become effective. Following the court order, WLW reduced its power to 50,000 W at 3 AM on March 1, 1939. This was only eight hours after the court ruling. WLW still had authorization to broadcast experimentally with 500,000 W during the early morning hours before dawn, using the call letters W8XO.

Figure 114. *The northeast corner of Seagate, the Crosley mansion in Florida.*

Shortly after the plea was denied, a simple statement was announced on WLW: "Stay Refused, WLW Returns to 50 kW." [100]. The WLW 500,000-W transmitter had been in use for nearly 4 years and 10 months before the FCC ruling went into effect. From 1939 to 1943, the transmitter was used experimentally each night after midnight with the call letters W8XO. In 1943 it was shut down permanently. One reason the transmitter was operated on the air regularly was to ensure that it would be able to inform a large part of the American population in the event of a national emergency during World War II.

When the powerful transmitter was forced to shut down, it broke Powel Crosley's heart and was a severe disappointment to him. He lost interest in broadcasting and became more active in the manufacturing of his other products, such as cars and appliances. He also took more interest in his ownership of the Cincinnati Reds.

Major league baseball was struggling to survive through the great depression. Especially hard hit were the Cincinnati Reds. With a population of only 450,000, the team was located in the smallest major league city in the country. The Reds had been purchased in September, 1929 by Sidney Weil, a Cincinnati native who had been very successful in the automotive business. One month after the purchase, he fell victim to the stock market crash of October 29, 1929. He retained control as long as possible but finally turned the operation of the team over to the Central Trust Company of Cincinnati.

Larry MacPhail, [87] an executive who had been very successful in the operation of the Columbus, Ohio American Association team, was brought to Cincinnati by Central Trust to revive the Cincinnati Reds. MacPhail convinced Powel Jr. that baseball's first professional baseball team should not be moved from Cincinnati and could be made into a very respectable and profitable team in a short time. In 1934, Powel Jr. purchased control of the Cincinnati Reds. (Figure 115) His ownership of the Cincinnati Reds was another aspect of his life that had a major impact on the city he loved. In a short time the stadium and its facilities were upgraded; and on April 16, 1934, its name was changed from Redland Field to Crosley Field [13]. Powel Jr. had joined forces with the energetic and visionary General Manager Larry MacPhail to rescue the Reds, and in the process they transformed baseball.

The Reds had averaged only 2,700 fans per game in 1934. MacPhail told Crosley that his Columbus team had higher attendance, but added "Of course we played under the lights." Always thinking about advertising, Crosley asked, "Why can't we put lights in Cincinnati?" MacPhail replied, "Oh, that's out of the question." Crosley persisted, "Is there a rule against it?" MacPhail replied, "No, but ..." Crosley immediately replied "Why don't we try?" [1] MacPhail agreed that evening, knowing that baseball could provide desperately needed revenue.

At the National League winter meetings in December 1934, Larry MacPhail presented the idea of night baseball at Crosley Field on a limited basis of seven night games a year. The dignified baseball executives opposed the idea until MacPhail promised, "*Give me seven night games a year, one with each opposing club, and I will give you seven additional Sunday crowds.*" The executives, thinking of higher profits, decided this idea would help the Reds compete with larger cities in the hiring of playing talent. The resolution was adopted unanimously. However, there was a restriction against night games on Saturdays, Sundays, and holidays. Visiting teams would also have the right to refuse to play at night, and any team that played more than seven night games would be penalized by the league office [1].

There was considerable opposition to night baseball, especially in the American League. Connie Mack, owner and manager of the Philadelphia Athletics, was very outspoken and considered "after-dark" baseball a circus. Four years later, on May 16, 1939, his team was the first American League team to have night baseball games [2]. At the end of 1940, ten of the eighteen major league teams had lights for night baseball, an innovation that increased the number of fans who could regularly enjoy the game.

The first major league night baseball game was played at Crosley Field on May 24, 1935 [2]. Prior to the game, there was a celebration which included short talks, celebrities, and fireworks that lit the sky and hurt the ears. Once again, Crosley asked his friend President Franklin D. Roosevelt to "press a button." This action turned on the lights for night baseball and launched a new chapter in baseball history. The Reds were winners over the Philadelphia Phillies 2-1 with 20,422 fans in attendance [3, 13]. The fans and players marveled at the 632 bright lights, mounted on

Figure 115. *Powel Crosley Jr., owner of the Cincinatti Reds, at the ballpark with Fred Hutchinson, the Cincinnati Reds' manager from 1959 to 1964.*

eight towers, which illuminated the playing field. For the next seven night games, the Reds' attendance averaged 18,000 fans, while day games averaged just 4,600 fans. Another first at Crosley Field was the installation of vertical screens attached to the left and right field foul poles. The screens helped to determine whether a batted ball was fair or foul since a ball that hit the screens was judged to be a fair ball. This reduced number of arguments and similar screens were soon installed at other major league baseball fields.

Powel Crosley Jr. became a real fan of baseball [95]. He attended games, traveled with the team, and employed management people who are now legends in baseball: Larry MacPail, Warren Giles, Chuck Dressen, Bill McKecknie, and a young announcer Red Barber. Originally, Powel Jr. had no inclination or desire to become involved in baseball other than to keep the team in Cincinnati. Later his involvement as owner grew. He attended meetings but gave his management staff a free hand and respected their judgements in the operation of the Reds. He also wanted his players to be good representatives of the city. In five years, with the addition of new players and an active farm system, the Cincinnati Reds improved from last place to winner of the National League pennant in 1939. They went on to win the World Series in 1940.

Cincinnati and Crosley Field were the hosts to the sixth annual All-Star game on July 6, 1938. The National League won 4-1. There were five Cincinnati Reds players on the team: Ernie Lombardi, Paul Derringer, Ival Goodman, Frank McCormick and Johnny Vander Meer.

Powel Crosley Jr. died in March 1961, but he will always be remembered for his determination to promote and keep major league baseball in Cincinnati.

Another Crosley motto was: *"Doing it first, that's Crosley."*

Powel Crosley Jr. was always aware of his appearance in his business and leisure time activities. The loss of his hair disturbed him. In his late 40s, he conceived the idea of a mechanical apparatus to stimulate the blood vessels of the scalp. (Figure 116) He had read in some scientific reports that cycles of alternating vacuum and pressure applied to the scalp area promoted hair growth. In November, 1936, the Xervac was introduced. It was advertised as the answer for hair loss and other abnormal conditions of the scalp, due to lack of circulation in the scalp blood vessels. These machines came with a helmet to be placed on the head to apply the alternating pressure and vacuum to the scalp. (Figure 117) The normal treatment lasted at least 30-minutes.

Figure 116. *Crosley Xervac hair growth stimulator, 1936.*

Most of the Xervacs were purchased by distributors who rented them to barber and beauty shops. At $2.00 a treatment, these hair-growing machines became very popular and they were valuable in promoting the barber and beauty shop business. After a short time, the Xervac proved to be a failure and the most embarrassing product Crosley had ever produced. It became the object of a Federal Trade Commission lawsuit shortly after its introduction. As a result, Xervac production ceased and some Crosley credibility was lost. However, Powel Jr. had faith in the Xervac and he continued to use one every morning for a number of years as his hair loss progressed.

In 1939, Crosley introduced another product that did not sell as expected. This was a facsimile machine called the READO. (Figure 118 and 119) A complete kit to build the printer was offered for $49.95. Crosley believed that experimenters and amateur radio operators would enjoy building the machine and then receiving printed information over the radio. The Reado printer operated under the William Finch system of facsimile. Finch had become interested in facsimile machines in 1920. By 1935, he had received 200 patents while working for William Randolph Hearst's International News Service. In 1935, Finch formed his own company to sell his facsimile system.

The Reado could receive and print information broadcast by radio stations. Crosley believed that one day the Reado could replace the daily newspaper. Crosley had a license to manufacture and sell these printers. Crosley engineers developed several additional features for the printer. In 1939 and 1940, at least 13 radio broadcast stations were equipped to transmit facsimile using the Finch system. WLW and W8XO were transmitting facsimile information during the experimental period from midnight to 6 AM. These broadcasts on, 700 kHz, also included weather forecasts, news reports, etc.

The transmission of facsimile was allowed on the normal broadcast band, 530 to 1570 kHz, from midnight to 6 AM. Some stations were also licensed to transmit facsimile during the day on frequencies from 25 to 47 MHz [4]. Crosley had an experimental facsimile transmitter, W8XUJ, on 26 MHz; but this was soon abandoned for lack of response.

Crosley manufactured and sold the Reado Printer model 118 and Reado receiver model 758-A. He also sold accessories such as a time clock and paper for the printer. The received message or picture was printed on paper 4.5-inches in width. The printing of a one-hour message required nearly three feet of paper. The Reado receiver was a Crosley design that could be used for normal broadcast reception. Special automatic features made it possible to

Figure 117. *Croisley Xervac hair growth stimulator advertisement, 1936.*

use the Reado receiver with the Reado printer. The receiver would also tune from 24 to 47 MHz for facsimile and normal shortwave reception.

For years, Powel Jr. invariably used the Xervac every morning to stimulate his scalp while reading or listening to the news. He received the news and weather reports from the Reado tape or by listening to WLW with a Crosley radio. He believed in using his own products.

Powel Jr. never lost his love for automobiles, even when he was devoting much of his time to the development of radio and his other business activities. As a young man, Powel Jr. made four attempts to enter the automobile industry, with only one attempt actually producing cars. In 1907, he designed a six-cylinder car he named the Marathon Six. However, the car never sold because of the 1907 Wall Street panic [87].

In the late 1930s, following his other business successes, Powel Jr. now had the resources to again enter the automobile industry [22]. On September 18, 1938, the Crosley Radio Corporation name was changed to just the Crosley Corporation. The elimination of the word "radio" from the name was an indication of a change in focus from radio to the automobile industry. Seven months later, on April 2, 1939, Lewis Crosley announced plans for a Crosley car. The car sold for $395, and was a two-cylinder coupe with the rear wheels spaced only eighteen inches apart. A few of the cars were built under the name "Crad" but they were not popular [15, 99]. (Figure 120)

By the end of April 1939, several of the Crosley cars were shown at the Indianapolis Speedway. These cars all had the normal wheel spacing with both rear and front wheels spaced the same distance apart. The two models included the convertible sedan and the convertible coupe. (Figure 121) They sold for $350 and $325 respectively. Both models were powered by a two-cylinder Waukesha engine and came in two exterior colors: Crosley blue and Crosley gray. A cream color exterior could be ordered at an additional cost. The only gauges supplied were the speedometer and the fuel gauge. The cars were displayed at the Crosley Pavilion at the New York World's Fair in 1939 along with other Crosley products. Crosley mass produced 2,017 cars in 1939 at Richmond, Indiana. These 1939 cars were known as the Crosley Model A [15].

Prior to World War II, Crosley introduced three other automobile models but sales were lower than expected. Production slipped to 422 cars in 1941. The post-war models of the cars were an entirely new design and some were assembled in Marion, Indiana. The cars were very fuel efficient, and this helped them to produce a small

Figure 118. *Crosley Reado radio facsimile kits, 1939.*

Figure 119. *Crosley Reado radio facsimile kits, 1939.*

profit. Crosley also produced a small truck. However, he could not compete in the automotive industry because of the start of the Korean War which caused the price of materials and labor to increase. By 1952, the Crosley car had failed. This was another severe disappointment for Powel Jr. He had lost over $1,000,000 per year during the final three years of automobile production. On July 17, 1952, the General Tire and Rubber Company purchased controlling interest in Crosley Motors [15, 100].

Powel Crosley Jr., who firmly believed in using his own products, was a very tall gentleman. At 6' 4" in height, many people have wondered how often he actually drove his own 1939 Crosley two-cylinder compact car.

Figure 120. (Left) *Crosley Crad automobile, 1939. Note the narrow 18-inch separation between the rear tires.*

Figure 121. (Right) *Crosley convertible automobile, 1939.*

Figure 122. *Portrait of Powel Crosley Jr. by William Oberhardt, who was widely known for his portraits of national and international figures in business and politics, 1924.*

Chapter Ten
Conclusion

Powel Crosley Jr. lived from September 18, 1886 until March 28, 1961. He not only lived the American dream; he helped create it with his business activities, marketing, manufacturing, and technical advances that changed Americans' lifestyles. He lived nearly 75 years, but his greatest achievements were accomplished over a period of nearly 20 years starting in 1921. During these eminent years he became known worldwide as an industrialist, radio broadcaster, inventor, businessman, sportsman, and entrepreneur who made entertainment and modern day products available at affordable prices. He built a manufacturing and communication enterprise that frequently set the pace for startling developments in the radio and refrigeration industries.

Powel Jr. depended upon his brother Lewis Crosley, a college graduate, to provide management knowledge and advice in all company activities [58]. Lewis kept the company's production lines operating at the highest efficiency. From the mid 1920s through 1940, Joseph Chambers, Joseph Whitehouse, and Ronald J. Rockwell were responsible for the operation of WLW and its associated equipment. They also maintained WSAI operations until 1936. Their responsibilities also included the construction and operation of various experimental television and shortwave transmitters and stations, such as WLWO.

During the great depression years of the 1930s, Cincinnati was very fortunate to have radios, refrigerators, and other Crosley products being manufactured in the city. Jobs were hard to find but Crosley consistently employed 3,500 to 4,000 people each week. Crosley employees may not have worked every day, but at least they had a job. Support for the Crosley manufacturing operations required the employment of several thousand more people locally and nationwide each week. The city of Cincinnati would have certainly been even more devastated by the great depression if it had not been for the operation of the Crosley plants and the opportunities for employment and even entertainment that Crosley provided.

Powel Crosley's local home was on Kipling Avenue in College Hill, a suburb of Cincinnati. (Figure 124) He had other estates and farms in South

Carolina, Georgia, Florida, Indiana, and Canada. He was a sportsman who liked to spend time with his dogs, collecting special guns, fishing, hunting, horseback riding and playing polo at his farm just south of Vernon, Indiana in Jennings County [4]. He spent much of his leisure time at his farm in Indiana where he built a fine lodge. In addition to his leisure activities, he enjoyed directing the farm operation. Powel Jr. was pleased when the farm became profitable just a short time after he purchased it. In 1958, part of the farmland was sold to the Indiana Department of Conservation for $150,000. It was stipulated that the land be used for hunting and fishing. This area is now known as the Crosley State Fish and Wildlife Area, in his honor. Powel Crosley Jr. had started coming to this area prior to his days in radio.

He was an officer of many radio organizations and he was very proud of his city. He was a leader in several civic organizations and was known as a gracious host. (Figures 122 and 123)

On February 26, 1939, his wife of nearly 30 years died at their Florida estate, Seagate. Two days later, February 28, 1939, the order was given by the Federal Communications Commission that WLW had to reduce its power from 500,000 to 50,000 W. At the age of 53, the life of Powel Jr. dramatically changed. He lost interest in broadcasting and eventually sold his broadcast stations and manufacturing facilities to the Aviation Corporation, AVCO, in 1945. However, he continued his interest in cars and the Cincinnati Reds. Because of World War II, the Korean War, and competition in the automotive industry, he discontinued the Crosley car in 1952. The Cincinnati Reds became a big part of his life. He attended many games in Cincinnati and also traveled with the team. At the time of his death, his controlling interest in the Cincinnati Reds was willed to a foundation controlled by members of his family and one or two others. The will made it very clear that Powel Crosley Jr. wanted the team to remain in Cincinnati.

After Gwendolyn's death, Powel Jr. had several tragic times with three failed marriages and family deaths. His son, Powel III, died from a heart attack in 1948; and his grandson, Powel IV, was killed in Korea in 1950.

Mr. Crosley had several licensed experimental radio stations dating back to 1921. These stations were located at Blue Rock Street, Colerain Avenue, and Arlington Street in Cincinnati. Other locations included Harrison and Mason. Some of the call signs were 8XAT, 8XAA, 8XT, 8XAY, 8XAL, etc. In October 1928, the Federal Radio Commission ordered all licensed experimental radio station call signs to begin with the letter W. 8XAL became W8XAL, with the station operating at a power of 250 W on 5,690 kHz from Harrison. By 1931, W8XAL had been moved to the WLW transmitter building at Mason and was operating with 10,000 W on 6,060 kHz. In 1938, a construction permit was granted to increase the power to 50,000 W. Shortwave transmitters of this power, with the capability of shifting rapidly to six operating frequencies in the international bands, opened new frontiers for design and development. This represented another outstanding accomplishment for the Crosley engineering department. In July 1939, the call letters were changed to WLWO, and the new transmitter was placed into operation. (Figure 125) In April 1940, the power was increased to 75,000 W. The station was now the most powerful international shortwave

Figure 123. *Powel Crosely Jr. in his office on arlington Street in 1936.*

broadcast station in the Western hemisphere and was the only station in the United States to hold frequency assignments on all international broadcast bands.

During 1940, representatives of the Crosley Corporation conducted an intensive survey of the important radio receiving and transmitting facilities in Latin America. From these findings and personal observations, Crosley established a chain of stations located in 10 different countries, with a potential audience of 6,000,000 people. These stations rebroadcast WLWO programs. This Latin America network of WLWO became known as Cadena Radio Inter-Americana, and consisted of 15 stations. These stations were located in Mexico City, Guatemala City, Tegucigalpa, El Salvador, San José, Panama City, Caracas, Maracaibo, Bogota, Medellin, Cali, Guayaquil, Lima, Havana, and San Juan.

This Latin America network was short-lived because of World War II. WLWO was leased to the State Department for the Office of War Information broadcasts. Another 50,000-W shortwave transmitter, WLWK, was installed in the WLW transmitter building for the same wartime service. Directional rhombic antennas that could be switched to either transmitter were used for beaming programming to Europe or Latin America.

Shortly after the start of the war, the Crosley Corporation was contracted to build three 200,000-W shortwave transmitters at a cost of $1,750,000. This transmitter plant, located a mile west of the WLW station in Mason, became a part of the Voice of America and was known as the Bethany Relay Station. The plant was operated by the Crosley Corporation until 1961, when the Federal Government modernized it. The government continued

Figure 124. *The Crosley Mansion in College Hill, a suburb of Cincinnati.*

its operation until November 14, 1994, when the plant was closed.

First in Ohio Television

Crosley telecasting, the first in Ohio, started with an experimental station in 1937 using the call letters W8XCT. The first demonstration, which was open only to the press, was made on a closed circuit on April 26, 1939, from the 48th floor of the Carew Tower in downtown Cincinnati. One more demonstration was made in 1941 before Crosley engineers concentrated their efforts on World War II manufacturing projects.

Another First

During its 50 years of operation, WCET-TV has received generous support from the Powel Crosley Jr. Foundation. WCET, located in Cincinnati, was the first licensed educational television station in the United States. In 1976 a substantial contribution from the Crosley Foundation provided impetus for the construction of the new home of WCET which was called the Crosley Telecommunications Center. This three-studio complex is now the center of a wide variety of community services. WCET uses not only traditional broadcast media but a plethora of new technologies like digital TV, the Internet and other broadband based programming, DVD, CD-ROM, and direct satellite transmissions [88].

Over the years, some publications have incorrectly spelled the name Powel as "Powell." The correct spelling is Powel Crosley Jr. with one "l."

Acknowledgements

In 1947, when I began working for WLW, the thought that I might have an opportunity to share information concerning Powel Crosley Jr. and WLW never occurred to me. I want to express my thanks to my deceased co-workers, Ronald J. Rockwell, Floyd Lantzer, Richard Walker, George Rawlings, William Schwesinger, and Jack Gray for the many valued notes, photographs, artifacts and discussions about the history of the company.

Further assistance has been provided recently. It is with my sincere thanks and gratitude that I want to acknowledge the following: Thanks to David B. Snyder, for the many hours he has spent

Figure 125. *George Frederick (Fritz) Leydorf, Radiation Engineer and Floyd Lantzer, Chief Engineer, standing in front of the 75-kW shortwave transmitter used for Crosley radio station WLWO. This transmitter was located in the WLW transmitter building near Mason, Ohio.*

at his computer organizing the text and pictures. His suggestions, ideas, technical knowledge, knowledge of the history of Powel Crosley Jr. and his willingness to help has been invaluable. John Leming, read the original draft, suggested numerous improvements and spent time at the Cincinnati Public Library providing several references. Clyde G. Haehnle shared the history of WLW, and made suggestions, offered remembrances and edited. Clyde worked at WLW as a University of Cincinnati co-op student when the WLW 500-kW transmitter was still in operation. He was a member of the engineering department for 37 years. Ludwell A. Sibley, John Harmer, Shawn Robinson, and John Walker provided invaluable help by locating and providing references. Paul Jellison and Ted Kendrick, who are present WLW staff engineers, helped me to again inspect and review the WLW 500-kW transmitter as it exists today.

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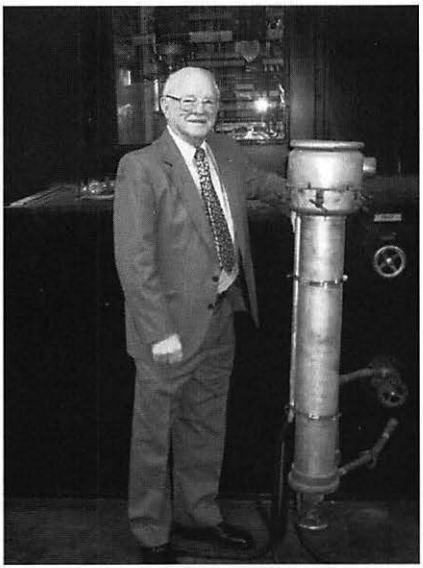

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Charles J. Stinger, a veteran of World War II, began his employment at Crosley Broadcasting on August 18, 1947, as a WLW transmitter staff member at Mason, Ohio. After 38 years of high power broadcasting, he retired as the plant supervisor of the Voice of America Bethany Relay Station that was built in 1944 and operated by Crosley Broadcasting for many years. The Voice of America Bethany Relay Station was located just a mile west of the WLW transmitter plant.

With the call letters of W8GFA, he has been an amateur radio operator since 1950, a member of the ARRL for more than 50 years, QCWA, OOT, and several historical and amateur radio clubs. Charles has been a member of the Antique Wireless Association, AWA, for more than 40 years and was the corresponding secretary for the third annual AWA meeting held at the Jack Gray Wireless Museum in Mason, Ohio in 1965.

His collection of radios, wireless equipment, and radio artifacts began in 1950 when a friend gave him a Crosley Model 51. While growing up, he was known as Chuck, but the name Charlie came about at the start of his broadcast career. The attached photograph shows Mr. Stinger standing by one of the tube sockets for the 898 final amplifier tubes of Crosley's 500-kW transmitter at station WLW.

David B. Snyder

David Snyder was born and raised in northern Indiana. He worked for a number of small radio stations and at WOWO in Fort Wayne from 1969 to 1982. He moved to Mason, Ohio to work for the Voice of America, Bethany Relay Station starting in 1982 and working there until one year after the station closed in 1994. He was the last Plant Supervisor at the station from 1990 to 1995. He has lived in the shadow of the WLW tower for over twenty years and has known the author since 1982. The attached photo shows Mr. Snyder with a souvenir of the VOA station, a 4CV100000C tetrode and a Crosley "fiver" receiver.