

A Death in New York City

Nobody saw the body as it fell from a thirteenth-floor window of the New York City high-rise. Nobody heard the thump of it hitting the third-floor balcony. The man's body, crumpled, broken – and fully clothed – was found the next morning by the maintenance man. He was a pitiful sight, as the dead man was dressed in a fine overcoat, hat and gloves. The police were called, and the worker identified the deceased as a resident of the building. Up in his apartment, the police saw no sign of a struggle. In fact, except for the air conditioning unit laying on the floor near an open window, nothing looked suspicious.

Then they found the note.

The next morning a New York Times article on the suicide included the contents of the two-page note the deceased had written to his wife. Just a few days earlier she had left him after a physical altercation. The Times reported that he had written "...he was heartbroken at being unable to see her once again, and expressing deep regret at having hurt her, the dearest thing in his life." The note concluded "God keep you and Lord have mercy on my Soul." It was dated January 31, 1954 and had been written just before he killed himself.

Edwin Howard Armstrong, one of the pioneers of radio, was dead.

Inventor of FM

Armstrong Writes Note To Wife, Dies in Plunge

Maj. Edwin H. Armstrong, sixty-three, inventor of frequency modulation (FM) and one of the nation's leading radio pioneers, plunged to death yesterday from his thirteenth-floor apartment at River House, 435 E. 52d St.

Maj. Armstrong was found, fully clothed to overcoat, hat and gloves, on a third-floor extension at 10:30 a. m. by Alfred Henrichs, building maintenance man. He had apparently been dead several hours.

Police found a two-page note to his wife, Mrs. Marion Armstrong, signed "Ed," in which he said it was "heartbreaking" that he could not see her again and continued: "How deep and bitterly I regret what has happened to us."

The note, written in pencil on yellow legal paper, said he would give his life to be able to turn back to the time "when we were so happy and free" and ended: "God keep you and the Lord have mercy on my soul."

Maj. Armstrong, who began his brilliant career in electronics when just a boy, was a professor of electrical engineering at



Maj. Armstrong

Columbia University and the winner of a score of awards including the Medal of Merit and a Presidential citation for his contribution to military communications. He was a major in the Signal Corps in World War I and preferred that title to "doctor" or "professor."

Columbia University called Maj. Armstrong "the most important of all radio inventors, including Marconi." Besides his invention of FM in 1935, which eliminated static and led to an

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Over Estimate

New York Herald Tribune, February 2, 1954

If you are like most people you have probably never heard of Edwin Armstrong. When you think of radio you doubtless think of Marconi, but it was Armstrong who made a series of discoveries and inventions that led to the modern AM radio receiver, FM radio, and doppler radar. Few individuals who came before or after him were as honored as Armstrong by the broadcasting community: he was a recipient of the Medal of Honor from the Institute of Radio Engineers, the French Legion of Honor, and the 1942 Edison Medal, among many other awards. After his passing accolades poured in from the scientific and business world. No words were more telling about Armstrong's tormented life and legacy than those of RCA President David Sarnoff to his biographer, Carl Dreher:

"I did not kill Armstrong."

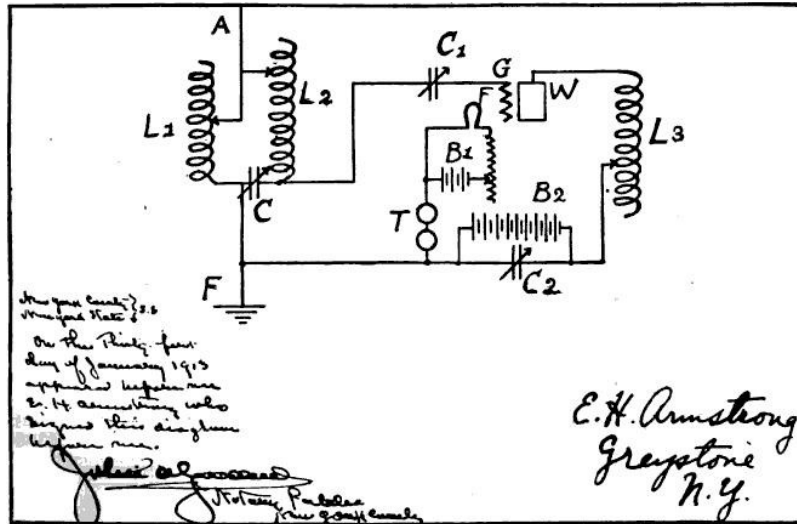
What a strange answer to a question that nobody asked. Then again, maybe not, given the long and litigious history between the two men and the well-known effect those court battles had on Armstrong.

To properly tell the story of his death requires that we go back to the very early days of radio, long before it was a business, when it was still the domain of the experimenters. Like the early days of home computers, it was a time when inquisitive young men and women tested and tinkered with things that most considered mere toys, and even fewer considered had potential to be a profitable business.

That began to change in 1906 with Lee De Forest's invention of the Audion tube, the first electronic device to amplify a signal. Even though it didn't amplify signals by much and the signal it produced was not very clean, it was still a major breakthrough. De Forest tried to improve the Audion but, like most other experimenters, he really didn't understand how the device he built actually worked.

Edwin Armstrong was among those who tinkered with the Audion, and he was equally frustrated over its poor performance. Not understanding *how* the tube worked or *why* it didn't perform better was not in Armstrong's nature. In 1912, working with Columbia professor John Morecroft, Armstrong exploited the known phenomenon of regeneration (also called positive feedback) to create a circuit with amplification hundreds of times greater than before.

Further tinkering with the regenerating circuit led to the discovery of how to generate a continuous-wave (CW) signal. This was hugely important because, up until this time, radio operators used "Spark Gap," which required massive amounts of power to generate a signal. Limited to low frequencies (near today's AM radio band) Spark Gap signals had limited range. CW, on the other hand, could broadcast at higher frequencies. There the signals could bounce around the ionosphere, thus enabling worldwide radio communication. Fewer discoveries were as game-changing not just for radio but for society at large. Armstrong was granted a patent for regeneration in 1914.



Armstrong's drawing of his regenerative circuit

Armstrong wasn't done. Just five years later, after serving in Europe during the war (where, as a member of the Signal Corps, he improved wireless communication for the Allies) he filed a patent for another groundbreaking invention; the supersonic or superheterodyne receiver. It is at this point that we start to run out of superlatives to describe the impact of Armstrong's inventions on communication. Perhaps the best way to describe the importance of the superheterodyne circuit is to say that it is still used today in most radio designs. Imagine, with all the breakthroughs made in electronics since then, that the preferred method of radio receiver design is still based on a 100-year-old blueprint!

But jealous eyes were cast on Armstrong soon after he was granted his patent for the regenerative circuit in 1914. Lee De Forest, who had been publicly skeptical about Armstrong's findings filed a competing – and strikingly similar – patent application. This triggered a hearing at the patent office that included two other claimants to the profits from the regenerative circuit. Our story now veers from the technical to the legal, two arenas with equally dense and arcane rules. One such rule was that Armstrong, who needed money to pay for the lawyers, could sell the rights to the circuit in dispute. The caveat being he could only sell to amateurs and experimenters, and not to any commercial concern.

Armstrong would double down in his fight for the rights when he counter-sued De Forest for infringement. Armstrong won. At this point one might expect he would be satisfied and move on. But, believing that the compensation board's award was not enough, Armstrong returned to court to press for more money. De Forest, feeling cornered, appealed the patent office decision in a higher court. Armstrong – and the engineering community at large – were shocked when the District of Columbia court ruled in De Forest's favor. Furious, Armstrong began a series of appeals which, as higher courts also ruled against him, wound up twice before the Supreme Court. He lost both times.

The stress and cost of one such legal battle would be enough for anyone. Yet, during the same period, Armstrong was also battling Frenchman Lucien Lévy for the rights to the superheterodyne receiver. Lévy had been awarded patents in France for a similar, but not exact, design as early as 1917. AT&T, looking to use radio in support of their existing landline network, had purchased the U.S. rights to Lévy's patent, and now challenged Armstrong's claim to the superheterodyne circuit. Armstrong, already consumed with his fight against De Forest over regeneration, would concurrently be on the defense over superheterodyne. In 1928, to Armstrong's dismay, the D.C. Court of Appeals found in Lévy's favor and stripped Armstrong of his legal claim to the superheterodyne circuit.

"Misery," so the actual quote from Shakespeare's *The Tempest* goes, "acquaints a man with strange bedfellows." Apparently so does the law. Even though he was embroiled in a legal battle with Lévy over superheterodyne, Armstrong could still work on improvements to the circuit. The catch? He could do so only as an employee of David Sarnoff's Radio Corporation of America, whom he was suing over the regeneration circuit. Strange bedfellows, indeed.

Working with other engineers at RCA Armstrong ultimately delivered a less expensive and simpler-to-use superheterodyne circuit than the one designed by Lévy. RCA would use it in a new line they called Radiola, which became the company's first big seller.



A Radiola 18 which, thanks to Armstrong's simplification of the superheterodyne circuit had only three simple, easy-to-use controls: ON/OFF, Tune, and Volume

One might expect that the success of the Radiola line would signal a rapprochement between Armstrong and Sarnoff. It did begin that way. In 1921 Armstrong developed something he called “super-regeneration,” which basically was regeneration on steroids. Armstrong, in another legal quirk, was able to sell the rights to super-regeneration to RCA even though he was mired in the legal battle with De Forest. Sarnoff was more than grateful to Armstrong, giving the inventor \$200,000 and 80,000 shares of stock in RCA, making the young inventor the biggest stockholder in Sarnoff’s company. Imagine giving a bonus to an employee who is suing your company! So what happened to sour the relationship between Armstrong and Sarnoff?

No Static at All...

From the very beginning AM radio was bedeviled by the problems of static and noise from lightning and electrical equipment. Nobody, not even Armstrong, could eliminate the problem. The public, having no alternative, was willing to put up with occasional static from their radios. Armstrong was not. He threw himself into the problem. In 1933, after years of work in a secret laboratory at Columbia, Armstrong was granted a patent for another groundbreaking achievement. It was a method of modulation for delivering high-fidelity audio broadcasts, called Frequency Modulation, or FM.

Armstrong was contractually obligated to offer the rights to RCA. David Sarnoff turned it down, preferring to stake his company’s future on television. Armstrong, freed from his obligation to RCA, partnered with some of their competitors, including radio giants Zenith and General Electric, to continue his research. Just three years later, in 1936, at a demonstration of FM radio at FCC headquarters in Washington, D.C. it was reported that...

...if the audience of 500 engineers had shut their eyes they would have believed the jazz band was in the same room. There were no extraneous sounds... Several engineers said after the demonstration that they consider Dr. Armstrong's invention one of the most important radio developments since the first earphone crystal sets were introduced.

This was just the first of several triumphant demonstrations of Armstrong’s FM. In 1940 General Electric set up a dramatic demonstration of FM’s ability to provide static-free listening. Next to the receiver they placed a Van de Graaf generator, which produced one million-volt arcs of interference.



FM outperforms AM in the famous 1940 GE test

When set to a test AM station, the radio blared nothing but static. Switched to FM there was no static at all. Impressed, the FCC established the frequency band 42 – 50 MHz for FM, beginning on January 1, 1941. Unfortunately for Armstrong and FM the December 7th attack on the United States put their research on hold. The country needed all its resources fighting the Second World War.

After the war, Armstrong expected to pick up where he had left off. But his dream for FM was shattered when the FCC unexpectedly moved the band up to 88 – 108 MHz, where it is located today. The commission cited the 42 – 50 MHz band's susceptibility to interference from atmospheric skip, which they said neutered the advantages of FM. Broadcasters had until January 8, 1949 to make the switch, which rendered the 400,000 receivers sold since 1941 obsolete. Armstrong, still smarting from his legal defeats over regeneration and superheterodyne, suspected that the decision to change the frequency of the FM band was nothing less than a conspiracy between Sarnoff and AM station owners to render his FM receivers obsolete. His paranoia heightened when, shortly thereafter, the FCC assigned the original FM band (42 – 50 MHz) to television. This was the ill-fated Channel 1, soon abandoned because viewers found the effects of skip on reception made it unwatchable. Ironically, the FCC was right about skip. (A good portion of the band was handed over to Amateur Radio. Hams *love* skip for the very unpredictability that doomed the band for commercial use.)

Armstrong's feelings of persecution were reinforced when Sarnoff (who had tossed aside FM in favor of television before the war) now put his engineers to work on RCA's own version of FM. Sarnoff then convinced his competitors to stop paying for the rights to use Armstrong's FM patent and use RCA's instead. A furious Armstrong sued, but ran out of money when the patent for his version of FM expired in 1950. His financial troubles and mental health both spiraled downward. Four years later he was dead.

After Edwin Armstrong's suicide his widow Marion pressed on with his lawsuit against RCA. Perhaps due to the bad publicity from the inventor's very public suicide, RCA settled out-of-court with Marion for \$1 million. Ironically that was the exact amount Sarnoff offered Armstrong for rights to his version of FM back in 1940. Marion also sued several manufacturers she claimed were infringing on her husband's FM patent. In 1967 she won the last of those suits which established Edwin Howard Armstrong as the inventor of FM. Until her death in 1979 Marion devoted herself to overseeing a research foundation named for her husband.

It is the final irony of Edwin Armstrong's life that, back in the 1920s, Marion had been David Sarnoff's secretary. It was there, at the offices of RCA, where Armstrong first became smitten with the woman who would become his wife, the woman who would later win the fight against Sarnoff, her former boss.