

AFD Ep 431 Links and Notes - Modern Elevators [in the US] - [Bill/Rachel] - Recording June 26, 2022

Intro: Elevators with manual or animal-drawn pulley systems have existed since ancient times but widespread production of modern elevators essentially begins with industrial steam power, originally in the mining industry, and then evolves into hydraulic elevators and eventually toward electric-power elevators at the end of the 19th century. In a lot of ways, they were closely related to and technologically analogous to streetcars, except for verticality. Let's talk today about their development in the United States and how they affected American urban life, especially in the biggest American city of all: New York.

<https://en.wikipedia.org/wiki/Elevator>

<https://www.cnn.com/style/article/short-history-of-the-elevator/index.html>

- [Bill] Experimental tourist and passenger elevators, as opposed to industrial workplace and cargo elevators, were tinkered with from the 1820s to the 1840s in Europe, but the modern Otis "safety elevator" was developed in New York City in 1852. After some years of experimental public showcases, including a dramatic exhibition at the 1854 World's Fair in New York, where [Elisha Otis](#) demonstrated his safety brake by severing the elevator cable with an axe, his elevator was implemented in a practical day-to-day use sense in 1857 at the five-story high-end commercial retail [E.V. Haughwout Building](#) in Manhattan. [[pronunciation](#): how-wit]. Otis also famously went on to build the elevators for the Eiffel Tower in Paris and his Otis Elevator Company went on to become one of the gigantic corporations specializing in the field. There are basically a handful of companies worldwide dominating the elevator market today and five of them were fined by European Union regulators in 2007 for cartel price-fixing activity. https://en.wikipedia.org/wiki/Otis_Worldwide https://usatoday30.usatoday.com/money/world/2007-02-21-eu-elevators_x.htm At the time Otis was owned by American defense contractor United Technologies but they were spun off during the Raytheon merger, along with another company we've covered on the show: Carrier air conditioners. https://en.wikipedia.org/wiki/United_Technologies
- [Rachel] Jumping back in time again: By the time Otis was showing off his safety elevator in the mid-1850s, the critical need for elevators in New York City to be able to continue building upward had become so obvious that the [Cooper Union](#) college's Foundation Building had already been built back in 1853 with an empty shaft on the expectation that an elevator would be built imminently. Another Otis, Otis Tufts, designed an elevator car with a bench for seating for his patented "vertical railway", versus the platform of Elisha Otis's design; Tufts's design graced the Fifth Avenue Hotel.
- [Bill] The technology of safety elevators didn't actually take off immediately after 1857, perhaps (my speculation) due in part to the local economic impact of the Civil War on New York's commercial and financial sectors, and there were still only a few other elevators in the city by the end of the next decade, serving residential or hotel buildings [[if Wikipedia is to be believed despite its inconsistencies](#)].
- In 1870, after two years of construction, the [Equitable Life Assurance Building](#) in Manhattan opened, which was an office building with two stories underground and seven stories above ground, and the company rented out extra space to other tenants (especially law firms) who jumped at the chance to have their offices in a prime spot with passenger elevator services making it feasible. Up until this point, employees and clients were uninterested in walking up lengthy staircases to work in or visit offices of high-end firms. The initial two hydraulic elevators at the Equitable Life building were so popular and the building filled vacancies so quickly that it became worthwhile to retrofit within just a few years to add four more. Hydraulic elevators were a lot faster than steam-powered elevators and were more desirable for fast-paced corporate office buildings; hydraulic elevators were also easier to maintain. In the next decade they added electric lighting to

the building (from power produced on site in the basement) and a further four elevators, for ten total, as well as adding a whole additional two floors.

- <https://www.bostonglobe.com/ideas/2014/03/02/how-elevator-transformed-america/b8u17Vx897wUQ8zWMTSvYO/story.html> - "How the elevator transformed America" March 2 2014 Boston Globe Ideas
 - *ELEVATORS FIRST ARRIVED* [proliferated] in America during the 1860s, in the lobbies of luxurious hotels, where they served as a plush conveyance that saved the well-heeled traveler the annoyance of climbing stairs. Initially these steam-powered "moveable rooms" were extravagantly furnished with chandeliers, benches, and carpeting, says Lee Gray, a columnist for *Elevator World* and an associate professor of architecture at the University of North Carolina at Charlotte. Passengers were expected to sit down and get comfortable before the operator fired up the new contrivance. "It was all about luxury," said Gray.
 - It wasn't until the 1870s, when elevators showed up in office buildings, that the technology really started to leave a mark on urban culture. Business owners stymied by the lack of available space could look up and see room for growth where there was previously nothing but air—a development that was particularly welcome in New York, where a real estate crunch in Manhattan's business district had, for a time, forced city leaders to consider moving the entire financial sector uptown. That plan came to be seen as unnecessary thanks to the initiative of one Henry Hyde, the founder of a large insurance firm, who realized that by installing a pair of elevators in his headquarters, he could make it the tallest building in the city: seven stories and 130 feet. In so doing, Hyde ushered in a new era. As a writer for *Scribner's Magazine* put it almost 30 years later, the passenger elevator turned out to be "a revolutionary agent" that did for modern building what the steam engine had done for transportation.
- [Rachel] The 1870s was also a time when elevator door technology was refined significantly with new patents for safety improvements, such as doors that closed off access to the elevator shaft if a car was not being entered and exited while stopped at a floor.
- In the 1880s, the Germans (namely Siemens of course) invented electric-powered elevators, but the American Frank Sprague, whom we discussed on [episode 421 \(April of this year\)](#) for his critical inventions in the field of electric streetcars, developed a ton of devices and technologies for electric elevators that made them safer, faster, somewhat more automated, more consolidated within the physical footprint of a building plan, and just generally way better than almost anything else out there. Sprague sold his company to Otis in 1895.
 - <https://time.com/5799872/electric-elevator-history/> Time.com March 10 2020 - "How Electric Elevators Transformed the Modern City" adapted from Robert Bryce's book, "A Question of Power: Electricity and the Wealth of Nations"
 - *Despite the absence of a plaque, despite being overshadowed by a myriad of other taller buildings in Manhattan, the 14-story-high Postal Telegraph Building deserves special stature in the history of skyscrapers. It was at 253 Broadway that one of the greatest — but least-known — inventors in American history, Frank Sprague, deployed the first bank of electric elevators. By doing so, more than perhaps anyone else, Sprague fueled the rise of the vertical city. Today we think nothing of riding in electric elevators, but those machines allowed cities to house more people on less land than ever before. That increased population density has fostered more human interaction and reduced the impact of cities on*

the environment. The world's cities now contain more than half of the global population but, as of 2012, cover less than three percent of its land.

- *After figuring out how to use his electric motors to move passengers across the horizon, Sprague focused on moving them skyward. In 1892, he formed the Sprague Electric Elevator Company and, shortly afterward, won a contract to install his electric elevators in the Postal Telegraph building. Sprague had to prove that his elevators were superior to the slow, balky hydraulic elevators that dominated the market. The deal was dangerously one-sided. If his elevators didn't work as promised, the contract required Sprague to rip them out and replace them, at his cost. Two years later, when the Postal Telegraph Building was finished, Sprague's elevators worked perfectly. In fact, they operated at speeds comparable to those of modern-day elevators. That speed was key to their success. In cities, we want to travel as fast — or faster — when we travel vertically as we do while traveling across the landscape. People in cities are in a hurry. A New York minute doesn't last very long. In the 1990s, Italian physicist Cesare Marchetti showed that our commuting patterns aren't necessarily determined by distance, but by time. That is, we don't think much about how far we are going, as we do about how long it will take us to get there. Our travel-time constraints also apply to vertical transportation. Sprague's electric elevators at the Postal Telegraph Building proved that vertical transportation could be just as fast as traveling by foot on level ground. That was a crucial turning point in the history of skyscrapers.*
- Another American contributor to the field of electric elevators was Schuyler Wheeler, who filed the first US patent in 1883 a few years after Siemens had created the technology in Germany. Wheeler was a pioneer of the electrical engineering field and an Edison protege. But Wheeler was spread out across such a huge range of electrical inventing projects that elevators were not (as far as I can tell) a big focus for him.
- [Bill] By 1900, all the safety and operational technologies had been invented to allow fully automated elevators that any passenger could safely and correctly use on their own without the aid of a dedicated elevator operator, but this didn't mean this actually happened. Either the technologies hadn't been implemented widely yet on older elevator systems ([there were often big lag times in safety upgrades to existing elevators](#)) ... or the public generally were so unwilling to use them alone (or were banned from self-service by ordinance in the case of NYC) that elevator operators remained in widespread employment for nearly half a century more, often very skillfully piloting their passengers up and down quickly and safely.
 - Prior to World War I, elevator operators in the US tended to be men. During both world wars, young women replaced many of the men as elevator operators, especially in retail settings where they could be trained to double in guiding customers to specific floors for various merchandise or to promote sales: https://en.wikipedia.org/wiki/Elevator_Strikes Office buildings also often switched to women operators. In both cases, they were less well protected by labor laws or prevailing wages and they were much more exploited with extensive requirements about how to dress and behave.
- [Rachel] The modern electric traction elevator was developed in its current form by the 1920s and this innovation in elevator technology ushered in the age of the penthouse. Prior to this, the space under the roof was undesirable and often filled with debris and building materials. The penthouse age turned this space into attractive apartments that were rented out for an elevated (pun intended) price.

- <https://www.bbc.com/culture/article/20140819-how-the-lift-changed-everything>
- <https://www.bostonglobe.com/ideas/2014/03/02/how-elevator-transformed-america/b8u17Vx897wUQ8zWMTSvYO/story.html> - "How the elevator transformed America" March 2 2014 Boston Globe Ideas
 - *The arrival of the elevator upended more than urban planning: It changed the hierarchy of buildings on the inside as well. Higher floors had once been distant, scrubby spaces occupied by maids and the kind of low-rent tenants who could be expected to climb six flights of stairs. The more important people climbed at most one or two flights, which gave brownstone-style homes, for instance, their high-ceilinged parlor floors. While the arrival of elevators didn't change this right away—the top floor of Henry Hyde's building was occupied by the in-house janitor—the upper reaches of buildings eventually became desirable. The elevator ushered in the end of the garret and the beginning of the penthouse, as lawyers and businessmen came to appreciate the advantages of having beautiful, bird's-eye views and respite from the loud noises of the street. Hotel owners, meanwhile, started turning their top floor rooms into their nicest ones. They could even rent out their roofs for garden parties where guests could survey the glittering new city, all without doing a bit of work to get there.*
 - This sudden desirability of upper floors of commercial and office buildings with the arrival of elevators caused an explosion in the rents for upper floors, and many buildings often ended up completely ditching ground floor offices or retail in favor of huge waiting area lobbies for elevators:
 - <https://www.chipublib.org/blogs/post/technology-that-changed-chicago-elevators/>
- Another iconic symbol of the elevator era was the Empire State Building - the tallest skyscraper until 1970 - which opened in 1931 with 73 elevators, the largest elevator order to date. These elevators boasted a respectable speed of 1200 feet per minute, and made the Empire State building a popular tourist destination.
- [Bill] The operator union strike in New York in September 1945, just after World War II, despite hindering millions of dollars in economic activity per day and despite the cooperation of perhaps a million and a half sympathetic New Yorkers honoring the picket line, apparently broke the spell of the elevator operator and passengers realized they could just do it themselves, which I guess is the ultimate scabbing. Nominally the strike ended in a win for the 32B union (a 10 year renewal of labor peace and an anti-discrimination policy), but that essentially merely bought time for building owners and passengers to make the transition away from operators.
 - <https://www.seiu32bj.org/history/> By the 1950s, automation was a major selling point for Otis Elevators and people generally could safely operate an elevator themselves with ease. There had also been a similar strike in 1920 after World War I, during the pre-union era for operators, but safety features were not as widespread at that point and so the strike had been somewhat tactically successful in either forcing people to use the stairs or unfortunately ending up with people sustaining gruesome injuries and fatalities trying to operate the elevators without proper training – and the result was a bunch of fairly quick although disjointed agreements between operators and building owners. The strikers were willing to settle fairly quickly too, however, because all those recently trained wartime female operators were easily recallable as strikebreakers if needed. The unionization of New York operators under 32B happened in the New Deal / LaGuardia years when the government was acting as a fairly reliable mediator between labor and owners. This was probably the peak of good times, relatively speaking, for operators.
 - https://en.wikipedia.org/wiki/Elevator_Strikes

- Later elevator technological developments:
 - The final technological leap in elevators came as part of the Third Industrial Revolution in the mid 1980s when Toshiba in Japan – [after 20 years of research and development](#) – used transistor technology to significantly improve smooth high-speed elevator movements for ultra-tall buildings. (I can't totally explain the science of what it's doing, but we probably can leave that for listeners [to read on their own.](#))
 - There are also now more complicated computer systems for “dispatching” elevators efficiently in super-tall 21st century buildings
 - Also ... I guess electromagnetic propulsion elevators, which lack a cable altogether but that kind of seems like a different technology altogether, in the same way I wouldn't consider a vacuum/pneumatic elevator to be a real elevator.
 - Steel cable strengths have long been a limiting factor on the length of an elevator shaft, often forcing taller buildings to use a landings system (although this is also used for speed and efficiency so that passengers need not wait through every lower floor stop to get to the higher floors), but recently elevator companies have been developing new cable materials such as carbon-fiber: <https://www.bbc.com/culture/article/20140819-how-the-lift-changed-everything>
- [Rachel] Other info: <https://www.bostonglobe.com/ideas/2014/03/02/how-elevator-transformed-america/b8u17Vx897wUQ8zWMTSvYO/story.html> - “How the elevator transformed America” March 2 2014 Boston Globe Ideas
 - *Advances in elevator technology combined with new steel frame construction methods to push the height limits of buildings higher and higher. In the 1890s, as Bernard recounts in his book, the tallest building in the world was the 20-story Masonic Temple in Chicago; by 1913, when hydraulic elevators had been replaced with much speedier and more efficient electrical ones, it was the 55-story Woolworth Building in New York. Quickly, the modern city assumed its present shape. As Patrick Carraja, the founder of the Elevator Museum in New York, put it, “If we didn't have elevators...we would have a megalopolis, one continuous city, stretching from Philadelphia to Boston, because everything would be five or six stories tall.”*
 - *EVEN LESS APPRECIATED these days than their transformative effects on American cities are the effects that elevators had on Americans themselves when they stepped inside of them. At first this was a central concern: As late as the 1900s, doctors worried about a nausea-inducing condition known as “elevator sickness,” caused by the sudden movement of one's organs inside the body when an elevator came to a halting stop. Public health advocates, meanwhile, warned that the shared conveyances would spread disease among neighbors and co-workers. Other worries were psychological: As Bernard points out in his book, the concept of claustrophobia emerged in the psychiatric literature at the same time as the elevator, and the experience of being inside one was listed from the start as a primary instigator of symptoms.*
 - *Elevators also raised new questions of etiquette. According to Gray, the author of a 2002 book on the early history of elevators, one big issue was whether a man in an elevator ought to remove his hat in the presence of a woman, as he would in someone's home or a restaurant, or keep it on, as he would on a train or a streetcar. The question, says Gray, reflected a basic uncertainty about what this space really was—a mode of transportation, or some kind of tiny moving room.*

- *That was only one of the peculiar uncertainties that came with riding elevators. Another was that they felt simultaneously public and private, taking people out of the broader world while locking them into a narrow, self-contained one alongside a random assortment of colleagues, neighbors, and strangers. By bringing together people who often only kind of knew each other, elevators created vague expectations of interaction—a smile, a nod, even a bit of small talk to acknowledge that everyone on board lived or worked in the same building.*
- Elevators preceded working escalators by nearly half a century, as the latter did not come into use until the mid 1890s. Otis Elevator Company quickly got into that business too after it was proven. Another company we've discussed, Westinghouse, did too. In general, the elevator and escalator businesses worldwide are dominated by the same small set of big firms.
https://en.wikipedia.org/wiki/Escalator#Inventors_and_manufacturers
- Other countries, especially Germany, got really into using Paternoster lifts instead of elevators, but we're ignoring those because our show is focused on the US side. (Also they look kinda terrifying)