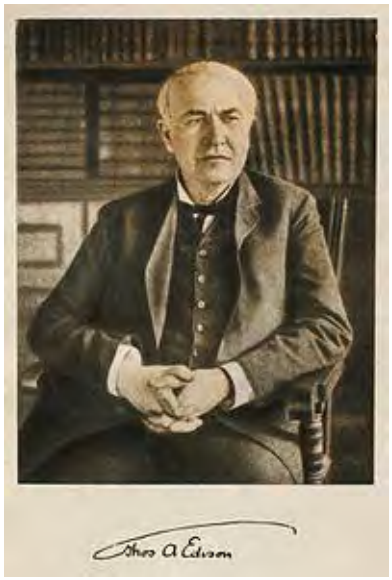
THOMAS ALVA EDISON (1847 – 1931)

About the man, his live, work, businesses, products and achievements

Introduction



A lot of books were published about Thomas Edison and the internet is full with articles about him (a simple Google search 'Thomas Edison' provides 65,000,000 responses…). What can I add to this? Well, it is noteworthy that in the literature about Edison there is very little talk about telegraphy (this is also the case with Lars Ericsson). The scope of this article is by definition focused on the domain of telegraphy, so I can shine here some light on this aspect. My main source is the fantastic book: THE PAPERS OF THOMAS A. EDISON, Volume 1, from 1989 (see my reference [1]). And my second source is the Wikipedia article that you can find via [2].
The book, the first part of a series of seven, deals with the period from his birth to 1873. I bought that part at the time because it goes very deeply (about 700 pages) into the period in which Edison focused almost exclusively on telegraphy.
Of Edison's telegraphs only one model is well known to collectors: the Universal Stock Printer (from 1873). The much later Self Winding Stock Ticker (from 1902) although very often attributed to Thomas Edison, is not at all one of his design. I am explaining this in detail in chapter 2.4.1. In PART 2 I will show, via a number of illustrations and comments, some of those that once were in my collection. But below I will also briefly mention the various other telegraph receivers and related apparatus that he has designed and commercialized, but of which, to my knowledge, only a few are in the possession of collectors.
As usual, I will briefly discuss in PART 1, his (peculiar) teenage years with some anecdotes and his moves from and to a number of companies (partly as a result of his many lay offs…). There is so much to tell about his professional activities and his inventions. In order to limit the number of pages here, I solved the problem twice by using compressed chronological lists.

Before really starting, I would like to come back to the aforementioned book (which I warmly recommend to those who want to dedicate an in-depth study to the life and especially the work of Thomas Edison). To describe it I cannot do better than quoting from the 'Preface'.
"… The publication of The Papers of Thomas A. Edison (seven volumes) represents the effort of a team of historical editors to bring to the public and the scholarly community an intimate view of the personal, entrepreneurial community activities of America's greatest inventor. Out of a documentary record comprising over three and a half million pages, the edition will provide the pieces to the puzzle that is Edison's place in history….The Edison Papers project at Rutgers, the State University of New Jersey, was established to help answer the many questions about Thomas Edison through publication of selective microfilm and book editions. The microfilm edition, for specialist researchers will include not less than four hundred thousand documents while the book edition is intended for a broader audience. …. It includes the inventor's personal and business correspondence, patent records, business contracts, experimental notes and drawings, laboratory and production models and other technical material …."

PART 1: HIS LIFE AND WORK

1.1. A general overview

To this date, people immediately associate his name with the electric light and his association with the phonograph. Less well known is the diversity of Edison's other significant achievements. He contributed notably to telegraph, telephone, electric power systems, electric traction, electric batteries, motion picture, chemical production, home applications, even ore milling and cement manufacture, &c. He pursued many of his inventions from conception through development into the marketplace, establishing large companies at home and abroad for their exploitation.

Edison, like most of his American contemporaries, received limited formal education, but through his reading and experience he acquired a broad and detailed understanding of the society in which he lived. Before he was twenty, he knew of the technical works of Michael Faraday as well as the Proceedings of the Royal Society of London! His 1868 correspondence reveals his detailed knowledge of European telegraph design. He received his technical apprenticeship in telegraph offices and machine shops in the Midwest and Boston. Working at first from standard telegraph manuals and periodicals, he varied the standard design for relays, repeaters, and duplex circuits (simultaneous transmitting and receiving over a single line). After arriving in Boston at the age of twenty-one, he not only worked as a telegraph operator but also published articles in the nation's leading telegraph journal. He learned to work in close association with technical and business people. From the time of his arrival in Boston in 1868, he joined in partnership with others. He obtained financial support from businessman and technical aid from colleagues. And by 1873 he had attracted the interest of key leaders in the telegraphy industry. Although some of Edison's early work seems to reflect the cut-and-try method, closer examination reveals a more conceptual approach. An example: early in 1872 he devoted an entire notebook to drawings of 100 escapement mechanisms, thereby preparing for himself a thesaurus of known ways of controlling motion…

Edison's early experience in business also shaped his later career. In the telegraph industry he worked increasingly ith captains of industry, gaining an enviable reputation as a telegraph inventor. His invention of the phonograph in 1877 attracted world-wide acclaim and simply reinforced the high regard the leaders of the telegraph industry had for his creative abilities. Consequently, when he began on work on electric lighting in 1878, his old financial friends from the telegraph industry introduced him to their friends in the railroad and banking communities and helped him acquire financial support for his efforts in fields beyond telegraphy.

His greatest contribution to progress was perhaps the research laboratory he had built around 1876 in Menlo Park, New Jersey. This was the first laboratory that was specially set up to develop new things and to make technological progress and can be seen as the first commercial research laboratory (see below in 1.8.1.)

His talents eventually led him to found 14 companies, including General Electric (in 1922), still one of the largest publicly traded companies in the world.

1.2. His early years.

Thomas Alva was born in Milan, Ohio, on 11 February 1847 as the seventh, and last, child of Samuel Edison and his wife Nancy, a former school teacher. In the spring of 1854, at the age of seven they moved north to the booming lumber town of Port Huron, Michigan, on the Canadian border. There, separated from neighbours as well as most of her family, mother Nancy devoted much of her time to the education of her son; he was at the age of nine the only child living at home. Thomas briefly attended a small private school, receiving instructions in piano in addition to the traditional subjects. For a short time he also attended the union school in Port Huron, where he may have studied the physical sciences. But with the exception of these two brief interludes and some Sunday School attendance, the youngest Edison received his basic education at home. The Edisons possessed a home library and encouraged Thomas to master it. The boy also avidly read popular science periodicals and contemporary fiction. Inspired by his reading, he conducted chemical experiments and joined his friends in a variety of mechanical pursuits. These included a the construction of a steam-powered saw mill and railroad.

Fascinated by steam locomotives and eager for adventure, twelve-year-old Thomas soon peddled candy, newspapers, magazines, and dime novels on the trains of the Grand Trunk Railway. These trains travelled the 60 mile route from the Canadian border to Detroit and passed less than half a mile from the Edison home.

This began Edison's long streak of entrepreneurial ventures, as he discovered his talents as a businessman.

Edison developed hearing problems at an early age. The cause of his deafness has been attributed to a bout of scarlet fever during childhood and recurring untreated middle-ear infections. Around the middle of his career, Edison attributed the hearing impairment to being struck on the ears by a train conductor when his chemical laboratory in a boxcar caught fire and he was thrown off the train in Smiths Creek, Michigan, along with his apparatus and chemicals… In his later years, he

modified the story to say the injury occurred when the conductor, in helping him onto a moving train, lifted him by the ears…
He became involved in telegraphy after he saved three-year-old Jimmie McKenzie from being struck by a runaway train. Jimmie's father, a station agent, was so grateful that he trained Edison as a telegraph operator. Edison's first telegraphy job away from Port Huron was at Stratford Junction, Ontario, on the Grand Trunk Railway. There he was held responsible for a near collision…
In 1866, at the age of 19, Edison moved to Louisville, Kentucky, where, as an employee of Western Union, he worked the Associated Press bureau news wire. Edison requested the night shift, which allowed him plenty of time to spend at his two favourite pastimes: reading and experimenting. Eventually, the latter pre-occupation cost him his job. One night in 1867, he was working with a lead–acid battery when he spilled sulphuric acid onto the floor. It ran between the floorboards and onto his boss's desk below. The next morning Edison was fired.
On Christmas Day 1871, Edison married the nine-year-younger Mary Stillwell (she was 16). He knew her only two months after his first meeting with her as a worker in Edison's News Reporting Telegraph Co.. Together they had three children: Marion, nickname "Dot", Thomas Jr. (1876-1935), nickname "Dash" and William. On August 9, 1884, Mary Edison died. Two years later, on February 24, 1886, Edison, 39 years old, remarried with the then 20-year-old Mina Miller in Akron, Ohio. They had three children: Madeleine, Charles and Theodore.

1.3. Chronology of his early jobs "in telegram style"

* During the Spring of 1862 (15 years old) he publishes and prints on the train his own "newspaper", the Weekly Herald.

* During the Fall of 1862 he studies telegraphy with the station agent at Mount Clemens, Mich.

* During the Winter of 1862-63 he begins work as a telegraph operator in a book and jewellery shop in Port Huron.

* In late Spring-Summer of 1863 he starts a job as a telegrapher for the Grand Trunk Railway at Stratford Junction, Ont. That was his first in a five-year series of jobs that would take him throughout the Midwest.

* In 1863-64 he returns briefly to Port Huron. He works the night shift as a railroad telegrapher and is employed for two months as a railroad telegrapher in Fort Wayne, Ind.

* During the Fall-Winter of 1864-65 he works in Indianapolis, Ind., office of the Western Union Telegraph Co. and experiments on improvements in telegraph repeaters.

* Spring-Fall 1865: he works in the Cincinnati, Ohio, office of Western Union and experiments on self-adjusting relays.

* On 17 September, 1865 (18 years old) he becomes a founding member of the National Telegraphic Union. The same month he is promoted telegraph operator first class and begins designing devices for multiple telegraphs!

* Fall-Spring 1865-66: He becomes the regular press-wire operator in the Memphis, Tenn., office of the South-Western Telegraph Co and where he conducts repeater experiments.

* In the Spring of 1866 he enters Western Union's Louisville, Ky., office as a press wire operator

* 1August 1866: he leaves for New Orleans, La., planning to embark for Brazil (the trip didn't happen).

* Fall 1866: Returns to the Western Union office in Louisville after a short stay in Port Huron.

* In the Summer of 1867 he returns to the Western Union office in Cincinnati.

* And in October 1867 he returns to Port Huron
.
* 1868, March-April He begins work as an operator in the main Western Union in Boston, Mass.

In the 1862-1868 time period he moved, in total, 13 times. He did not always leave his position of his own free will, as he was laid off and/or fired a couple of times. For instance once because of his absent mindedness that led to an accident, once by experimenting for his own purposes during working hours…

1.4. Chronology of some major facts during1868-1873

Also here, again in "telegram style" a list with his main activities regarding telegraphy during the six years of 1868-1873. Those years are indeed his most active and fruitful years in the domain of telegraphy.
Note: In appendix 1 you will find an explanation of the caveat & patent system in the US in the 19th century.

1868
* 11 April 18: At the age of 21, he publishes in the *Telegrapher* the first of several articles on his telegraph inventions and on the Boston telegraph community.
* 11 July: Makes the first of several agreements with a Mr. E.B. Blaker, a Boston businessman, who helps finance his early inventive work.
* 28 July: Signs a caveat for a **fire alarm telegraph**.
* 13 October: Signs a patent application for an **electric vote recorder**, which later (22 June 1869) issues as his first patent.

1869
* 21 January: Sells rights in his first successful **printing telegraph**, the 'Boston Instrument', to Boston businessmen.
* 30 January: Announces his resignation from his job with Western Union in order to devote himself full time to inventing and to pursuing telegraph enterprises.
* 13 April: Tries and fails to make his **double transmitter** work between Rochester and New York City
* August: Improves Law's stock printer.
* October: Announcement of the newly formed *Pope, Edison & Co.* as a firm of electrical engineers and telegraph contractors.

1870
* c 15 February: Joins William Unger in establishing his first major shop , *the Newark Telegraph Works.*
* 1 July: Participates in the forming of the *American Printing Telegraph* Co.
* 3 August: Signs an agreement with Daniel Craig to invent an improved **perforator** for automatic telegraph.
* 1 October: Becomes a partner in the *American Telegraph Work* and receives funds for **automatic telegraph** experiments.
* 19 October: Negotiations start to sell his newly designed **universal private-line printer** to the 'Gold and Stock' company.

1871
* Winter-Spring: Designs **perforators, transmitters, ink recorders and typewriters** for automatic telegraphy.
* April-may: Changes the name of the Newark Telegraph Works to *Edison and Unger*.
* August: Begins manufacturing his **universal stock printer** for 'Gold and Stock'.

1872
* 15-17 January: Designs a **district telegraph**.
* May-June: Supplies his universal stock printer to *the Exchange Telegraph Co*. of London.

1873
c 10 February: Meets with W. Orton, president of WU, and makes a verbal agreement to develop **duplex telegraphy.**
*23 April: Leaves for England.
*23-27 May: Conducts tests of his **automatic telegraph** system for the British Post Office.
*June: Conducts tests of his automatic telegraph for the *Telegraph Construction and Maintenance Co*.
*25 June: Arrives back in the US.

Unlike most inventors, Edison did not always work on one invention at a time, but often a few at a time or went back and forth between ideas. However, it is fair to say that he learned from each project and often incorporated ideas from previous experiments and inventions into later ones.

1.5. His patents

In Appendix 1 you will find a nice description of the American Patent System (out of [1])

He accumulated 2,332 patents worldwide for his inventions. 1,093 of them, of which the first hundred mainly deal with the telegraph system, were issued in the United States. The other ones were approved in countries around the globe. Reference [3] lists them all; and the beauty of the US Patent Office web site is that you can download the first page and a drawing.
U.S. Patent 90,646 -Electrographic Vote-Recorder- of1869 was Edison first one. It permitted a "yes" or "no" vote via one of two switches. Washington congressmen were not interested in the device and the invention was unsuccessful.
Here is a small selection out of the many ones related to telegraphy:

Exec. Date	Appl. date	Issue Date	Pat. No.	Title
13 Oct 68	28 Oct 68	1 Jun 69	90,646	Electrographic Vote-Recorder
25 Jan 69	17 Feb 69	22 Jun 69	91,527	The Boston Instrument
17 Aug 69	27 Aug 69	9 Nov 69	96,567	Edison-Law
5 Feb 70	11 Apr 70	17May 70	103,035	Electro-Motor Escapements
12 Apr 70	14 Apr 70	7 Jun 70	103,924	Gold Printer (Edison & Pope)
22 Jun 70	28 Jun 70	9 May 71	114,658	Electro-Magnets for Telegraph Instruments
12 Aug 71	18 Aug 71	19 Mar 72	124,800	Improvement in Telegraphic Recording Instruments
3 Jan 72	12 Jan 72	7 May 72	126,532	Universal Stock Printer
28 May 72	6 Jun 72	17 sept 72	131,340	Printing Telegraph Transmitter (with transmitter keys)
10 Jun 72	7 Jul 72	17 Sep 72	131,343	Transmitter and Circuits for Printing -Telegraphs
8 May 72	6 Jun 72	14 Jan 73	134,867	Automatic Telegraph Instruments
31 Oct 72	5 Nov 72	23 Sep 73	142,999	Galvanic Batteries
26 Nov 72	12 Mar 73	27 Jan 74	146,812	Telegraph-Signal Boxes
23 Apr 73	27 Jun 73	24 Feb 74	147,917	Duplex Telegraphs

Note that most patents in the complete lists bear the title 'Printing-Telegraphs' ,which makes it very difficult to search for a typical one.

1.6. A bit more about his most important telegraph models

Apart from the Universal, Edison was involved in -or was the sole inventor of- many other types of stock tickers. Hereby a limited list:

* The BOSTON INSTRUMENT: This one embodied Edison's first patented printing telegraph design. He had worked on such a device since April 1868 and finally executed a successful patent application on 25 January 1869. He encased his instrument in a wooden box with a glass front.

* The MAGNETOGRAPH was an alphabetic dial telegraph for use on private lines. They were manufactured in the Spring of 1869. Like the dial telegraphs from Wheatstone (inv. 1858) they did not require a battery as the power was generated by a magneto.

* Redesign of the REPORTING TELEGRAPH of Samuel Laws during the second semester of 1869.

* The AUTOMATIC TELEGRAPH. This is a system that one can compare with the 'High Speed' system of Prof. Charles. Wheatstone (see my article on Wheatstone). It is a way to increase considerably the capacity (by more efficiency) of the line. The message is first punched in a paper tape which then can be transmitted at high speed to the receiving station. Here the transmitter consists of a revolving drum upon which rest a metallic point. This point is connected to the line, while the drum is connected to the battery and thence with the earth. The electric impulses passes over the wire and are recorded at the receiving end as a dot on a continuous strip of paper moistened with a chemical solution. And the effect of the electric current in passing through is to make a form of "ink". As there are small and large holes in the perforated paper, short and long marks are made upon the moistened paper, thus forming the dots and dashes of the Morse alphabet.

* An AUTOGRAPHIC or FAC-SIMILE TELEGRAPH. Already in February 1870 he made and entered into an agreement to invent and perfect such an apparatus. Apparently it wasn't an easy task, or got not priority, as it was only patented in 1881.

* The GOLD PRINTER. So called because the 'Gold & Stock Telegraph Co. used it to report gold sale, was the second joint invention of Edison and Franklin Pope, also in the first semester of 1870 (joint patent 103,924).

* The AMERICAN PRINTING TELEGRAPH (also called POPE AND EDISON PRINTER). This was the third and last collaborative effort of Edison and Franklin Pope. They developed this instrument in the second half of 1870 for private lines and established the '**American Printing Telegraph Co'**. The primary innovations lay in the circular transmitter. It was powered by a small electric motor by its own design (however he did not attempt to patent it).

* The UNIVERSAL PRIVATE LINE PRINTER. Edison began developing this printer in the Summer of 1870. This was a combination telegraph transmitter-receiver, and was Edison's most sophisticated device His notebooks show that he continued to work on it until March when he abandoned it. But in April1872 he developed a new one.

* The COTTON INSTRUMENT. The cotton instrument was the telegraph printer employed by the Gold and Stock Telegraph Co. to report prices from the New York Cotton Exchange. The design was sufficiently complete by December 1870 that the company ordered 150 of them. But by the end of the Summer he had abandoned the cotton instrument in favour of a new basic design, which he incorporated into his universal stock printer (or 'ticker').

* The UNIVERSAL STOCK TICKER. Edison began developing this new printing telegraph in the Spring of 1871. As it was based upon a previous model, the 'Cotton Instrument' it all went rather fast: the prototype was ready in June and in late summer he began manufacturing these machines (by the newly formed company '**Edison and Unger'**). By the end of the year he had delivered 600 to the 'Gold & Stock' company (plus another 640 in 1872) and had finally executed a covering patent application. Although the new ticker superficially resembled the cotton instrument, it incorporated several changes Edison had made in the earlier instrument and also displayed some novel constructions. The fundamental design became a standard in the Western Union ticker inventory for many years. Edison continued working to improve it after filing the basic patent (126,532 issued on 7 May 1872). It was followed by 9 "improvement-patents". About 6,000 of these later 'Universals' (the first also being called the 'Edison & Unger') have been made. (where have they all gone…? ;o)

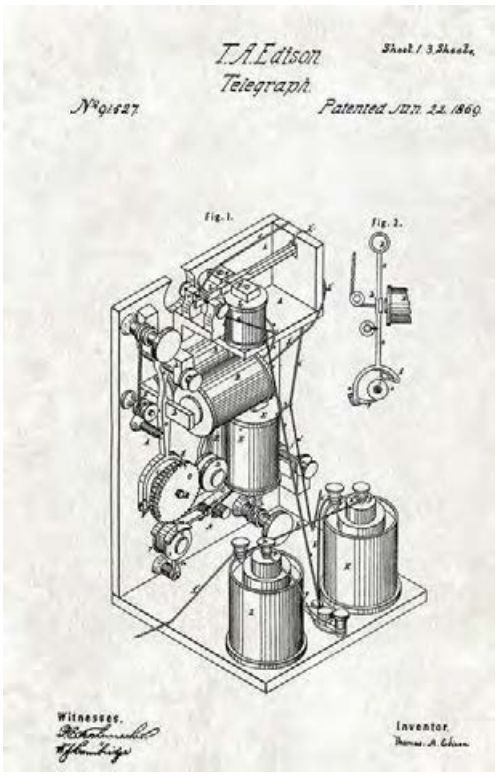
* PRINTING TELEGRAPH TRANSMITTER. Made during the first months of 1872. Patent 131,343

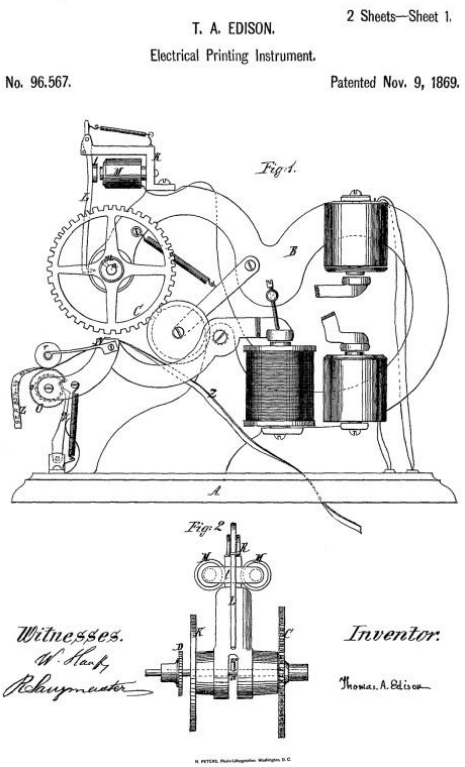
* Furthermore he was involved in inventing and developing other instruments. Just to name a few:
A 'DISTRICT TELEGRAPH, CHEMICAL TELEGRAPHS, MULTIPLE TELEGRAPHY (duplex, quadruplex,…), SIPHON RECORDERS, ELECTRIC PERFORATORS, ELECTRIC PEN, ….

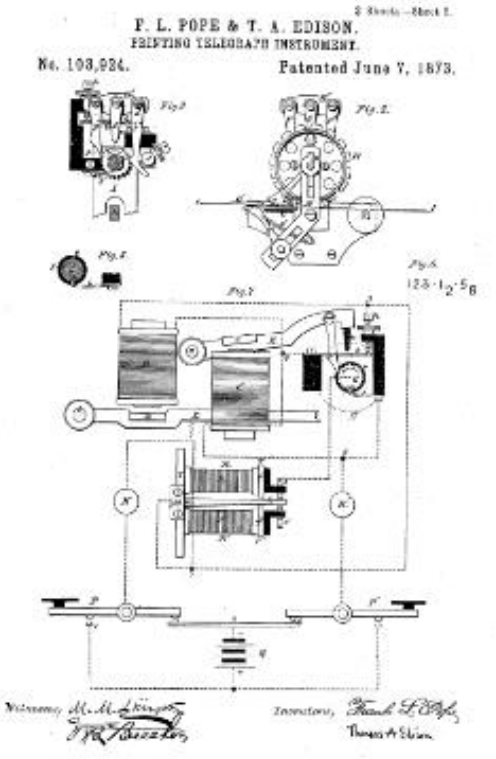
1.6.**Quadruplex.**
In an article about Edison, a short review of his quadruplex system should, of course, not be omitted
In 1853, Julius Gintl in Vienna, Austria discovered a way to send two telegraph messages in opposite directions down the same wire. This technology was not commercially successful until 1871, when it was improved by the inventor J. B. Stearns. Within a year or two, Western Union and other telegraph companies were using duplex telegraphs on their busiest lines in major cities. In 1874, Thomas Edison invented the first quadruplex telegraph, which was capable of sending two messages simultaneously in each direction. He accomplished this by having one message consist of an electric signal of varying strength, while the second was a signal of varying polarity. (Today this concept is known as polar modulation, considering amplitude and phase as radius and angle in polar coordinates > e.g. ITU-T recommendation V29 for 9,600 bit/s modems.)
He sold the rights to Western Union in 1874 for the sum of $10,000. It enabled Western Union to save money by greatly increasing the number of messages the company could send without building new lines.
The quadruplex continued to be used into the twentieth century.

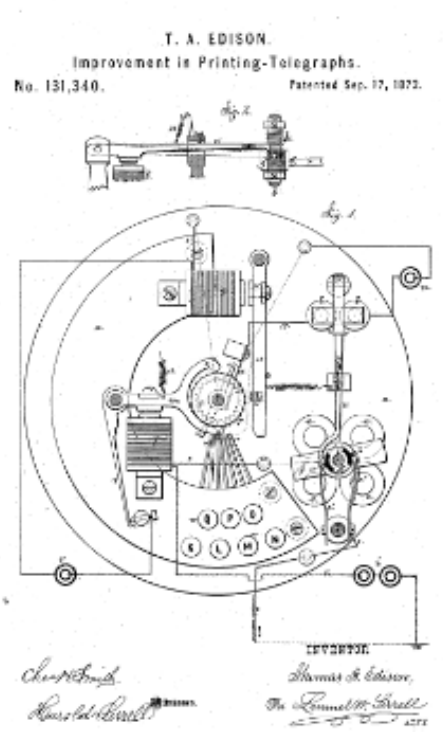
Here are four patent figures related to the following telegraphs:

- 91,527:The Boston
- 96,567:Edison-Law
- 103,924:Gold Printer (Edison-Pope)
- 131,340:The Printing Telegraph with keyboard









Unfortunately there is no patent for the Universal Private Telegraph Printer. Personally I find it the most beautiful of all of them; that's why I will do him honour by presenting here its photo. (Sadly it's not in my collection ;o).

And, who did all these stock stickers work for? The answer:

1.7. The Exchange Telegraph Company of London ("EXTEL") [17].

In 1871 Edison's relation with the men that ran 'Gold & Stock' and 'Western Union' grew closer (on 25 June WU assumed control of G.& St.). In May Gold & Stock directors (amongst them George B. Field) applied for a British patent, covering what would eventually be three of Edison's U.S. patents, including that of the 'cotton' instrument. In early June the men set out to introduce Edison's ticker on the London stock exchange.

And in the spring of 1872 George Field and six British men incorporated the 'Exchange Telegraph Co' It began operations in June and employed Edison's universal stock printer. Edison supplied his tickers to the company for a year or so, when manufacture began in England.
The English instruments had the basic design of the universal stock printer with several details altered to increase transmission speed.
In 1902 a gentleman, named Frederick Higgings invented his own stock ticker. It was a beautiful instrument called the "Exchange Telegraph Stock Ticker" (British Patent 14,430).

1.8. His further life and inventions

As said before, the 'golden period' of the work of Edison in the telegraph area was in the 1868-1873 period. The rest of his life was mainly devoted to the many other areas in which he made most of his inventions. I will only say here a few words on Menlo Park and on his Carbon microphone.
This article is about telegraphy, so I will not dig any further into that period and refer the reader to the very many books and web-articles about it. I will only say here a few words on Menlo Park and on his Carbon microphone.

1.8.1. The Wizard of Menlo Park

After his demonstration of the quadruplex (simultaneously sending of four messages, two in each direction) telegraph system to Western Union, Edison was not sure that his original plan to sell it for $4,000 to $5,000 to them was right. So he asked Western Union to make a bid. He was surprised to hear them offer $10,000 (a small fortune at that time) which he gratefully accepted. So he could realize one of his dreams: to create "Menlo Park".
The Menlo Park Laboratory (erected in Menlo Park, a part of Raritan Township -now named Edison Township in his honour- in Middlesex County, New Jersey) was the first centre for research in which investigation by a team of individuals with diverse technical backgrounds and experience would be focused on developing practical products. The lab was equipped with the latest state-of–the-art scientific electrical, chemical and mechanical instruments, tools and materials required to perform experiments.
The years at the Menlo Park labs were most productive in Edison's working life. From 1876 through 1884, over 400 patents for electrical, electro-technology or electro-mechanical devices were generated at Menlo Park.
Edison was legally attributed with most of the inventions produced there, though many employees carried out research and development under his direction. His staff were generally told to carry out his directions in conducting research, and he drove them hard to produce results.
In addition to the inventions that came out of the lab, one can say that the lab itself is noteworthy as another of Edison's great inventions - the modern industrial research organization. Menlo Park was imitated by many large companies in the early 1900s and acted as a model for later industrial research labs such as the famous Bell Laboratories, also in New Jersey.
So it is not surprising that his nickname became "THE WIZARD OF MENLO PARK"

To commemorate Edison, the "Thomas Alva Edison Memorial Tower" was built in 1937 and dedicated to him the following year. The Tower is located where Thomas Edison had his laboratory and is known for the large light bulb at the top. The gatehouse was built to service it and during the 1940s, it evolved into the (small) "Thomas Edison Center Museum". The original buildings, including his house, laboratory and workshops, are long gone.
The commemorative plaque at the Menlo Park Museum says:
"*Between 1876 and 1882 at Menlo Park, New Jersey, Thomas Edison developed the world's first industrial research and development laboratory devoted to developing new technology. At this laboratory Edison and his staff developed the first system of incandescent electric lighting and electric power generation, and invented recorded sound and a commercially successful telephone transmitter."*

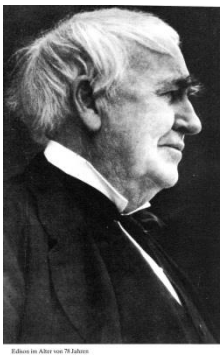
1.8.2. Carbon telephone transmitter

In my article / chapter on David Hughes, I briefly talked about his invention of the carbon microphone and the dispute he had about it with Thomas Edison. That's why I want to bring Edison's version here .

In 1876, Edison began work to improve the microphone for telephones (at that time called a "transmitter") by developing a carbon microphone, which consists of two metal plates separated by granules of carbon that would change resistance with the pressure of sound waves. A steady direct current is passed between the plates through the granules and the varying resistance results in a modulation of the current, creating a varying electric current that reproduces the varying pressure of the sound wave.

Up to that point, microphones, such as the ones developed by Johann Philipp Reis and Alexander Graham Bell, worked by generating a weak current. The carbon microphone works by modulating a direct current and, subsequently, using a transformer to transfer the signal so generated to the telephone line. Edison was one of many inventors working on the problem of creating a usable microphone for telephony by having it modulate an electrical current passed through it. His work was concurrent with Emile Berliner's loose-contact carbon transmitter (who lost a later patent case against Edison over the carbon transmitters invention) and David Edward Hughes study and published paper on the physics of loose-contact carbon transmitters (work that Hughes did not bother to patent).
Edison used the carbon microphone concept in 1877 to create an improved telephone for Western Union. In 1886, Edison found a way to improve a Bell Telephone microphone, one that used loose-contact ground carbon, with his discovery that it worked far better if the carbon was roasted. This type was put in use in 1890 and was used in all telephones along with the Bell receiver until the 1980s.

1.9. Final years



By the twentieth century, Edison had built in new Jersey a small industrial empire that culminated in 1911 in the organization of Thomas A. Edison, Inc.
Henry Ford, the automobile magnate, later lived a few hundred feet away from Edison at his winter retreat in Fort Myers. Ford once worked as an engineer for the Edison Illuminating Company of Detroit. They were friends until Edison's death (see further).
In 1926 he handed the leading role of 'T.A. Edison-Inc. over to his sons Charles and Theodore.
Edison was active in business right up to the end. He died of complications of diabetes on 18 October 1931, in his home, "Glenmont" in Llewellyn Park in West Orange, New Jersey, which he had purchased in 1886 as a wedding gift for his second wife Mina. He is buried behind the home.
Mina outlived Thomas Edison, dying on 24 August 1947.
His son Charles (1890-1969) took over his company after Edison's death (he was once governor of New Jersey).

1.10. Just a few of his many awards.

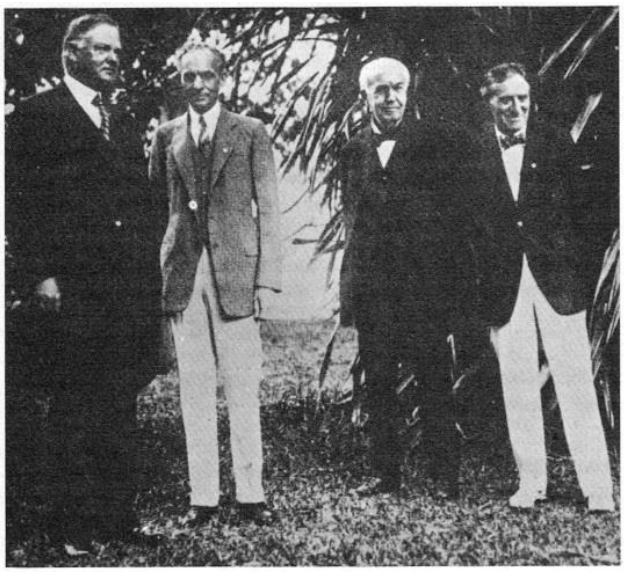
* Portrait of Edison by Abraham Archibald Anderson (1890), National Portrait Gallery (photo on the right).
* In 1881, the president of the Third French Republic designated Edison with the distinction of 'Officer' of the Legion of Honour (Légion d'Honneur). Later on he was named 'Chevalier' in the Legion, and finally, in 1889, 'Commander'.
* In 1887, Edison won the Matteucci Medal.
* In 1899, he was awarded the Edward Longstreth Medal of The Franklin Institute.
* In 1908, Edison received the American Association of Engineering Societies John Fritz Medal.
* In 1915, Edison was awarded Franklin Medal of The Franklin Institute for discoveries contributing to the foundation of industries and the well-being of the human race.
* In 1923, the American Institute of Electrical Engineers created the Edison Medal and he was its first recipient.
* In 1927, he was granted membership in the National Academy of Sciences.
* On May 29, 1928, Edison received the Congressional Gold Medal.
* In 1983, the United States Congress designated February 11, Edison's birthday, as National Inventor's Day.
* Life magazine (USA), in a special double issue in 1997, placed Edison first in the list of the "100 Most Important People in the Last 1000 Years", noting that the light bulb he promoted "lit up the world

* In 2010, Edison was honoured with a Technical Grammy Award.

The Port Huron Museum, in Port Huron, Mich., restored the original depot that Thomas Edison worked out of as a young news butcher. The depot has been named the Thomas Edison Depot Museum. The town has many Edison historical landmarks, including the graves of Edison's parents, and a monument along the St. Clair River.

1.11. More about Edison and Henry Ford

Ford's humble beginnings are well documented, and one of the first jobs he had was at the Edison Illuminating Company where he became a senior engineer. In his free time, while still working for Edison, he was designing and building his first automobile prototype. One day in 1896, at a convention of the Association of Edison Illuminating Companies in New York., Ford finally got the chance to approach Edison, his boyhood hero, and explain his ideas to him. According to the story, Edison was so impressed with Ford's ideas that it inspired him to continue down the road of car manufacturing. The two fast became friends and spent a lot of time together in the early 1900s when Ford's business took off and everyone was clamouring to buy their own personal cars. Their first meeting grew into a life time friendship. The two stood very close and spent much time together. In 1916, the two became neighbours. Vacancy neighbours, at least. That year, Ford purchased an estate next to Edison's winter home in Fort Myers, Florida that Edison had purchased in 1885. Between 1914 and 1924, Ford and Edison toured the eastern U.S. in Ford cars for a series of camping trips. The two 'Best Friends Forever' were joined by other famous figures, tire-maker Harvey Firestone and essayist John Burroughs, and branded themselves "the Vagabonds" for their cross-country adventures. The trips functioned as advertisements for Ford cars and Firestone tires, generating headlines like "Millions of Dollars Worth of Brains off on a Vacation" and "Genius to Sleep Under Stars." Of course, the trips were also just a good ol' time with the boys out in the wilderness, where they'd challenge each other to races and tree chopping and high kicking contests during the day and tell stories around the campfire at night. Especially during Edison's last years, Ford entertained Edison with silly activities such as holding wheelchair races (Ford bought several of his own to compete with the wheelchair-bound Edison). At the 50th anniversary of the light bulb Edison was even quoted saying: "As to Henry Ford, words are inadequate to express my feelings. I can only say that in the fullest meaning of the term, he is my friend."



Präsident Hoover, Henry Ford, Edison und Harvey Firestone (v. l. n. r.) bei Fort Myers, Florida, an Edisons 82. Geburtstag, 1929

HENRY FORD AND THOMAS A. EDISON
HENRY FORD MUSEUM and GREENFIELD VILLAGE, DEARBORN, MICHIGAN

Henry Ford and Thomas Edison in conversation at Greenfield Village, in 1928. Their friendship had begun in 1896, when Edison encouraged the then young and unknown Ford's automobile experiments.

The deafness, which had afflicted the inventor since childhood, is evident in this pose, as Henry Ford speaks loudly into his ear.

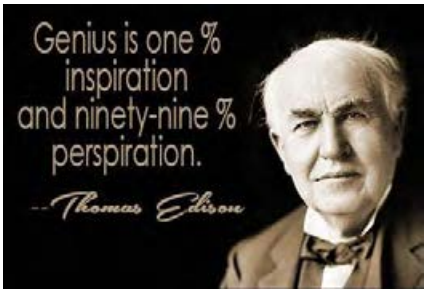
1.12. Edison's Last Breath Lives in a Test Tube ?!?

http://pietrow.net/relics/

In the Henry Ford museum we can find a testament to this friendship in the form of a small glass test tube that was once given to Ford by Edison's son, a test tube that is alleged to hold the last breath of Edison. This tube was one of Fords closest possession, one that he kept privately until his death, a possession that was now known to exist until it was catalogued by the Ford museum in 1950. The tube was then forgotten in the depot for a few decades until it was rediscovered in 1978 and put up on display in the museum, where it is to this day. For a long time it was believed that, upon Fords request, Edison's last breath was captured in a test tube and sealed with paraffin wax in order to capture his soul, potentially for resurrection. An explanation that was not met with much scepticism as Henry Ford was a known 'mysticist' who believed in the paranormal and reincarnation. However at a later date a letter was discovered between Edison's son Charles and the columnist Walter Winchell. In this letter Charles stated a different story about the tubes, it said that he had noticed a number of test tubes standing open in a rack in the bedroom in which his father had just died. They did not contain the last breath of Edison, but rather the air of the room in which he took his last breath. Charles had asked the attending physician to seal the tubes with a cork and paraffin wax, one of these was sent to Ford at a later date, while the remaining 7 were kept in the family. Note: Many sites state that there were 40+ tubes instead of 8, however in a letter between Charles Edison to Walter Winchell from 1953, Charles states that there were originally 8, one of which went to Mr. Ford. It is currently not know if the remaining 7 still exist and if they do, where they are.

1.13. Some quotes

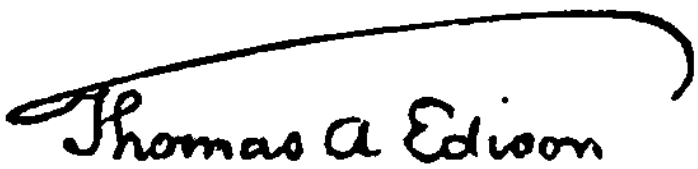
Is this his most famous one?



Ref [4] lists 300 quotes 'all from Edison'; I have some serious doubts about this, but anyway….

Did you know that Edison coined the term "Bug"?

See [13]



PART 2: HIS TELEGTRAPHS

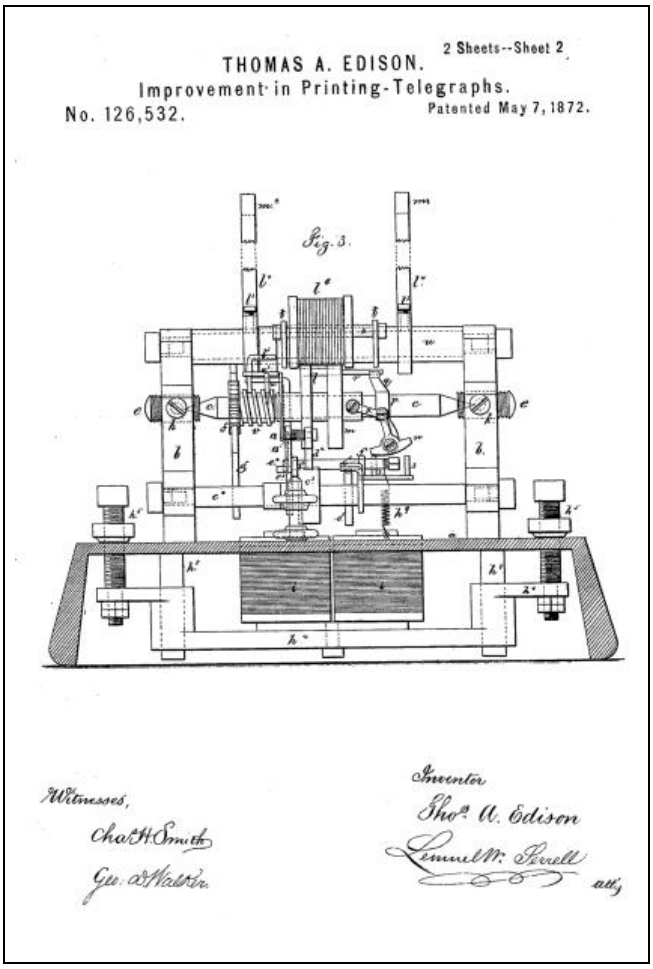
2.1. Introduction

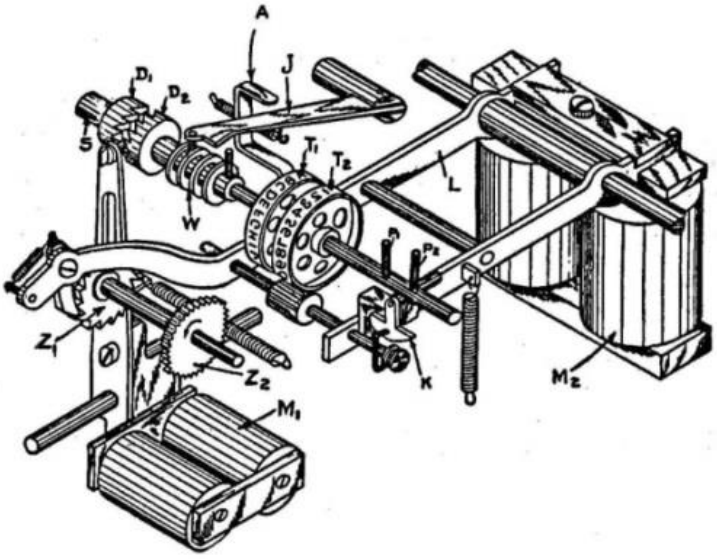
In most of my articles I describe the apparatus that is/was in my collection, together with a lot of images and photos. I will do the same here but my collection was restricted to only one Edison stock ticker, the 'famous' UNIVERSAL Stock Ticker.

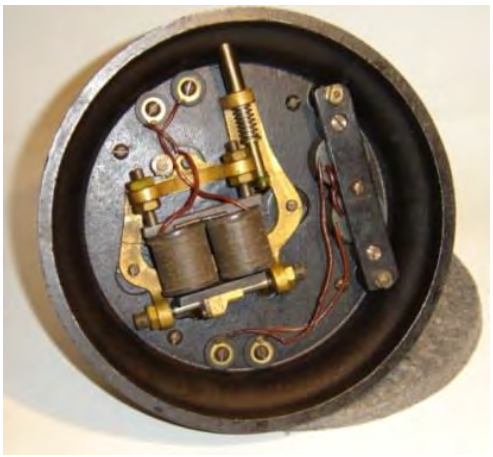
I am taking the liberty of also bringing to your attention one of my other tickers, the so called SELF-WINDING. One of the reasons is to make a clear statement that this one was NOT designed by Thomas Edison - contrary to what is generally stated.

2.2. The Universal Stock Ticker…….

This famous telegraph became also known as the Western Union 3A.







2.3. Two receivers from the Exchange Telegraph Company of London

In addition I am showing here some of my telegraphs from the British 'Exchange Telegraph Co' (EXTEL) - quite logical as we have seen in PART 1 that their first instruments were Edison ones.

The one on the left is derived from the Universal by Edison (see chapter 1.7.)

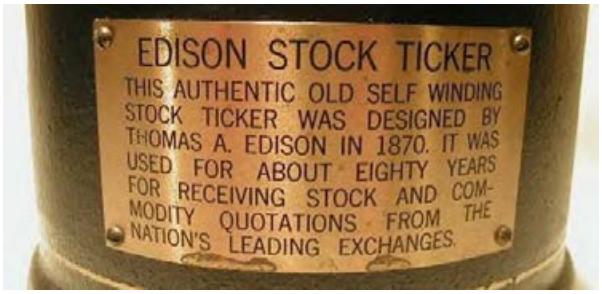
2.4. The Self-Winding stock ticker from the early 20-th century.

2.4.1. First a warning: The Thomas Edison Myth [16]

Now and then a "self-winding Edison" ticker shows up for sale (eBay,…). Not the model from the 1870's but from the early 20-th century!!

Rusty Erpenbeck [16], on his http://www.lostwackys.com/tickers/self-winding-tickers.htm warns again this myth, or most often, this scam. Here is his message:

Quote
Many people still believe that Thomas Edison invented that particular Self-Winding Ticker. In part, because some are marked "MF'D BY T A EDISON INC". Many self-winders were manufactured in Edison's factory, but he had nothing to do with its invention. In fact, when the new self-winder came out, over 30 years had already passed since Edison's last ticker patents; and all had expired!
Furthering the myth, in the 1940's or 1950's, it is believed that at least one retailer purchased many obsolete self-winders from Western Union and sold them as novelties with this brass plaque attached.



In the 1960's, retiring Western Union executives would often receive one of these "Edison" self-winders as a gift from Western Union. It has come to the point where even the Edison Museum displays one of these tickers with the Edison plaque as one of his first inventions, and they even sold postcards of it.
Unquote
I got another confirmation of this scam from Pierre Blanc: "A catalogue company called Hammacher Schlemmer. offered some they bought for sale in the 1960's. You could buy them through the mail or in their stores. They wrongly affixed a plaque to the front of the tickers they sold calling it an Edison ticker from 1870, which is completely incorrect."

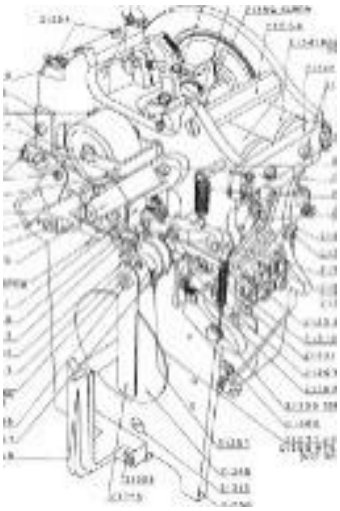
2.4.2. The receiver

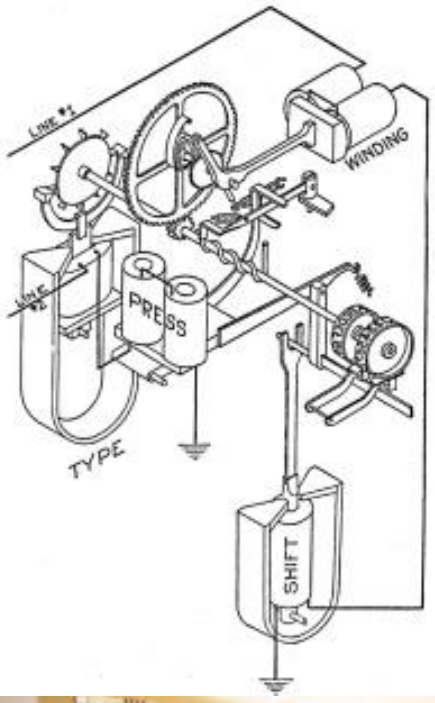
So, it is clear that they have nothing to do with Thomas A. Edison. The only connection to "Edison" this machine had was that it was assembled in a factory that bore his name. Other manufacturers made 100% identical models (e.g. J.H. Bunnell & Co, Hurd & Haggin, M&I Electric Co,…). Based upon the known serial numbers it is estimated that about 16,000 were made (and where have those all gone? ;o).
The Gold & Stock Telegraph Co. (owned by Western Union) introduced the Self Winding, which was invented by Georges Scott in 1902. In 1923 Western Union engineers, with the help of Scott, improved the original one and the official designation was the "Western Union Automatic Self-Winding 1-C Stock Ticker". Minor improvements were made to it, including more efficient magnets and an ink box which housed two ink rollers. Typical model types are the 3-A, 23-A, 33-A, …
It is called 'self-winding' ticker because a small watch spring, which furnishes the power to revolve the typeshaft, is wound automatically by current impulses sent over the wires.
In Europe, so far as I am aware, stock ticker reporting systems were only used in the Netherlands. The service was set up by Western Union. They had an office in Amsterdam and exploited an existing telegraph line to New York. The start-up date was 2 November 1931. In 1935 the "TIKKERDIENST" (meaning Ticker Service) extended its services to The Hague (it has never operated in Rotterdam) [15].

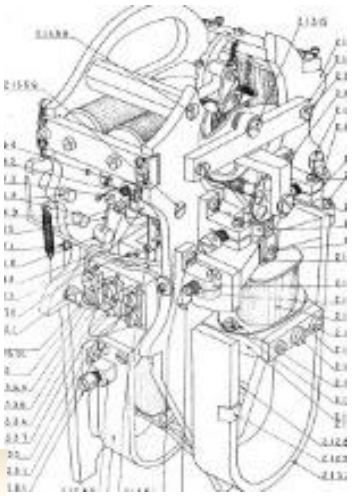

TIKKERDIENST
AMSTERDAM

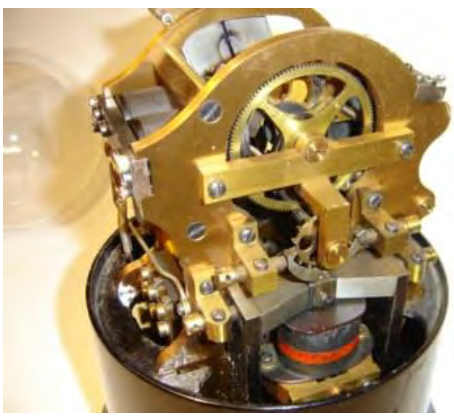

QUOTATIONS FURNISHED
WESTERN UNION TELEG
APPLY TO LOCAL MA


QUOTATIONS FURNISHED BY THE
WESTERN UNION TELEGRAPH CO
APPLY TO LOCAL MANAGER




WINDING
PRESS
TYPE
SHIFT





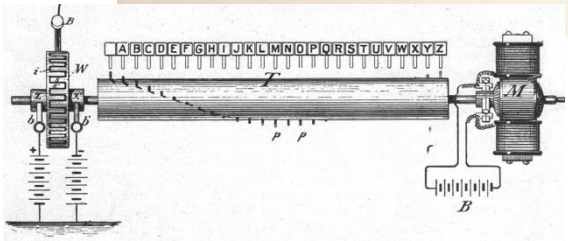

200th Anniversary-
New York Stock
Exchange-1792-1992
NEW YORK
MAY 17
1992
10199
1792
1992
USA
29
FIRST DAY OF ISSUE


UNITED STATES POSTAGE
3¢

2.4.3.. The transmitter

This transmitter was used to drive both the Universal Ticker as well as the Self Winding one [12]. Through repeating relays and reasonable care in balancing lines, one central office transmitter could drive dozens of tickers over distances of 300 to 500 km.

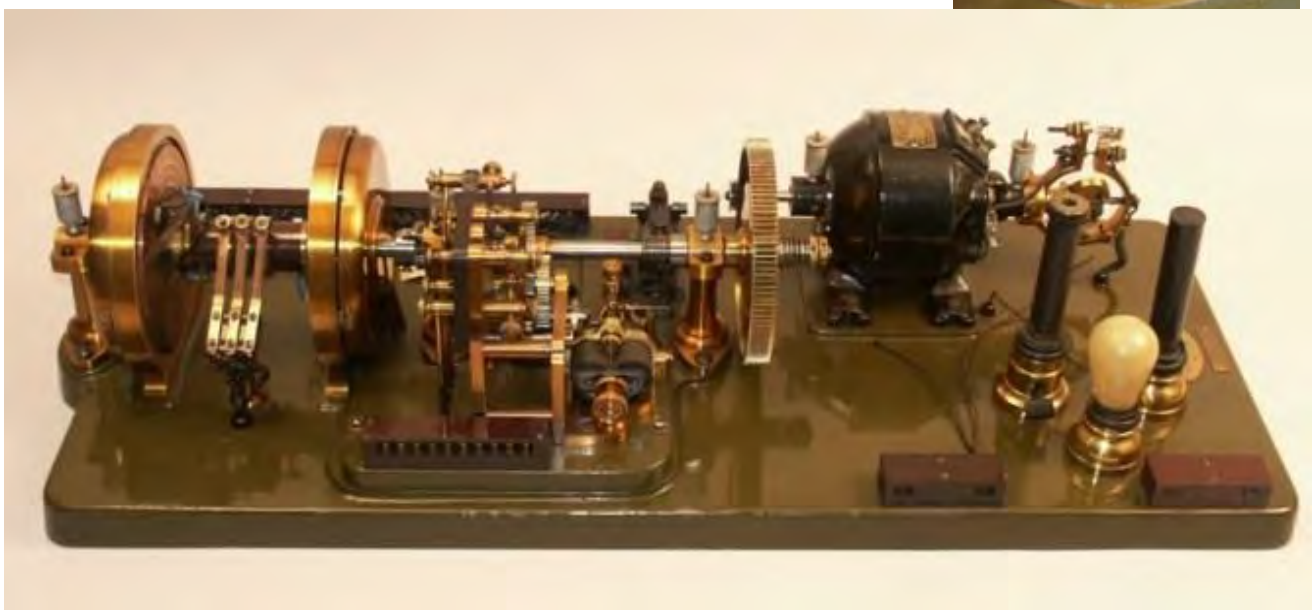
Ticker keyboard transmitter universal



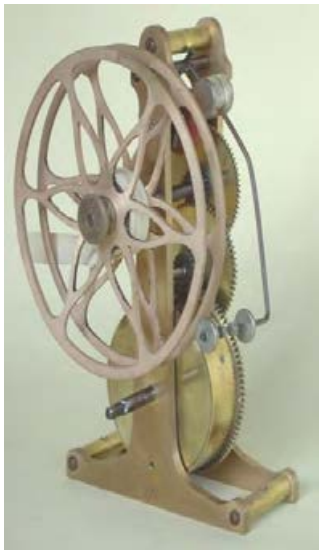
2.5. Other (non Thomas Edison) equipment at the central site.

This was used by Western Union well in to the 19tth century.

Automatic transmitter 10-BKeyboard Transmitter



Two Anti-Noise Sets2-A
Two Ticker Condensor2 3 AC
Stock Ticker Tape winder
Keyboard Perforator
S-N circuit Panel 3-A and 1A



2.6. Some photographs from a friend with an amazing collection of stock tickers [P.B.]

They are all completely unrestored and original with all parts intact.

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[3] https://en.wikipedia.org/wiki/List_of_Edison_patents

[4] https://www.azquotes.com/author/4358-Thomas_A_Edison

[5] EDISON; Fr. VÖGTLE; 1990; 158p.; small format; in German.

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[7] AMERICAN TELEGRAPHY; W. MAVER jr.; 5th ed. 1912; 695 p.

[8] ELECTRICIANS AND THEIR MARVELS; W. JERROLD; 2nd ed.; Date ?; 160 p.

[9] THE SPIRIT OF INVENTION; J. FENSTER; 2009; 210 p.

[10] KEY AND TELEGRAPH; my friend R. REINKE (+); November 1996; Article in the AWA bulletin; 2 p.

[11] THE TELEGRAPH Its History and Present Development; The WESTERN UNION Co.; c. 1915: 23p. small format.

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[13] http://theinstitute.ieee.org/tech-history/technology-history/a-history-of-wall-streets-stock-tickers
and http://theinstitute.ieee.org/tech-history/technology-history/did-you-know-edison-coined-the-term-bug

[14] AUTOMATIC AND PRINTING TELEGRAPH SYSTEMS – Part VI – Instruction paper; 1919; The Western Union Telegraph Co.

[15] ICT IN INFORMATION SERVICES, Use and Deployment of ICT in the Dutch securities trade 1860-1970; J.M. HERMANS; Erasmus University Rotterdam; 2004; 267 p.

[16] http://www.lostwackys.com/tickers/self-winding-tickers.htm from Rusty Erpenbeck

[17] EXTEL 100 The centenary History of the Exchange Telegraph Company; J.M. Scott;1972; 235 p.

Also:

http://www.thomasedison.com/Inventions.htm

https://curiosity.com/topics/thomas-edison-and-henry-ford-were-both-iconic-inventors-and-best-friends-curiosity/

http://pietrow.net/relics/

http://www.edisonticker.com/

WITH THANKS TO

My thanks go to Mr. **Pierre Blanc**. Pierre, a good friend of mine, works in the financial world in New York and has been interested in stock tickers for many years. He became a world authority with his knowledge about stock tickers and his unique collection.

Mr. **Sam Hallas** has been so kind as to do a quick review of my 'Flemish English'. Sam is on the committee of the U.K. Telecom Heritage Group (THG) where he is the archivist. And as a Desk Top Publishing specialist delivers each quarter a great THG Journal.

APPENDIX 1: The American patent system (out of [1])

America's patent laws and practices were a crucial feature of the world within which Edison the inventor matured. The US. Patent Office administered these laws and collected fees from inventors in order to meet its operating expenses. These fees, quite modest in comparison with their British counterparts, made US. patents accessible to many inventors American patents provided inventors with exclusive ownership of their creations for seventeen years. In return, inventors had to disclose to the public the details of their invention. The patent system, established under the US. Constitution, was intended to provide economic incentive for the inventor, who could assign all or partial rights in a patent to other individuals or companies. Inventors frequently sold their patent rights for a flat sum or in exchange for royalty payments. Some also obtained financial support for past or on-going inventive activity or for help in establishing businesses to exploit their inventions.

To obtain a patent, the inventor submitted to the US. Patent Office an application consisting of a proper specification, carefully measured drawings, and, in most cases, a physical model of the invention (see note 1 below). The application required careful preparation so that it clearly stated its claims and described the invention and how it worked. After the inventor submitted the application, an official examiner scrutinized it and determined whether the description and claims were satisfactory. If the examiner concluded that the application was acceptable and that the invention was new, useful, and unknown prior to the time of submission, a patent could be issued. If an application was rejected, the inventor could amend the written description or the claims but not the drawings or model. Such amendments were allowed in order to make the application clearer or to make the claims more precise or narrow. The cycle of rejection and amendment could involve many rounds and take many years before the patent was issued or the application was abandoned.

If two or more persons submitted applications for substantially the same invention, the Patent Office issued the patent to the inventor with the best claim to priority. This often made inventive activity much like a race, particularly when others were known to be working on the same problem. It also placed a premium on careful record-keeping and secrecy. To establish priority, inventors at this time often submitted caveats to the Patent Office. Caveats were preliminary applications in which the inventor made claims to one or more potential inventions without presenting the detail required in a formal application. The Patent Office noted the subject matter of the caveat and placed it in a confidential archive. If within one year another inventor filed an application on a similar process or device, the Patent Office notified the holder of the caveat, who then had three months to submit a formal application (see note 2).

When two or more inventors submitted similar patent applications or when one inventor submitted an application for an invention that had already been patented by another, these applications and patents were declared in interference with each other. The Patent Office then held a quasi-judicial hearing be-fore the examiner of interferences to determine which inventor had priority. The proceedings often included depositions, testimony, exhibits, and arguments. The inventor could appeal the decision of the examiner first to the commissioner of patents and then to a federal court in the District of Columbia. The Patent Office could not rescind an issued patent, but it could issue a patent for the same invention to a second inventor who established priority. The issuance of a patent did not, therefore, provide the inventor with a definitive claim. Economically significant patents were often challenged in court on grounds of priority, novelty, and ownership.

Many inventors turned to professional patent solicitors and agencies to ensure the cogency of their claims in applications and to defend their patents in interference proceedings. Because any person of intelligence or good moral character could appear as a patent attorney, many mid-nineteenth-century patent solicitors had no formal legal training. Commonly they had some technical training and had made a study of the patent laws and procedures. For example, Franklin Pope, a telegraph engineer and inventor who was associated briefly with Edison, served as a patent expert for the Western Union Telegraph Company and then established his own practice as a patent attorney. Only attorneys admitted to the bar, however, could bring suit in the federal courts regarding infringement or ownership of a patent, and a number of such attorneys specialized in patent law.

The popular magazines *(*like *Scientific America)* presented articles about the Patent Office and patent law, editorialized about needed reforms, and published information about the latest patents issued.

Note 1

The 1861 Patent Act set fees that remained in force for several decades. These included $15 for filing application, $10 for filing a caveat, and $20 for issuing a patent. Additional fees were collected during interference proceedings, when recording an assignment, or for design patents. (These fees were substantially lower than the ones demanded in the UK.)

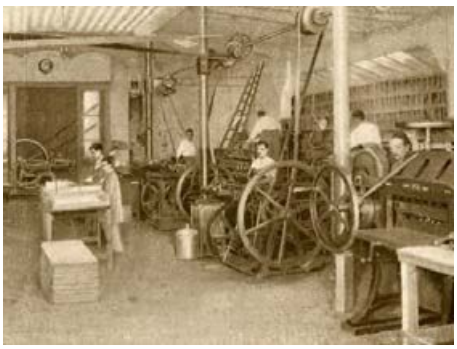
Note 2

A caveat could be renewed annually. The caveat procedure fell into disuse during the late ninetieth century, and Congress abolished it in 1910

APPENDIX 2: How did they make it?

This is a question that often people ask me when admiring some of the most beautiful telegraphs. Their afterthoughts mostly are: "is this all made by hand … they had no electricity… so no machines… probably only very rudimental tools".
Here is how to make that clear:
In the nineteenth-century they had machines like lathes. In the small shops the power to drive them came from a foot-pedal (like my grandmother's sewing machine). In the big workshops the power was transmitted from a steam engine or waterwheel by means of horizontal, rotating overhead shafts that ran through the shop and were connected to the machines on the shop floor by leather belts that moved in vertical loops.
Apart from lathes they had punch presses, drop presses (a form of power hammer), screw presses, milling machines (to shape metal the same way planning machines shape wood), screw and gear making machines (adapted lathes), and so on.
In the early years manufacturers usually had a special set of tools for each instrument they made, including jigs to guide machines; gauges to check work; cutting blades for milling machines, shapers and lathes of course, &c…
Some of the tools were standard, other were designed to shape specific individual parts and were probably useless for other work.

Photo top left: Edison Workshop Caton – late 1860's



APPENDIX 3: Chronology of the Stock Ticker [by Pierre Blanc]

1. E.A. Callahan of The American Telegraph Co. invented the first stock ticker in 1867. He formed The Gold & Stock Telegraph Company in NY on Sept. 19, 1867 to manufacture & market the tickers. The first ticker was placed in the office of David Groesbeck & Co. in NY. In Sept of 1871, Western Union Telegraph Company took over The Gold & Stock Telegraph Co. Mr. Calahan resigned.
2. Samuel Laws invented the Laws Stock Ticker in 1867 & started the Reporting Telegraph Company to market the ticker & service. Laws retired early and sold his patents to The Gold & Stock Telegraph Co.
3. Thomas Edison invents the two wire Universal Stock Ticker in 1870-1871. Sets up shop in Newark, NJ on Railroad Ave with William Unger to manufacture stock tickers called the Newark Telegraph Works. Patents are bought by Gold & Stock. In 1871, Edison moves shop to Ward St. & changes company name to Edison & Unger. Continues making Universal Tickers. Approximately 6k Universals were produced. In 1872, Edison supplies the Exchange Telegraph Co of London with a stock ticker designed with the help of Unger. Used without success until 1902 when FW Higgins invented the EXTEL Ticker. Edison & Unger dissolve their partnership.
4. George M. Phelps of Gold & Stock invents the Phelp's Stock Printer called "The Financial Instrument". Its use was limited due to its delicate nature & expense.
5. In 1871 The Manhattan Quotation Co. produces a single wire stock ticker invented by J.E. Smith & Charles T Chester. The company was acquired by Gold & Stock. Tickers were leased for $10/month. Stock quotes and symbols were printed in one line, making it difficult for brokers to read.
6. The Commercial Telegram Co. ignores all patent rights & introduces its own ticker invented by Stephen D. Field in 1880. They were ordered to pay Gold & Stock $266K for patent infringement.
7. Gold and Stock produced a superior ticker invented by George B. Scott called the Scott Ticker to compete with The Commercial Telegram Co. This new Gold & Stock machine sat in a beautiful wood base. Due to a falling out between The NYSE and Gold & Stock, the Commercial Quotation Ticker becomes the official ticker of the NYSE instead of the Scott Ticker.
8. The Commercial Telegram Co is taken over by the NYSE in 1889 & renamed The New York Quotation Company. They manufactured a refined version of Field's original ticker called The New York Quotation Stock Ticker at their West Street Plant. This became the exclusive ticker used on Wall Street.
9. The Stock Quotation Company introduced their own stock ticker invented by A. Wirshing & was greatly improved by John Burry, incorporating a self-winding device. This ticker was used by the Consolidated Exchange and became known as the Burry Ticker. 11,666 Burry tickers were in service. By 1923, most Burry tickers were used in sporting and financial gossip services of various News Bureaus throughout the East.
10. The Gold & Stock Telegraph Company (owned by Western Union) then introduced the Self–Winding Stock Ticker which was invented by George B. Scott of Gold & Stock & W.P. Phelps of the Philadelphia Local Telegraph Co & Mr. Barclay & Mr. Page in 1902. This Scott-Phelps-Barclay-Page ticker became known simply as the Self-Winding Ticker.
11. In 1923, Western Union engineers with the help of George B. Scott improved the original Self-Winding Ticker and the official designation was the Western Union Automatic Self-Winding 1-C Stock Ticker. Minor improvements were made to it including more efficient magnets and an ink box which housed two ink rollers. Models designations ranged from the 32-A to the 35A. The Self-Winding is the model that most people associate with Wall Street.
12. Western Union introduced a new, high speed ticker in 1930 called the "Black Box" 5-A Ticker. It was made for them by the Teletype Co.
13. The New York Quotation Co. introduces the last of the mechanical stock tickers in 1960 called the Series 900.