

The Advent of F.M. Radio
and the life story
of Major Edwin H. Armstrong, Its Inventor



The Advent of FM Radio, and its Inventor, Major Edwin H. Armstrong.

Frequency Modulation, or FM, and the super-heterodyne receiver, are ~~both~~ the products of one of radio's all-time greats . . Major Edwin H. Armstrong.

His system of varying the frequency of/^a transmitter, rather than the amplitude of the wave as in AM or Amplitude Modulation, was so different and so revolutionary that it was ridiculed and condemned by the die-hards of ^{all the} competitive means of radio broadcasting.

A nation-wide campaign of adverse publicity was instituted by Armstrong's enemies, who foresaw in his system a dire threat to their old ~~and~~ established methods. It was claimed that the Armstrong *method* would never be accepted by the radio public, because it was too critical to adjust, and too unstable in operation. Furthermore, a special and expensive kind of a receiver would be required, because FM and AM were not compatible.

Major Armstrong's FM system was the culmination of a long and colorful career. He was also the inventor of the super-heterodyne receiver system, and-earlier still-the super-regenerative circuit of the '20s.

When the great radio boom began, on the heels of World War One, the vacuum tube as a detector and amplifier was not in general public use. Rich and poor alike were required to enjoy their radio broadcast entertainment on equal ground. Money could not buy a "better" radio receiver. There was only a single kind - the inexpensive little crystal set. Millions were built at home, while other millions were ~~made~~ in "factories"-such as garages, basements, lofts, and kitchen tables. These erstwhile manufacturers operated under such glamorous names as International Wireless Telegraph and Telephone Manufacturing Corporation, and other equally enticing designations.

The crystal set was simple to construct. Almost anyone could make his own tuning coil. A cardboard oatmeal carton, or any kind of non-metallic tubing a few inches in diameter, sufficed for a form on which a single layer of insulated wire was wound.

The detector, with its "cat-whisker" contact wire resting lightly on a piece of silicon or galena ore, could be assembled in minutes, at a cost of less than a dollar.

The condenser was made of alternate layers of tin-foil and wax-paper. And the only remaining equipment was a single headphone, or a pair, the most costly accessory of a radio receiver. Yet the complete outfit could be made or bought ready-made for as little as five dollars.

As the radio boom swept across the length and breadth of the nation, there was hardly a rooftop without its radio aerial or antenna. The simple crystal set was good enough to pick-up stations within a five-mile radius, if an aerial of proper length and sufficient height were erected.

When the fabled recording artist known as Cohen, of "Cohen On The Telephone" fame once asked a radio dealer how to properly erect an aerial, he was given the following instructions: "You simply run a wire - an aerial - from your rooftop to a pole."

"I can't do that," Cohen replied, "Because I don't know any Poles."

The Second Stage of the Wireless Craze

Soon the crystal set gave way to the magic lamp of radio, the vacuum tube. And with it came one of the most fantastic eras yet known to science. Radio stores by the hundreds were opened almost simultaneously in the larger cities. Each soon had its Radio Row.

In New York City, one of the afternoon newspapers began publication of a Saturday tabloid section of 64 pages. Advertisements for every conceivable piece of equipment and accessories of all kinds and descriptions filled its pages. Pictorial and schematic wiring diagrams were shown prolifically - and to the extent that any person possessed of a screwdriver, a pair of pliers, and a soldering-iron, could build any one of a hundred different kinds of radio receivers.

The early receivers were insensitive and lacked selectivity. If two or more broadcast stations were on the air at one and the same time, the loudest one prevailed.

The first regenerative-type receivers were the bane of the radio listener. They were called "bloopers" because of the bloop, and squeals, and howls that came through the headphones or loud-speaker each time the set was tuned.

The presence of the human body, or even the hand, in the immediate vicinity of the tuning dial, caused a weird sound to be emitted like that of a banshee - a piercing, high-pitched whistle. The motion of the hand, or the turning of a dial, resulted in a combination of distressful noises. Eventually this problem was overcome by substituting a metal front panel for the earlier wooden ones originally used. For better "shielding" this panel was usually connected to the ground or earth terminal of the wiring plan.

The annoyance of the howls and yowls of such a receiver once caused a reader of a radio magazine to write the editor in quest of a solution. "Every time I hold my hand in front of my receiver it howls," the letter said. "Please tell me how I can correct this condition." To which the editor replied: "Never having heard a hand howl, I suggest you see a doctor without delay."

Major Armstrong's Super-heterodyne

In the language of the Greeks, the word hetero means other, or different, while dyne means power. Armstrong combined the two, ~~and~~, and called his newest discovery super-heterodyne; it was super in difference, and super in power. It dwarfed every other receiver circuit yet known to the art of radio.

Major Armstrong proved the success of his "super-het" in the trenches of France during World War One. The older circuits of the regenerative types often disclosed the presence of the Allied troops and their emplacements - by the squeals and howls inherent ~~with~~ in these early receivers. These squeals were radiated, or re-radiated, into the ether in the form of an actual signal which could be heard by the enemy in their nearby listening posts. Sensitive direction-finders would then pin-point the precise location of the place from where the radiation emanated - and with fatal results to our forces.

To prevent the gun-layers from finding their targets in this manner, Major Armstrong perfected the famed new circuit which is in use today in countless millions of radio receivers. Few inventions have proved more versatile in their application.

The "super-het" - even the earlier Armstrong super-regenerative system - found the inventor face to face with many others who laid claim to similar circuits, and who additionally challenged the patents of Armstrong. He was forced to pay huge sums for legal services, court costs, and the like. At times he found himself deeply in debt, in spite of the fortune he received for his inventions and subsequent royalties for their use by others.

In the words of the layman, the super-heterodyne principle of reception is a method in which waves of different lengths are impressed upon the received waves, and thereby produce beats. Another and different high-frequency signal is introduced, in addition to the one actually received- to cause ^{this} "beat."^{etc.}"

The fertile mind of Major Armstrong envisioned this complex new mode of signal reception and put it into practical operation. Its principles and applications were so drastically at variance with others previously used that he was again ridiculed as having devised a scheme of questionable merit. Armstrong and deForest were the two most vulnerable inventors of the era. ~~More~~ Patent suits and counter-claims were filed against them in a seemingly unending stream. And under this effort they both suffered severely.

Armstron's FM invention was shelved during the war years. Only a few FM receivers were sold. Only a few within the industry knew what he had accomplished. "Old Feed-Back Armstrong," they called him - the expression ~~xxxx~~/originated from the manner in which a radio signal would be made to "feed back" upon itself in one circuit he devised.

He was ^{publicly}/unknown during the days of the first radio boom. And it was more than three decades later that the news of his new system of FM first became widespread. He built, owned, and operated his own experimental station. Soon it collapsed. Said one of its employees: "We lost our jobs because, for no visible reason, FM was a dying duck. And it was so obviously good, as we knew it to be. It was a shock from which I will never recover, that collapse - but imagine what it was for the Major himself who had fought for FM already more than a dozen years."

The undercurrent of ridicule again rose to the surface. "It was no good. It was visionary. It was impractical. And it could never be made to work on a larger scale," were some of the diatribes.

Not too many years ago, the listening public just did not like high-fidelity sound. Much of it was exaggerated. The high notes were too high, the bass notes too boomy. Only FM could reproduce faithfully the gamut of the scale. But people plugged their ears with their fingers and shouted: "Ugh! turn it off, turn it off." FM was not at fault; it merely reproduced what it had originally received. Later came "true fidelity" and hi-fi was the darling of every listener who could afford to buy it.

The slow progress of hi-fi ~~is~~^{was} a direct result of the effort exerted by a coterie of manufacturers who rubbed noses in secret caucus and emerged with the nation's most effective anti-hi-fi publicity campaign. The keystone of the drive to clobber Armstrong and his FM system was a four-word slogan: "People don't like it." The psychological impact was instantaneous. The most bitter years of Armstrong's life came with this slur at his integrity, ability, and a desire to contribute to the joys of radio reception.

In 1945, the Federal Communications Commission decreed that Armstrong must vacate the conventional radio broadcasting frequency spectrum and "move upstairs," - i.e. up and into the high radio frequencies, or the short wavelengths, as they are also known. The higher the frequency the shorter the wavelength, and conversely so. By this cruel stroke, the FCC spelled out the doom of all FM radio receivers then in use.

Was it political? Was it a result of pressure exerted by the big corporations in the radio field? Was it an effort to put Major Armstrong out of business for once and always? The answer will never be known. Politicians have strange bed-fellows.

His biographer, Lawrence Lessing, once with Scientific American, labels him a man perhaps as big as Franklin, Morse, Henry, Edison, and Bell. "He was one man against the huge power of the corporations.

"He was a terrific fighter and he fought endlessly for almost forty years. And yet he was beaten to the wall, out-argued, out-reasoned, smoothly derailed- all in the most skillful fashion- as though he were some impostor."

He poured almost two million dollars of his own money into his pioneer FM station at Alpine, New Jersey. It was not until 1956 that his invention of 1933 found its rightful place in radio.

The British Broadcasting Corporation put a high-fidelity FM network into operation, covering all of the **Tight Little Isle**.

The U.S. Army Signal Corps named Armstrong Hall in his memory, at Fort Monmouth, New Jersey. It will never be told how many lives, even entire armies, his invention of the super-heterodyne saved in France.

Mr. Lessing states that the most important event of the Armstrong Saga came two years after his death, "with the colossal FM infringement suit against R.C.A. settled in his favor. Payment of almost a million dollars went into his estate."

Those who knew him best said he was bull-headed, obstinate, yet soberly honest. He never compromised a lawsuit- it was all or nothing. "He wanted the truth and nothing but it. He was obstinate. His life was one long fight- but most of the fights were started by him. And they were carried on with every bit of personal force he could muster, plus all of the large fortune he managed to make in between the corporate wars.

"He was perhaps the only great inventor who had the financial power to launch his own inventions in spite of corporate disinterest, and to fight for his rights at the top corporate level. Not even Edison managed that."

The corporations despised him. In every legal action they fought him to the bitter end. Lessing continues: "The corporation may perhaps be hated and feared, it may do untold damage, it may hold up progress as often as it advances it . . . it has enormous power."

Edward Tatnall Canby, one of the editors of Audio, believes strongly that the corporate kind of team laboratory research can never come up with the sort of basic intuition that has governed the great inventions of history- until just recently. The Computer and the Transistor are two glaring exceptions; both required intensive team effort, because of their ramifications. But these are not really inventions- basic discoveries, in the true sense, argues Canby. Not like the Armstrong super-heterodyne, not like FM radio.

When Armstrong invented FM, there existed a practical use for it, whereas the deForest invention of the three-element vacuum tube was literally kicked from pillar to post for six years before Armstrong- and deForest too - found use for it in ^{either a} a regenerative, or super-regenerative circuit.

When Armstrong died, his FM system was 21 years old. But he died while still fighting to prove his prior right to its invention. Now, more than three decades later, his system is a household word.

He died a tragic death. On the night of January 31, 1954, he dressed impeccably as ^{if he were} ~~though~~ to be the ~~honored~~ guest at a reception in his honor. He stepped out through the thirteenth floor window of his luxurious apartment in River House. The next morning they found his body on the pavement below.

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