

# The History of the Twentieth Century

## Episode 236

### “The Radio Music Box”

#### Transcript

[music: Fanfare]

The first to benefit from the invention of radio were the crews of ships at sea. For the first time in maritime history, they could remain in communication with people on land throughout their voyages. The open sea need never again be a lonely or isolated place.

But as radio became more sophisticated, it graduated from being an emergency service to a convenience to a new medium that could bring networked news and entertainment to millions of households at the same time.

Welcome to *The History of the Twentieth Century*.

[music: Opening Theme]

Episode 236. The Radio Music Box.

We looked at the early days of radio back in episode 52. Allow me to remind you that the earliest radios could do no more than make a buzzing sound start and stop, albeit over a long distance, as far as hundreds of miles. This led to a brief reappearance of Morse code, which had originally been developed for land telegraphs, and had fallen into disuse when teleprinters replaced human operators.

Early radio operators transmitted messages by manually keying them in Morse code, while the radio operator receiving listened to the dots and dashes and transcribed the message. This was a slow and cumbersome process; twenty words per minute was considered a good pace. It was not exactly the Algonquin Roundtable. Radiotelegrams were subject to human error. The system was also subject to human frailty. Radio operators keying messages for hours at a time experienced what we today would call repetitive motion injuries and what at the time they called a “glass arm.”

Naturally, radio telegraph operators developed a shorthand code, which they used, especially among themselves, to communicate more quickly and to minimize wear and tear on the fingers, which I also talked about in episode 52. For example, you might signal to a fellow radio operator “TU” instead of spelling out “thank you.” Or CQD, which was the first distress call. Think of this as an early form of texting.

This code system also included short sequences of letters, known as “call signs,” that identified individual transmitting stations. For example, back in episode 64, when we discussed the sinking of *Titanic*, I mentioned that the radio room aboard *Titanic* was not operated by the White Star Line, the owners of the ship, but was contracted out to the Marconi Wireless Telegraph Company. The Marconi Company identified its stations with a three-letter code, the first letter of which was M. So for example, the *Titanic* radio transmitter was designated MGY. The Marconi station at Cape Race, Newfoundland was designated MCE. These codes made it quick and easy for radio operators to identify their own station and the station they were calling.

As more and more ships began carrying radios, and more and more land transmitters were popping up to communicate with them, it became necessary to create an international standard for call signs, under which the first one or two letters would identify the country in which the transmitter was located, or if it was aboard a ship, the flag under which that ship was sailing. Such a standard was set just a few months after the *Titanic* disaster. Some of these code assignments get complicated, so let’s take an easy example: the United States. US merchant ships were assigned the letters K or W as the first letter of their call sign, while US Navy ships got the letter N. I’m not quite sure how one country got three whole letters to itself, but there you go.

Then came the Great War. During the war, the German U-boats were a grave threat to Allied shipping, which made radio communication potentially a matter of life and death. In the US, a system was worked out under which ships sailing in the Atlantic, including the Gulf of Mexico, would use call signs beginning with K and ships in the Pacific would use W. Land stations communicating with those ships would use the opposite letter; thus, land stations on the East and Gulf coasts of the US would use W, while land stations on the West Coast would use K.

Shortly before the Great War, radio engineers began experimenting with amplitude modulation as a way of transmitting sound over radio waves. These AM signals could be received and converted back into sound by a relatively simple electronic device called a “crystal set.” The heart of a crystal set was a diode in the form of a literal crystal with a fine wire attached to it, known as a “cat’s whisker.” I’m not going to go into detail about how a crystal set works. I actually have a degree in electrical engineering, so be assured I could talk at great length about the wonders of amplitude modulation, but I will spare you that series of episodes.

What’s cool about a crystal set is that it does not require a power source. It uses the radio wave itself as a source of power. And it’s simple enough to build that a hobbyist could make one at

home out of a few inexpensive parts, and many did. Building a crystal set was practically a rite of passage for young people interested in electronics in the twentieth century. I built one. And you can get crystal radio kits even today.

What's not cool about a crystal set is...everything else. You have to build the apparatus, typically wired onto a board you would rest on a tabletop. The cat's whisker has to touch the crystal at *just* the right place for the thing to work, and the hobbyist-operator probably has to keep readjusting it every fifteen minutes, or more often if other people come along and bump the table. The crystal sets they sell today use solid-state diodes, which are far more dependable and rugged than those old-time crystals, thank goodness.

And because these crystal sets were powered by the radio wave itself, the sound output wasn't very strong. It couldn't power a speaker; you had to use headphones to listen, meaning only one person could listen at a time, and as often as not, that one person would forget themselves and start to move around the room and drag the crystal set off the table and send it crashing to the floor, after which it would take ten or fifteen minutes of fiddling to get the thing working again.

The technology to build solid-state diodes did not appear until the 1950s, but early work with vacuum tubes, or valves, as they were known in the British Empire, produced vacuum tube diodes, and later vacuum tube triodes, which could be used to amplify the signal. I also talked about these devices in episode 52. Vacuum tubes have their own set of drawbacks. They are bulky, they get hot, and they for sure require a power source, a hefty one. Batteries usually won't do it, you'll want full-on electric current, like what comes from the outlets in your home.

On the plus side, a vacuum tube diode can replace the crystal and eliminate all that fussing around, and vacuum tube triodes can give your audio signal enough oomph to power a loudspeaker that can fill a whole room with sound. Now the whole family could listen to the radio together.

These technologies developed during the Great War, but at that time, Allied governments discouraged civilian radio transmission, out of worries that it might interfere with the all-important ship-to-shore communication that was a vital tool in the war against the U-boats. But there was no bar to civilians building their own radio receivers, which developed into a hobby, and then something of a fad. At first, the only reward a hobbyist could expect to get out of building a home radio was the opportunity to listen in on the dots and dashes of those ship-to-shore messages and the occasional experimental broadcast of voice and music.

After the war ended and government regulation of radio eased up, radio began to explode. Hardcore hobbyists built and operated their own amateur broadcasting stations. In the United States, the US Navy had taken over Marconi Wireless's civilian radio facilities, on the grounds of wartime necessity. With the return of peace came political pressure on the Navy to restore civilian control of the new medium.

But the admirals weren't at all sure they were ready to let go. The biggest force in radio in the US at this time was Marconi Wireless, the US subsidiary of a British corporation. The Marconi Company had plenty of market share, but it was losing ground technologically and looking for a way to catch up. Its biggest supplier for the new generation of more modern transmitting equipment was the US manufacturing firm General Electric. General Electric, known universally as GE, and still very much in business in our time, was formed in 1892 from the merger of two major electrical manufacturers, the Thomson-Houston Company of Boston, Massachusetts, and Thomas Edison's Edison General Electric Company. Marconi Wireless went into talks with General Electric over purchasing GE's transmitter business. The admirals at the Navy didn't much like the idea of a British corporation dominating the new technology, and they liked the idea of American companies selling their technology to a British corporation even less. So they approached GE with a proposition: instead of GE selling its equipment and technology to Marconi, how about if GE buys Marconi's American subsidiary and makes it into its own subsidiary for the manufacture and sale of radio equipment?

And so a complex business deal was arranged. In order to make its new radio business work, GE would need some patents held by other American corporations, notably Western Electric, the manufacturing division of Alexander Graham Bell's American Telephone and Telegraph Company, and Westinghouse Electric, GE's arch-rival in the industry, founded by Thomas Edison's arch-rival George Westinghouse. The new corporation would pool the patents held by each of these companies, thus eliminating any legal obstacles to development of the new technology, in the same manner as when the US government encouraged the Wright and Curtiss companies to pool their aviation patents.

The new enterprise was dubbed the Radio Corporation of America, universally recognized by its initials, RCA. GE owned 30% of the new company, Westinghouse 20%, AT&T 10%, and the United Fruit Company 4%. Hey, remember the United Fruit Company and their role in banana cultivation in Central America, episode 97? Well, if you do, then you must remember that United Fruit had been a shipping company before it diversified into first, bananas, and later, the governance of small Central American republics, and as a shipping company, it also held a few useful radio patents.

Across the Atlantic Ocean, in the United Kingdom, a similar process was in play, as attention turned from wartime military necessities to the peacetime potential of radio. What's different in the UK, in contrast with the US, was that from the beginning, there was always a greater role for government agencies, especially the Post Office. Since the mid-19<sup>th</sup> century, UK law had treated telegraphy as a form of mail—electronic mail, if you will. Telegraphy provided the same service the Post Office did, ergo it was a form of mail and it became the Post Office's responsibility to provide it. This is distinct from the US model, where private companies provided telegraph services, most notably the Western Union Company.

When the telephone came to the UK, the Post Office oversaw that technology as well. When Marconi introduced his radio technology, it was initially offered as “wireless telegraphy,” which is why what Americans call radio was more often called “wireless” in the UK. Wireless telegraphy was also seen as an extension of regular mail, and licensing of civilian radio transmitters and receivers was overseen by the Post Office.

The creation of the Radio Corporation of America, which was finalized in 1921, inspired leaders in the industry in the UK to create a similar corporation which, like RCA, would serve to pool the radio patents of leading UK firms into one central business that would manufacture and sell radio equipment in the UK. The investing companies included Marconi Wireless and the British subsidiaries of Western Electric and General Electric, along with some British firms. This new consolidated radio corporation was created in 1922 and was named the British Broadcasting Company, Ltd., or the BBC. It was closely regulated by the Postmaster General, and it also had one big advantage: radio receivers had to be licensed by the Post Office, and the Post Office would only grant licenses to equipment purchased from the BBC.

Meanwhile, in the United States, RCA would be from its inception the biggest name in radio. Now that the war was over, military contracts for radio equipment were drying up, but the new RCA was well-positioned to exploit the growing consumer market for radio. But keep in mind that at the time civilian use of radio was largely conceived as point-to-point transmission of messages. In other words, ship-to-shore and wireless telegraphy. After years of frustration and delay, the Marconi Wireless Company had finally perfected the technology to send wireless telegrams all the way from Great Britain to the United States faster and cheaper than the transatlantic cable companies could. And it was this model, wireless telegrams, and soon to come, wireless telephone communication, that people envisioned as the future of radio.

The early dominance of RCA was particularly alarming to the folks at Westinghouse, who wanted a piece of the radio market for themselves. Yes, Westinghouse owned 20% of RCA, but why sell RCA radio equipment for a 20% profit share, and let those dirty rotten creeps at GE get 30%, when you could sell Westinghouse radio equipment for a 100% profit share and leave GE with nothing?

An interesting question, but to answer it, you first have to answer a larger question: how do you get people to buy radios at all? So far, the civilian market for radio equipment was limited to hobbyists, who were just as happy to buy parts and build the radios on their own. Hey, they were happier doing it that way. If you wanted to sell factory-manufactured radios in the mass market and make them into household appliances like stoves or refrigerators or lamps or washing machines, you have to give the American consumer a good reason to want one. In 1921, a good radio receiver could cost as much as \$200 in the United States, equivalent to close to \$3,000 in our time. In the UK, they were even costlier. That’s a substantial investment for even a middle class family. How are you going to get customers to buy these gadgets? What’s the hook? It’s

going to have to be something more attractive than the opportunity to listen to ships at sea sending messages in Morse code.

Henry Davis, a vice-president at Westinghouse, hit on the answer one day when he read a newspaper advertisement for a Pittsburgh department store. The store was touting amateur radio sets by noting that a local amateur radio enthusiast, a Frank Conrad of Wilkinsburg, had broadcast an impromptu twenty-minute concert by playing phonograph records into his radio transmitter. The music was received and enjoyed by a hundred or more local radio hobbyists. For the low, low price of \$10, you, too, could buy an amateur radio kit and listen in.

And so, Westinghouse began broadcasting from its experimental radio transmitter in Pittsburgh, known at first as 8XK, then 8ZZ, and finally as KDKA. Because of some early inconsistency in the issuance of call signs, KDKA got a “K” call sign, even though it was east of the Mississippi. So did KYW, another Westinghouse station that would begin in Detroit and end up in Philadelphia. They are, I believe, the only two radio stations with a “K” call sign in the eastern US to this day.

On November 2, 1920, KDKA, which technically was still 8ZZ at the time, broadcast continuously from 8PM to midnight, announcing the election returns of that day’s US Presidential election, which I mentioned back in episode 216. The results were collected at the offices of the Pittsburgh *Post* and telephoned to the radio station, where they were announced over the air. In between election announcements, when they had nothing to report, the station played phonograph music.

Westinghouse’s Pittsburgh transmitter, KDKA, was not the first experimental civilian radio transmitter. There had been many others. Other electronics companies and a few universities had them. A couple of newspapers, and of course, everyday people who happened to have an interest in radio and some spare cash. But the publicity that KDKA earned from its election night broadcast changed radio’s reputation overnight from a technological curiosity into the next must-have consumer product. In researching this episode, I came across the story of a Pennsylvania hobbyist named Edgar Love, who operated a radio receiver in the coal shed behind his parents’ house because they wouldn’t allow his strange and probably dangerous contraption inside. After election night, his parents relented and invited his gizmo into the house.

And so it was across the country. One breathless reporter for the *Detroit News* wrote that listeners to KDKA’s election night broadcast had learned who was going to be the next President of the United States before the candidates themselves had. Radio hobbyists were no longer exiled to the coal shed. Not only that, but now their friends, families, and neighbors were begging them to build radio sets for them, too.

Now there was a market for Westinghouse radios. Westinghouse continued to broadcast over KDKA, at first for one hour every evening, from 8:30 to 9:30 PM, and gradually increasing. KDKA’s programming was announced in advance in the newspapers, so those who owned radio

receivers knew exactly when to tune in, and those who didn't knew exactly what they were missing out on.

Westinghouse tried broadcasting a live band from a concert hall, but the reverb was too much. It worked better from inside a tent, so they set up a tent inside the studio for musical performances. The 100-watt transmitter that had broadcast the election returns was replaced with a 500-watt model. In January 1921, KDKA broadcast live church services from the Calvary Episcopal Church. In March, when the new Secretary of Commerce Herbert Hoover came to Pittsburgh to speak to the Duquesne Club, KDKA broadcast his remarks. In April, the station broadcast ringside commentary from a boxing match.

Demand for radios soared, and applications flooded into the government from amateur and experimental stations that suddenly wanted to become full-fledged commercial broadcasters. It was a huge success for Westinghouse, one that caught its competitors flat-footed. One General Electric researcher remarked later that he was "amazed at our blindness...we had everything except the idea." At GE and AT&T, management scrambled to get aboard the radio bandwagon. Remember RCA, the company that was supposed to be the 800-pound gorilla of the new medium? The creation of RCA began in 1919, but wasn't finalized until mid-1921, after Westinghouse broadcasting had already made its splash. Back in 1919, the company had been conceived as an American version of Marconi Wireless, its mission to send wireless telegrams and provide ship-to-shore communication. Two-way communication, in other words. But by the time of RCA's birth, its mission had morphed into something completely different. Call it one-way communication.

And that brings us to David Sarnoff.

[music: "The Japanese Sandman"]

David Sarnoff was born on February 27, 1891, into a Jewish family in Uzliani, a small town outside of Minsk, in what was then the Russian Empire and today is Belarus. In 1895, when David was just four years old, his father, Abraham Sarnoff, left to seek his fortune in the United States, promising to send for his wife and five children, including young David, just as soon as he saved up enough money to finance the voyage. The next year, David began attending a *cheder*, a Jewish elementary school where boys were taught Hebrew and studied Torah. David was a bright boy, and his family dreamed that one day he might become a rabbi.

In 1900, Abraham Sarnoff's plan came to fruition. He sent his family the money they would need for the journey. They packed up their belongings, including pickled kosher meats so they would have something to eat on the sea voyage, and headed for Liepāja, in what is now Latvia, and sailed to Liverpool, then to Montreal, then to Albany by train, and then down the Hudson on a river boat to New York City, where the streets were said to be paved in gold.

They were not. It was an even bigger disappointment when they discovered that their husband and father, Abraham, who had been working as a house painter for the past six years, had come down with a serious case of tuberculosis and was bedridden in the humble tenement where they lived on the Lower East Side. He never would recover his health.

This meant that ten-year-old David Sarnoff would have to go to work at once to help support his family. Fortunately for the Sarnoffs, David was nothing if not a diligent worker. On the second day after his arrival in New York, he landed a job as a delivery boy at a kosher butcher shop. Soon afterward, he picked up another job delivering newspapers, and he earned \$1.50 a week on the side singing in a synagogue boys' choir, though he had to give that up when he hit puberty. And he went to school and learned English. At the age of eleven, he impressed his teachers in a school debate over whether the Philippines should be granted independence. (David took the "yes" side of the debate.) His reputation as an up-and-comer persuaded his neighbors to loan him a total of \$200 so he could buy his own newsstand on Tenth Avenue.

At the age of fifteen, David decided it was time to pursue a full-time position, so he dressed in his best suit and went to the offices of the New York *Herald*, in search of a newspaper job. Instead, he happened across the telegraph desk at the *Herald*, which was staffed by one of the transatlantic cable companies. They offered him a job as a messenger, and he took it. David was fascinated by the telegraph, learned Morse code, and persuaded his employers to allow him to practice on the machine when it was idle. He conversed with other telegraph operators in Morse code and honed his skills. One of the operators he chatted with told him of a job opening for a telegraph operator at Marconi Wireless.

David applied for the position. He didn't get it, but the Marconi Company offered him a job as an office boy at a higher salary than what he was making now, so he took that. This was in 1907, when Marconi Wireless was a booming company, and teenage David Sarnoff immersed himself in the business. When an errand needed running, someone would call out "Davey," a nod to his youth, and he would come running. Others of his co-workers called him "Jew Boy."

Part of his job was filing letters in the filing cabinets, which were the state-of-the-art information storage and retrieval system of the time. David made it a point to read each letter as he filed it. This helped him polish his English, and learn how to communicate like an American business manager. He kept a dictionary close by to look up the unfamiliar words. Also, reading all the internal company letters gave David a keen understanding of who was who and what was what inside the company.

He got his break at an electrical show in which the company had an exhibit, but they didn't have a telegraph operator available to do a demonstration. David volunteered, and did well enough to land a job as a telegrapher, and quickly developed a reputation as one of the fastest of them. When Guglielmo Marconi himself came to New York to inspect his American operations, David Sarnoff was assigned to escort him around. In 1908, at the age of 17, David was assigned to the



Marconi station on Nantucket Island. It was a lonely and isolated job, but it paid \$70 a month. David lived on \$30 a month and sent the rest of it to his family.

In 1910, David began getting assignments as a Marconi Wireless operator aboard ships at sea. In 1911, the John Wanamaker department stores hired the Marconi Company to station wireless operators in its Philadelphia and New York stores, allowing for instant wireless communication between them. This was a something of a publicity gimmick, but David asked for and got the job of managing the radio room in the New York store, which allowed him to take night classes in electronics.

The following year, David Sarnoff had his first brush with fame, on April 16, 1912, the day after *Titanic* sank and frantic friends and family in New York were desperate to learn whether their loved ones were among the survivors. David Sarnoff and his staff monitored transmissions from *Carpathia*, taking down the names of survivors and distributing them to the crowds gathering at the store.

Perhaps it was that incident that got David Sarnoff thinking about the potential of radio not merely as a new method of two-way communication, but as a means for the dissemination of news and entertainment to a mass audience. While he was thinking about it, he was also rising rapidly through the company, from telegraph instructor to traffic manager to engineer to commercial manager. He understood the business side and the engineering side of the company better than anyone.

In May 1914, David Sarnoff, now 23, put on a demonstration of his new concept. He assigned a technician to play phonograph records through the transmitter at the Wanamaker store while he rode on a cruise boat taking passengers on a tour around Manhattan, while a radio receiver played the music coming from the store. Sarnoff called it a “radio music box.” The passengers on the boat were duly impressed by the technology, only everyone kept asking the same question: Wouldn’t it be easier just to bring the phonograph onto the boat?

Not everyone’s a visionary.

By 1916, others were experimenting with broadcasting news and music over the radio, but in November of that year, the same month that Woodrow Wilson edged out Charles Evans Hughes to win a second term as President, David Sarnoff wrote a four-page memo elaborating on his idea and laying out a business plan. He wrote:

*I have in mind a plan of development that would make radio a “household utility” in the same sense as a piano or phonograph...The receiver can be designed in the form of a simple “Radio Music Box” and arranged for several different wave lengths, which would be changeable with the throwing of a single switch or pressing of a single button...This proposition would be especially interesting to farmers and others living in outlying districts removed from cities. By*

*the purchase of a "Radio Music Box" they could enjoy concerts, lectures, music, recitals, etc., which may be going on in the nearest city...*

Edward Nally, the general manager of American Marconi, reportedly called the idea "harebrained." David Sarnoff's memorandum got filed away and forgotten by everyone, except David Sarnoff.

Five months later, America was at war. The Navy took over American Marconi, and its employees set about the business of winning the war.

Four years after that, Westinghouse's KDKA in Pittsburgh was suddenly all the rage, and David Sarnoff dusted off his memo and showed it to Owen Young, general manager of GE, the principal stockholder of the newly forming Radio Corporation of America.

At last, David Sarnoff's vision was about to become reality. That is, if Westinghouse hasn't beaten him to the punch before RCA even gets organized.

But that is a story for next week. We'll have to stop here for today. I thank you for listening, and I'd especially like to thank Myriam for her kind donation, and thank you to Dan for becoming a patron of the podcast. Donors and patrons like Myriam and Dan help cover the costs of making this show, which in turn keeps the podcast available free for everyone, so my thanks to them and to all of you who have pitched in and helped out. If you'd like to become a patron or make a donation, just visit the website, [historyofthetwentiethcentury.com](http://historyofthetwentiethcentury.com) and click on the PayPal or Patreon buttons.

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And I hope you'll join me next week, on *The History of the Twentieth Century*, as we take a look at the radio craze. KDKA convinced American consumers to buy radio receivers and radio transmitters were popping up everywhere. Who was going to regulate all this? How was it going to be regulated? And perhaps most important, who is going to pay the huge costs of building and operating a radio station? The Phone Booth of the Air, next week, here, on *The History of the Twentieth Century*.

Oh, and one more thing. The Marconi companies had by this time lost their early position as technological leaders in the new field of radio. The creation of RCA ended the Marconi Company's presence in the United States. The company also had a subsidiary in Canada, which was renamed the Canadian Marconi Company in 1925. It's still around in our time; it's now

known as CMC Electronics. In the UK, the parent company, “Marconi’s Wireless Telegraph and Signal Company,” continued on until after the Second World War, when it was acquired by the English Electric Company.

Marconi himself won a Nobel Prize in 1909 for his work in radio. In 1914, he was made a member of the Italian Senate, and during the Great War, he worked on radio projects for the Italian military. After the war, Marconi was drawn to Benito Mussolini’s Fascist Party and joined it in 1923. In 1930, Mussolini appointed Marconi to the Fascist Grand Council, which was the governing body of the Party, and by this time the Fascist Party fully controlled the Italian government, making Guglielmo Marconi a pretty important guy. He died in 1937, after a series of heart attacks. He was 63 years old.

[music: Closing Theme]