The 'Telharmonium' or 'Dynamophone' Thaddeus Cahill, USA 1897

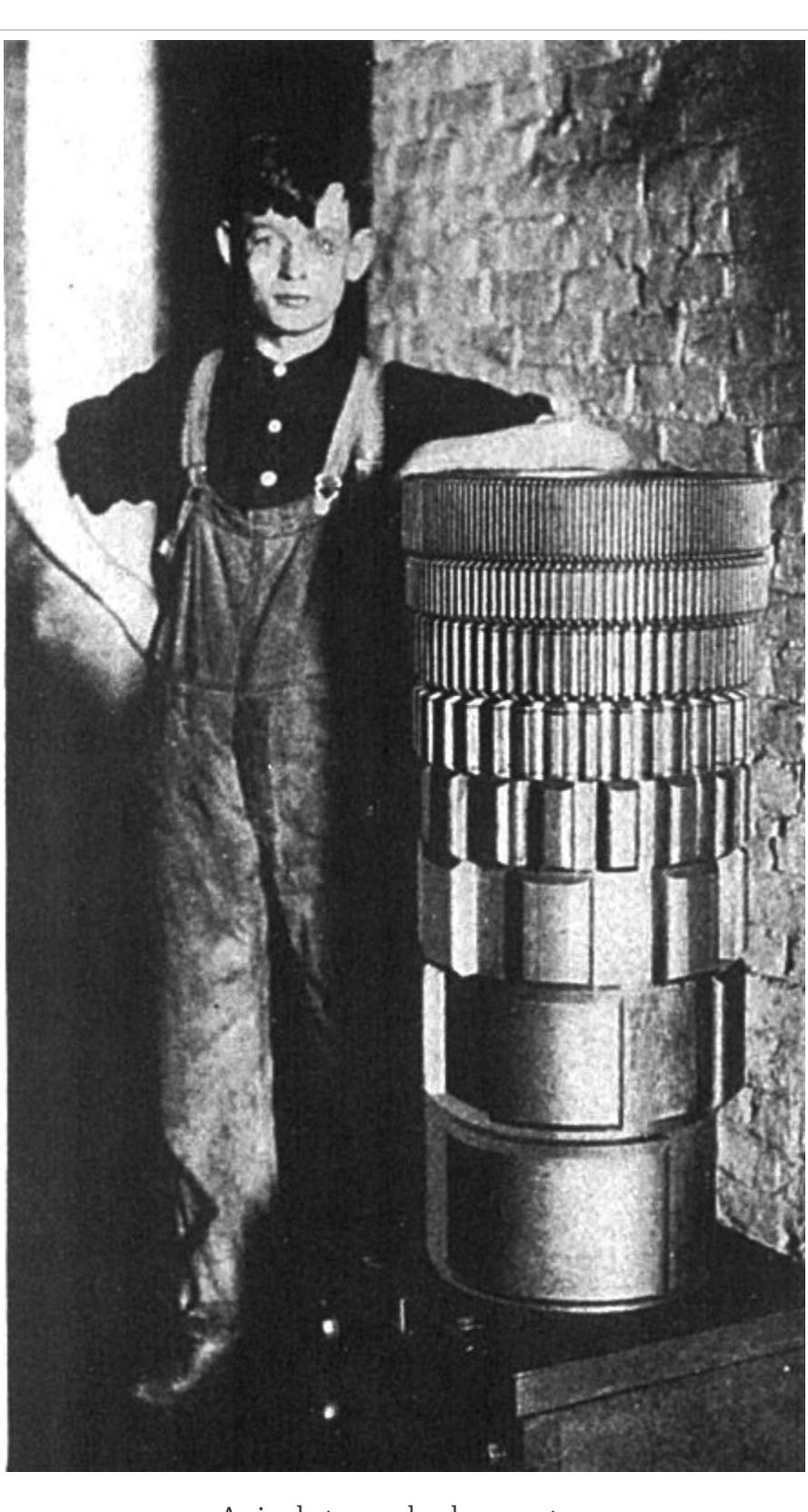
Thadeus Cahill
b. Mount Zion,Iowa 1867, d. New York City 1934

In 1897 Thaddeus Cahill patented what was to become the "Telharmonium" or "Dynamophone" which can be considered the first significant electronic musical instrument . The Telharmonium was an immense instrument of about 200 tons in weight and 60 feet in length assuming the proportions and appearance of a power station generator .the quoted cost was $200,000. The monstrous instrument occupied the entire floor of "Telharmonic Hall" on 39th Street and Broadway New York City for 20 years. Despite the Telharmonium's excessive proportions the sound it produced was both flexible and novel to a degree unmatched by subsequent designers until the 1950 s, and unusually, the instrument was 'portable' – taking up thirty railroad carriages when transported from Holyoke, Mass to NYC. The visionary 36-note-per-octave keyboard designed around Cahill's ideas of just Intonation were far ahead of their time musically but proved unpopular with musicians who had little time to practice on the unusual keyboard this factor eventually added to the demise of the instrument.

The Telharmonium. Scientific American magazine 1907.

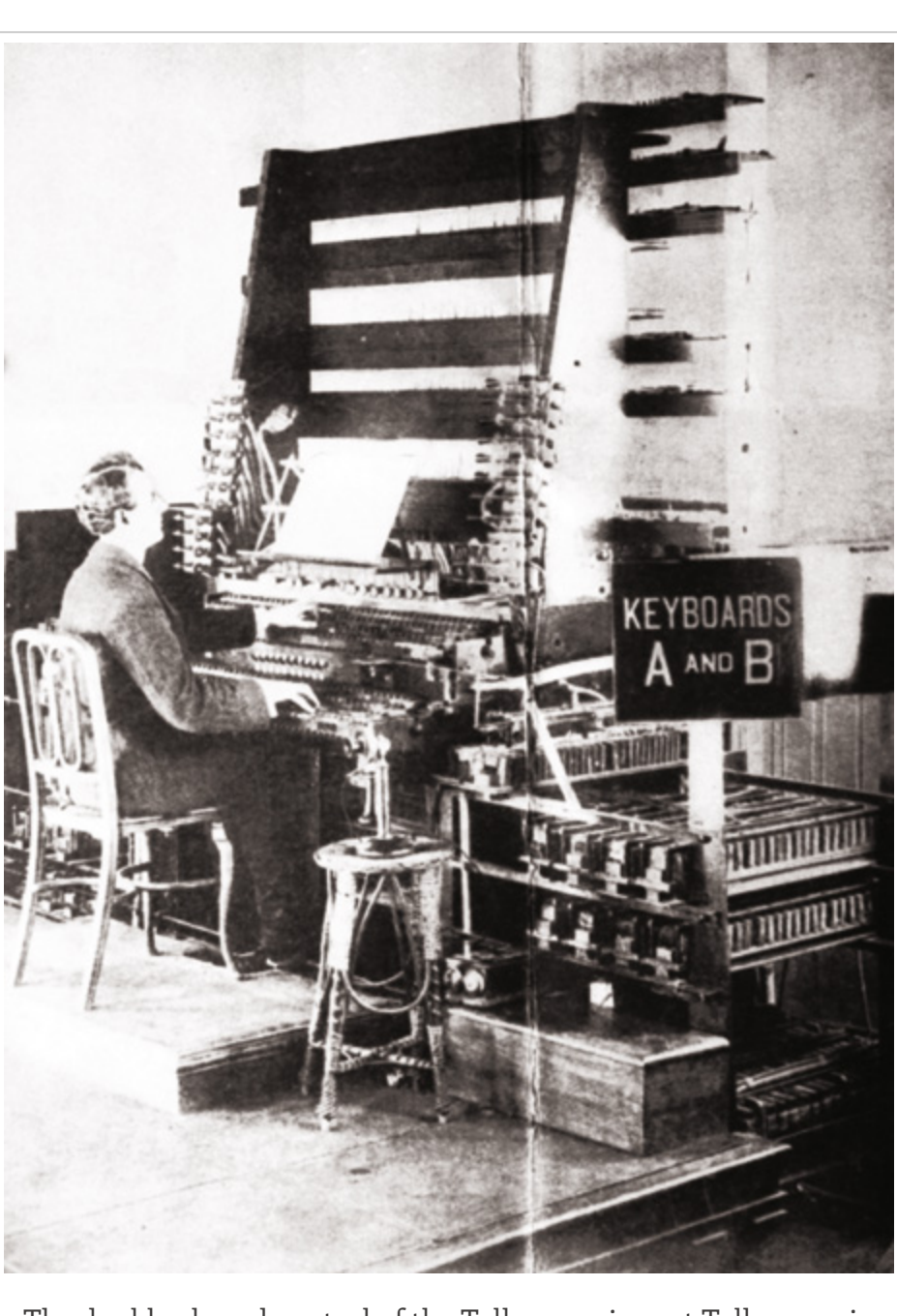
The Telharmonium was a type of additive synthesiser – and Cahill probably coined the phrase 'Synthesiser' to describe his instrument – using a electro-mechanical method to generate it's sound. As the only way to hear the instrument in the era before amplification and loudspeakers, was to send the voltage output over a telephone line, Cahill hit upon the idea of centrally performing music and serve it over the phone network to paying subscribers in hotels, railway stations and private houses; a kind of early Victorian audio internet.

The reasons for the instruments vast proportions were that it produced sounds using 'rheotome' tone wheels; basically a set of varied shaped rotors which when spun created tones through interrupted contact with wire brushes. Each key had it's own rotor shaped to produce a set of harmonic overtones. The first version of the Telharmonium required a massive four hundred and eight dynamos, each weighing many tons. (this was reduced in later models where overtones from multiple rotors were 'overlapped' and rheotomes were replaced with alternating current dynamos in later models).



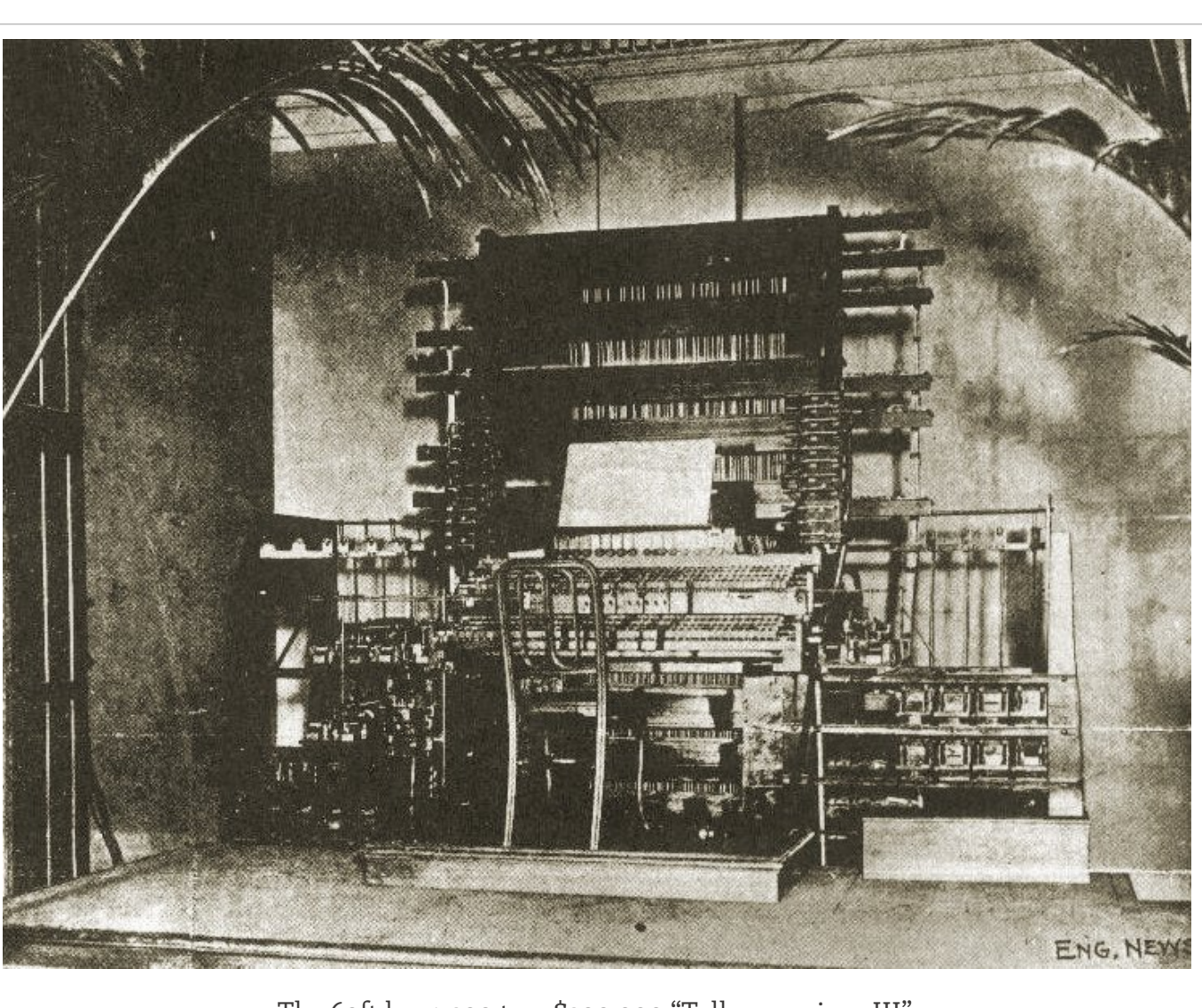
A single tone wheel generator

Essentially there were three version of the instrument. The first fully completed model, built in Washington DC in 1906 and moved to Cahill's workshop at Holyoke, Massachusetts. The second, smaller (Fourteen feet and 14,000 lbs in weight) machine was built at the Cabot St Mill in Hollyoke .The final machine, installed at Telharmonic Hall in New York in 1917, was by then already obsolete, killed off by the far more efficient and cheaper vacuum tube, loudspeaker and radio technology.



The dual keyboard control of the Telharmonium at Telharmonic Hall 1907

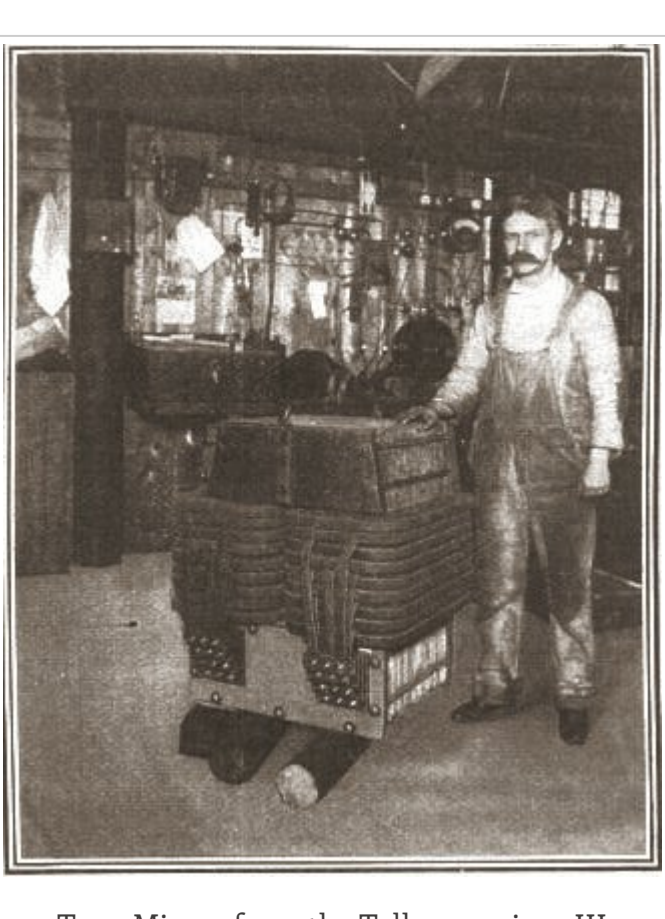
The Telharmonium was essentially a collection of 145 modified dynamos employing a number of specially geared shafts and associated inductors to produce alternating currents of different audio frequencies. These signals were controlled by a multiple set of polyphonic velocity sensitive keyboards (of seven octaves, 36 notes per octave tunable to frequencies between 40-4000Hz) and associated banks of controls.The resulting sound was audible via acoustic horns built from piano soundboards in the early models, later models were linked directly to the telephone network or to a series of telephone receivers fitted with special acoustic horns – this was the only way to amplify the sound in this pre-amplifier era (Cahill's invention had pre-dated the invention of amplifiers by 20 years). The Telharmonium supplied 1 amp of power to each telephone receiver on the network this was much more than the telephone itself but was enough to be able to hear the music without lifting the receiver speaker to the ear however this also masked and disrupted any other signal on the line. The instrument was usually played by two musicians (4 hands) and reproduced "respectable" music of the time: Bach, Chopin, Grieg, Rossinni etc.



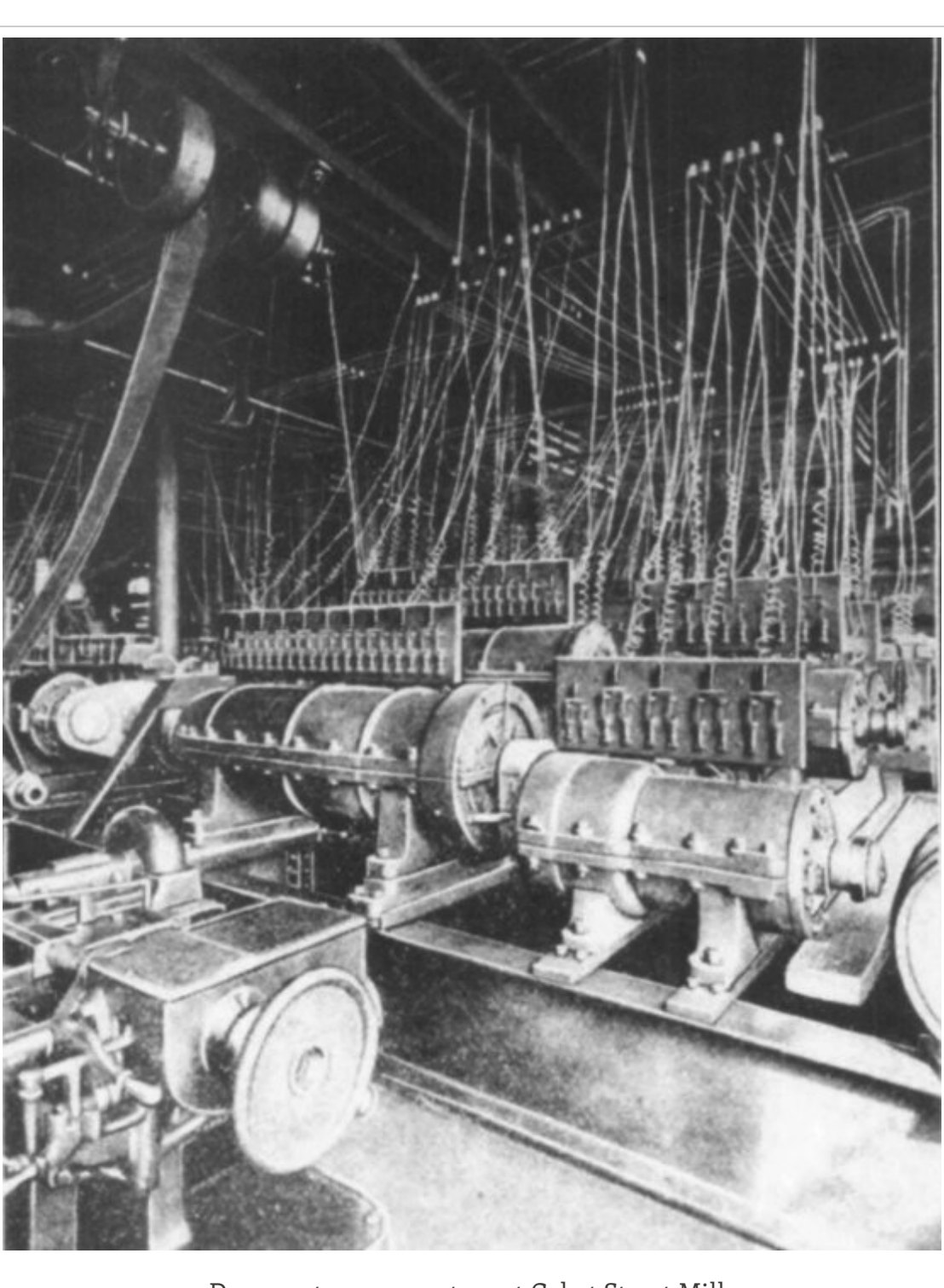
The 60ft long, 200 ton, $200,000 "Telharmonium III"

The sound produced from the Telharmonium at Telharmonic Hall was dogged with technical imperfections on behalf of the performers and by cable transmission errors such as sudden drops in volume when extra voices were added and a 'growling' effect on the bass notes that was said to make the overall experience 'highly irritating'. Cahill completed the third and final Telharmonium in march 1911, this machine was even bigger and more expensive than its predecessor. The third Telharmonium had a whole set of redesigned and more powerful alternators, stronger magnets to reduce the bass rumbling and volume controls. The instrument was installed at 535 west 56th street New York City.

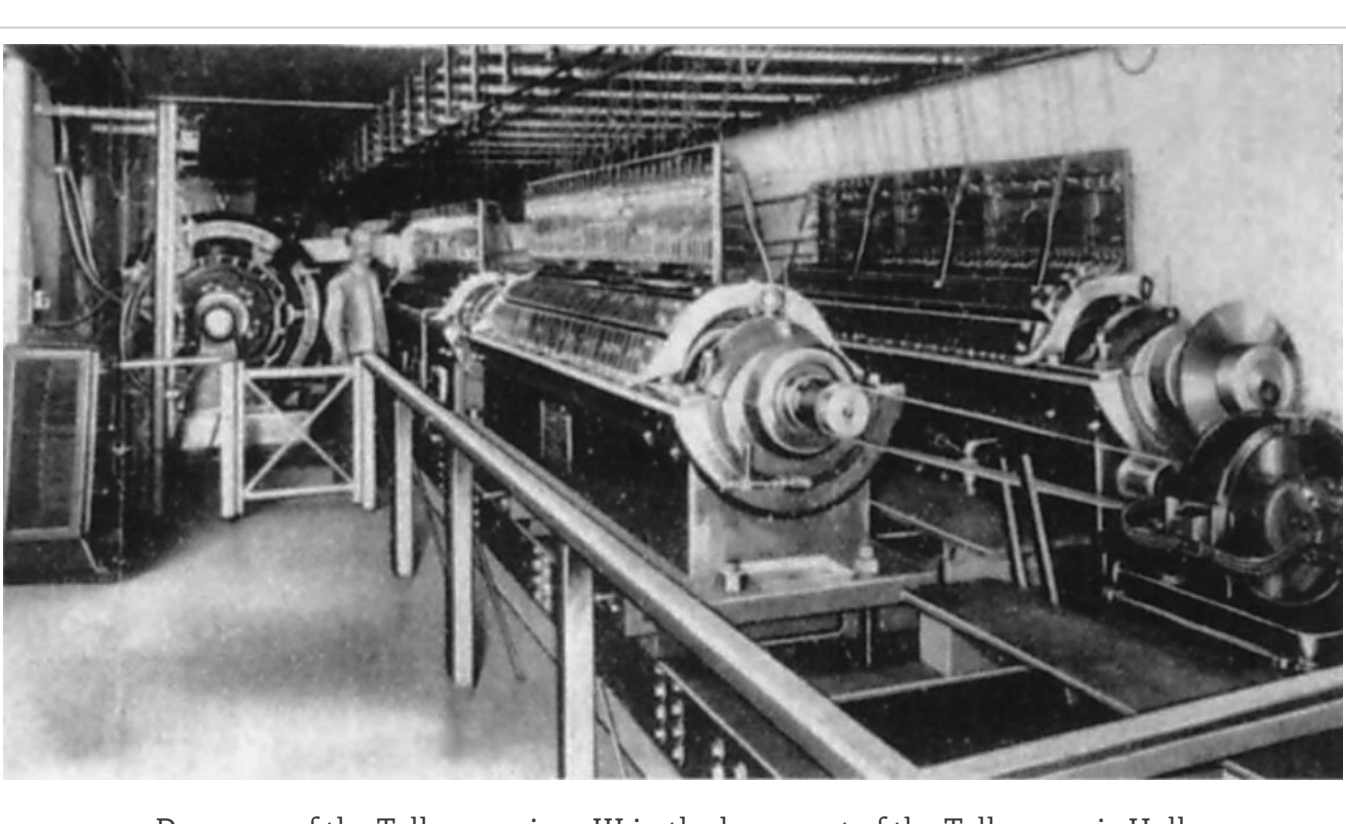
Inside the Telharmonium:



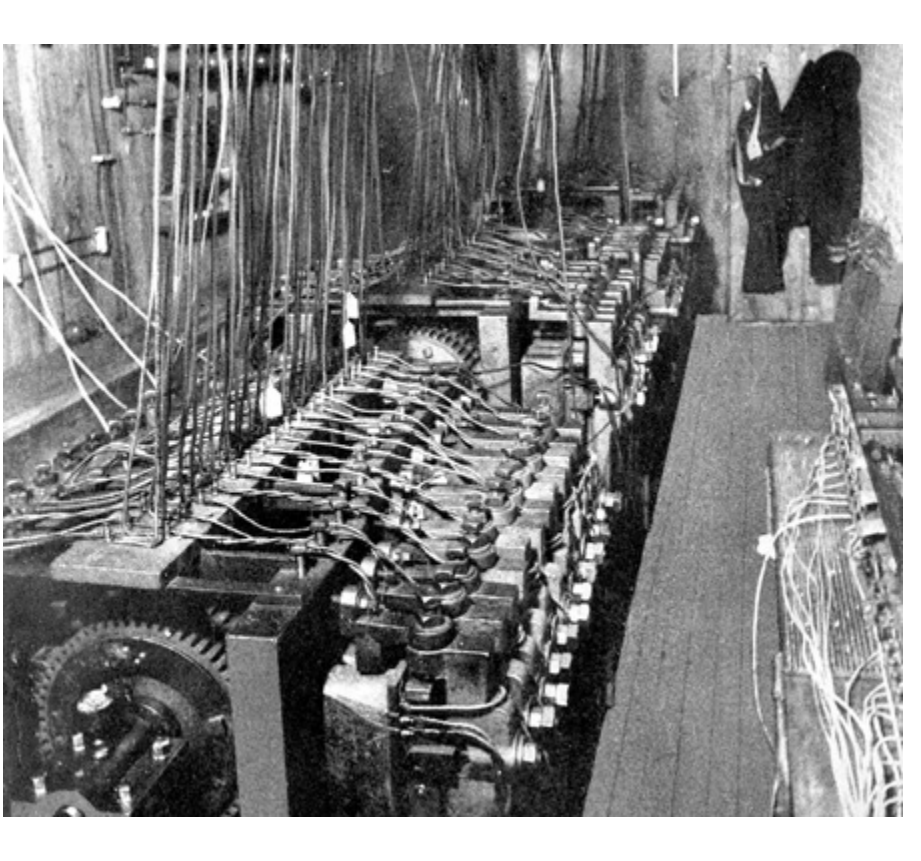
Tone Mixers from the Telharmonium III

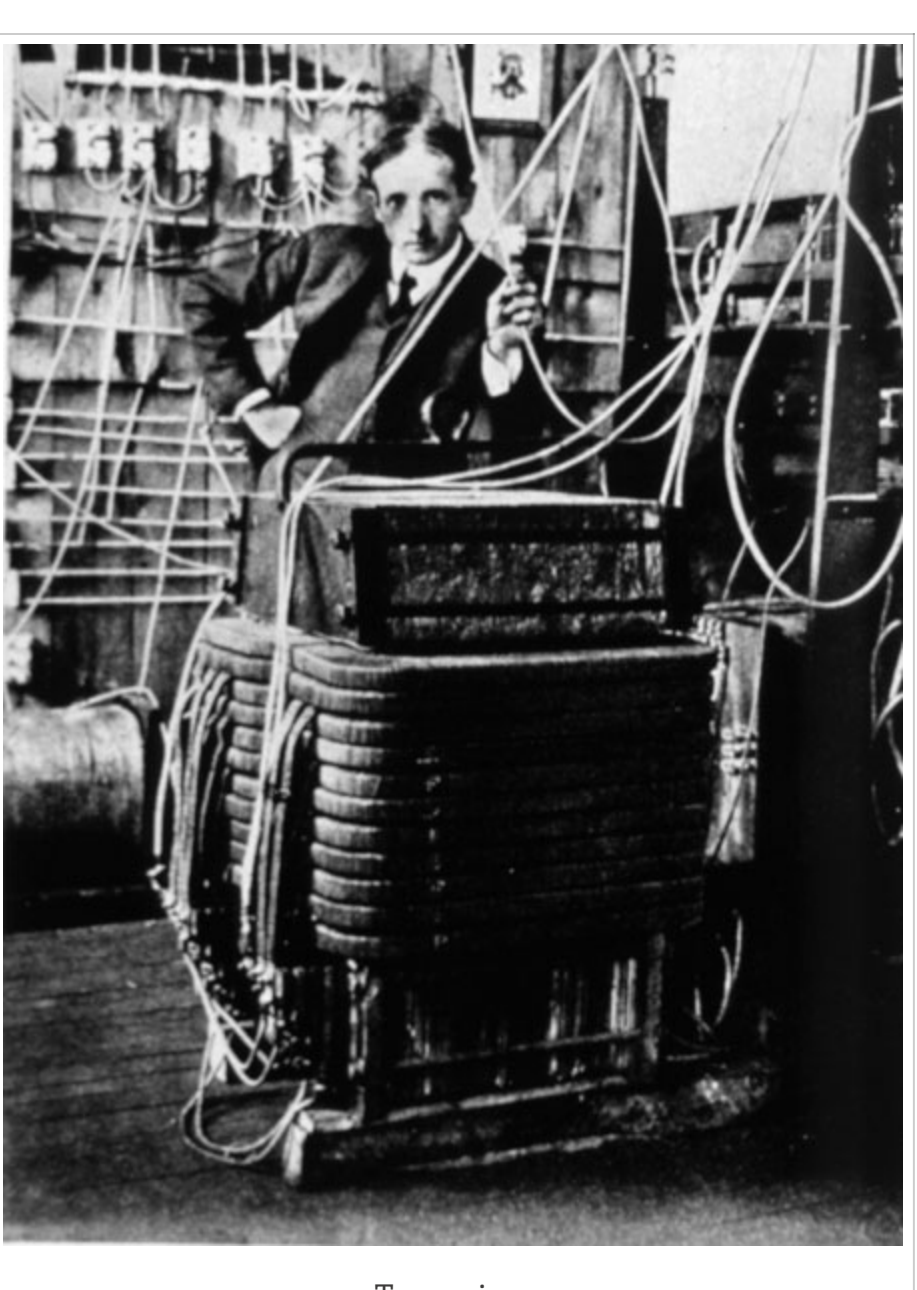


Dynamo tone generators at Cabot Street Mill.

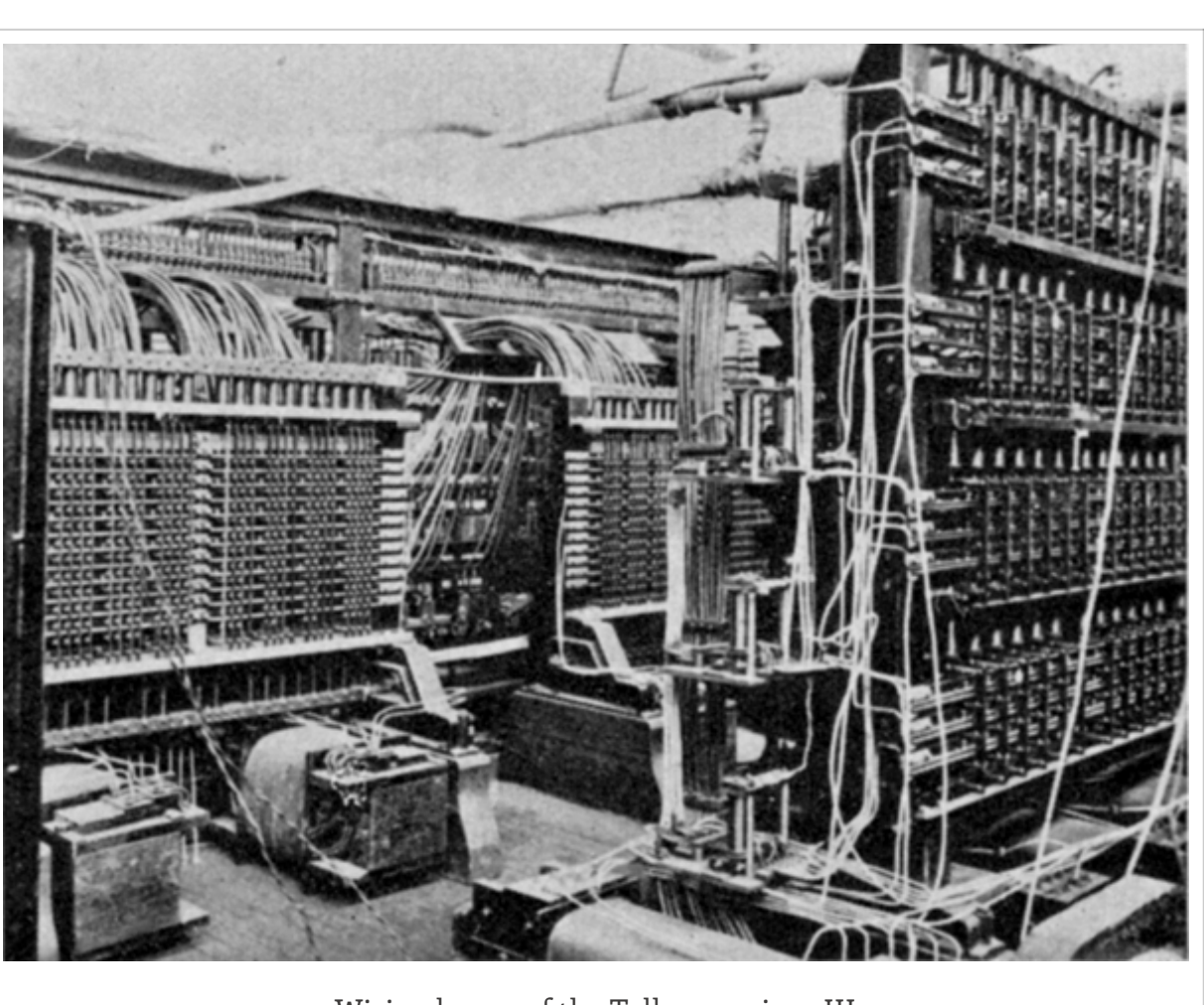


Dynamos of the Telhamronium III in the basement of the Telharmonic Hall





Tone mixer



Wiring looms of the Telharmonium III

Cahill and the 'New England Electric Music Company' funded a plan to transmit 'Telharmony' using the Telharmonium to hotels, restaurants,theatres and private homes via the telephone network. This visionary quest failed when the capital outlay became prohibitive and it was discovered that the machine interfered seriously with local telephone calls. The venture ground to a halt before the first world war. Rumour has it that a New York businessman, infuriated by the constant network interference, broke into the building where the Telharmonium was housed and destroyed it, throwing pieces of machinery into the Hudson river below. The final Telharmonium (the last of 3 built) was operating until 1916 and having survived the Wall Street crash and World War 1 was finally killed off by the advent of popular radio broadcasting and amplification.

Despite its final demise, the Telharmonium triggered the birth of electronic music- The Italian Composer and intellectual Ferruccio Busoni inspired by the machine at the height of its popularity was moved to write his "Sketch of a New Aesthetic of Music" (1907) which in turn became the clarion call and inspiration for the new generation of electronic composers such as Edgard Varèse and Luigi Rusolo.

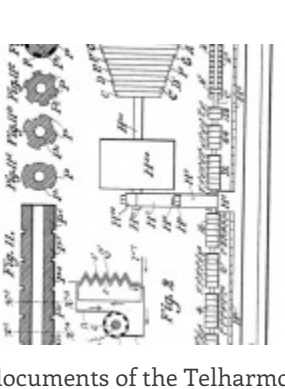
No recordings of the Telharmonium/Dynamophone are known to have survived, though Arthur.T. Cahill, brother of Thaddeus, was as recently as 1950 trying to find a home for the prototype instrument, his search proved unsuccessful and the historic machine vanished. The principles underlying the Telharmonium are still used in the Hammond organ designed in the early 1930s.

Mark Twain (Clemens) remembers the Telharmonium:

> "I recall two pleasant social events of that winter: one a little party given at the Clemenses' home on New-Year's Eve, with charades and storytelling and music. It was the music feature of this party that was distinctive; it was supplied by wire through an invention known as the telharmonium which, it was believed, would revolutionise musical entertainment in such places as hotels, and to some extent in private houses. The music came over the regular telephone wire, and was delivered through a series of horns or megaphones — similar to those used for phonographs — the playing being done, meanwhile, by skilled performers at the central station. Just why the telharmonium has not made good its promises of popularity I do not know. Clemens was filled with enthusiasm over the idea. He made a speech a little before midnight, in which he told how he had generally been enthusiastic about inventions which had turned out more or less well in about equal proportions. He did not dwell on the failures, but he told how he had been the first to use a typewriter for manuscript work; how he had been one of the earliest users of the fountain- pen; how he had installed the first telephone ever used in a private house, and how the audience now would have a demonstration of the first telharmonium music so employed. It was just about the stroke of midnight when he finished, and a moment later the horns began to play chimes and "Auld Lang Syne" and "America"."Mark Twain: A Biography,Albert Bigelow Paine (New York: Harper & Brothers, 1912), 1364-1365

Patent Documents

Patent documents of the Telharmoinium



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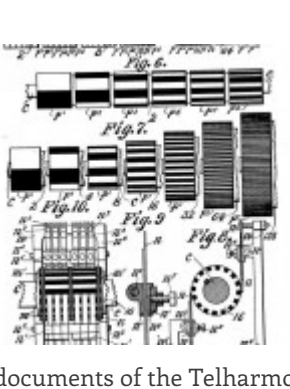

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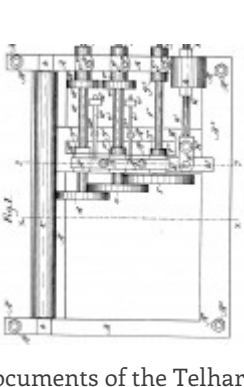

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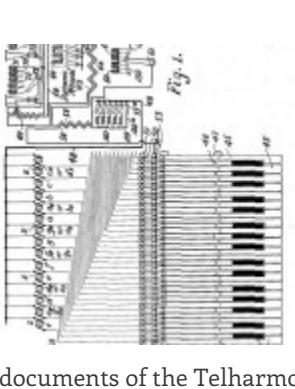

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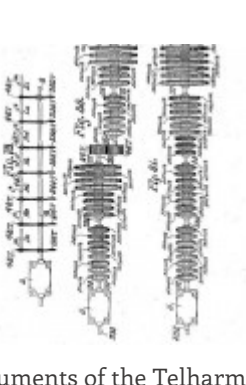

Patent documents of the Telharmoinium

Sources:

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