1 Francois Van Rysselberghe, a pioneer of long-distance telephone networks

1.1 Introduction: his early life

Figure 1: François Van Rysselberghe (1846-1893)

François Van Rysselberghe (1846-1893) was born in Ghent, Belgium as the oldest son of a humble carpenter. Besides François, there were four other sons, which were remarkable in their area of interest:

- **Julien Van Rysselberghe** (1852-1931) was an engineer *"des ponts et des chaussées"* (government official responsible for bridges and roads) and became in 1891 professor at the science faculty of the Ghent university.
- **Charles** (1850-1920) and **Octave Van Rysselberghe** (1855-1929) were known as famous architects.
- **Theo Van Rysselberghe** (1862-1926) was at the end of the 19th century a famous painter (he became in the 1890s expert in pointillism). One of his numerous paintings is the children of his older brother François Van Rysselberghe (*see Figure 2*), which can be seen at the Museum of Fine Arts in his hometown of Ghent, Belgium.

Figure 2: The children of François Van Rysselberghe

Painted by his younger brother Theo Van Rysselberghe in 1885. Painting in the Museum of Fine Art in Ghent, Belgium

1.2 Early achievements

As a young boy Van Rysselberghe attended the college Saint-Barbe, in Ghent, Belgium, from which school he was graduated with honor in 1863, at the age of 17. He was the son of a humble carpenter. Although he was a brilliant student, he could not afford to go to the university, so he became a self-made engineer and scientist. He became teacher at the Ostend school of Navigation while he was still a teenager. In 1866 he passed an exam and was nominated professor of nautical astronomy and mathematics at the same school. He was the very best of all candidates. While teaching as a professor in Ostend, he prepared the exam of *"candidate in physical sciences and mathematics"* at the university (without attending any course), and succeeded in 1869.

In the 1870s he became meteorologist at the Royal Observatory of Brussels, and designed several automatic meteorological instruments, such as the "téléméthéorographe". This instrument was capable of doing meteorological measurements at the Belgian coast in Ostend and send the data to the Royal Observatory in Brussels over telegraph lines[1]. A major achievement in the 1870s! At the Paris Electrical Exposition in 1881 he registered with this device at the Hall of Industries the meteorological conditions prevailing at Brussels, at a distance of 340 kilometers. The information was sent in real time over a telegraph line, which was astonishing for his international colleagues.

He came up with an idea of continuously collecting meteorological data from 43 sources in Europe and generating "on line" weather maps, but this project stayed in the conception phase.

During his work as a meteorologist he did some experiments in the beginning of 1882 on the telegraph link between the Royal Observatory in Brussels and the measuring station in Ostend. As telephony came up, he thought it would be interesting to have a long distance telephone connection, and he tried to carry telephone signals over the telegraph network, and so we come to the following section of this document.

1.3 Telephony around 1880

Telephony was invented by several people, but commercialized after the inventions of Alexander Graham Bell in 1876.

In the beginning of the 1880s, telegraphy networks existed in Europe already for decades, and were used and controlled by European governments as their communication network. It was installed nationwide, with international links to their neighboring countries. Telephony was at that point in time considered as a hype and not important. It was mostly used for local communication only.

[1] The "télémétéorographe" was capable of logging six meteorological parameters: air temperature, air humidity, rain- or snowfall, wind direction, air pressure and air speed.

From this perspective a separate telephony network was unnecessary, there was a limited use only of long distance connections. The first telephone lines were, for convenience, usually strung right alongside existing telegraph lines. But the strong electrical pulses in the telegraph wires induced currents in the phone lines and interfered with the transmission. “Induction” or “crosstalk” as we should call it today. But the noise was very annoying for the telephone user, a regular voice conversation was almost impossible.

1.4 Mixing telephony with telegraphy

Van Rysselberghe came up with the idea of running both signals (telephony and telegraphy) on the same line. He turned the problem into one of signal retrieval.

He invented circuits to separate telephone and telegraph signals on the same wire. Using a coil of wire an inductor was formed that could filter *the lower Morse frequency* from *the much higher voice frequency*. The **inductor** blocked the *higher voice frequency* but allowed the *low Morse frequency* to pass. Similarly but opposite to the effect of the inductor, a **condenser** (capacitor) was installed that passed the *higher voice frequency* but blocked *the low Morse frequency*. The two separated frequencies were diverted the respective instruments, either the Morse instrument or the telephone instrument. So now he had means for carrying **telephone signals over really long distances over telegraph networks.**

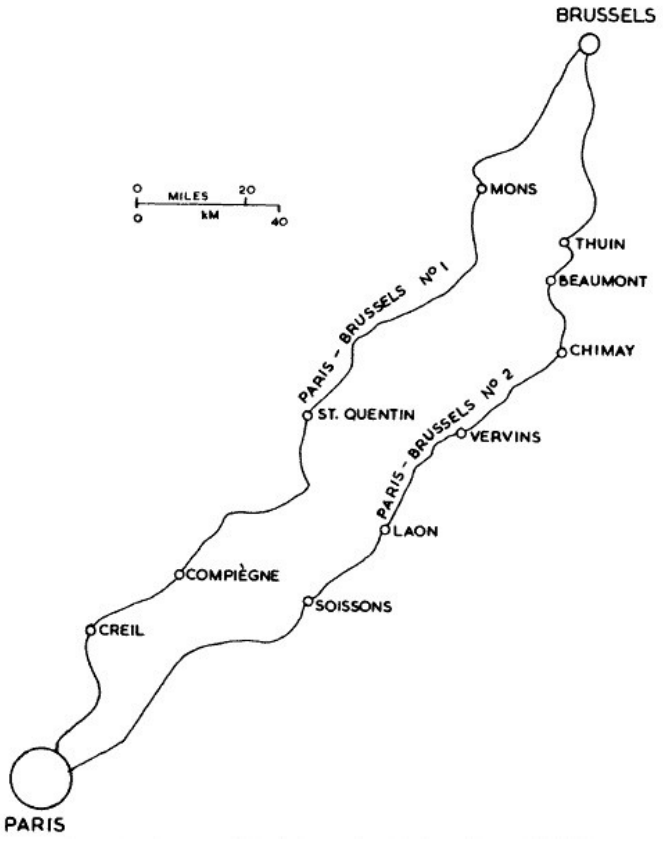


Figure 3: Test setup of the Van Rysselberghe system between Brussels and Paris (1882)

In 1882 François was appointed professor at the well-known Ghent university and gave courses about electrical applications.

At the same time he conceived the idea of transmitting 12, 18 up to 24 signals over the same wires. What we call multiplexing today.

After his tests within the Royal Observatory in January 1882 some more tests were done on the Belgian telegraph network, and a few months later a test on a link to Paris gave good results. Also a test over a submarine cable to Dover was also successfully.

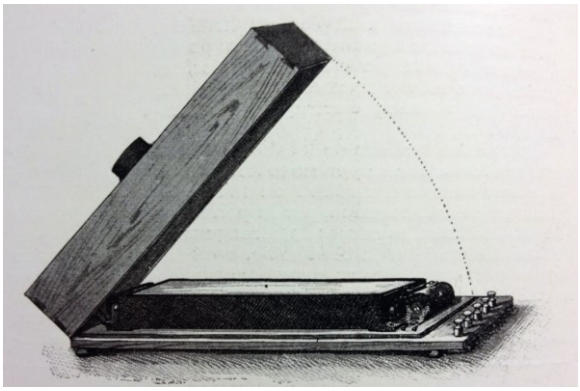


Figure 4: Unit with 2 anti-induction circuits of Van Rysselberghe

1.5 Business association with Charles Mourlon

Figure 5: Charles Mourlon (1851-1932)

Charles Mourlon (1851-1932) was a business man of Brussels mainly active in electro-technical applications. From 1880 until 1889 he worked together with François Van Rysselberghe to commercialize his invention of using the same wires for telegraphy and telephony. Together they sold licenses and apparatus for what was called **"the Van Rysselberghe system"** all over the world.

This invention, patented in 1882 in Belgium and the UK, caused the rapid expansion of the Mourlon works in Brussels. Later on patents were obtained worldwide.

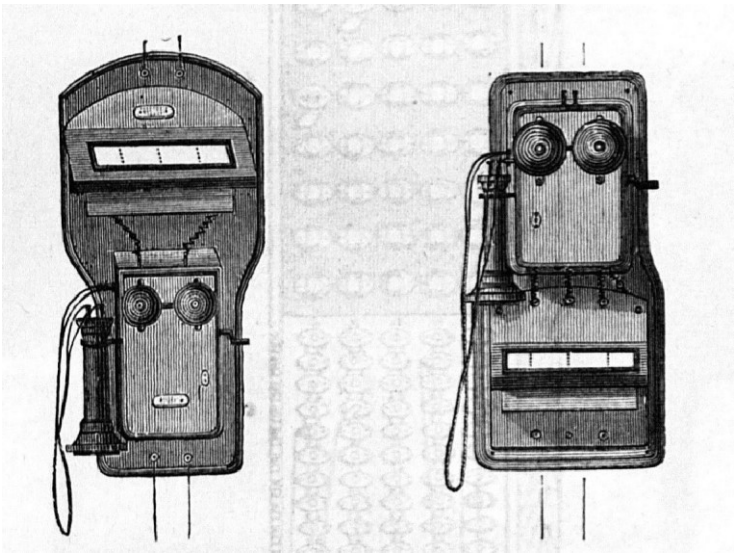


Figure 6: Commercial phones from Ader, adapted for long distance by Van Rysselberghe

Used by the Belgian telegraph services

All adaptions could be done at the telegraph circuitry. On longer distances an enhanced microphone (higher level of transmission) in the telephone, and a battery with a low resistance were recommended. Adapted Van Rysselberghe phones were sold when necessary. Background on Ader: *see note*[2].

[2] **Clément Ader** *(April 2, 1841 - May 3, 1925)* was a French inventor and engineer. Ader was an innovator in a number of electrical and mechanical engineering fields. He originally studied electrical engineering, and in 1878 improved on the telephone invented by Alexander Graham Bell. After this he established the telephone network in Paris in 1880. In 1881, he invented the théâtrophone, a system of telephonic transmission where listeners received a separate channel for each ear, enabling stereo-

1.6 Installation on several networks internationally

The real importance of van-Rysselberghe 's system of simultaneous telephony and telegraphy was that it enabled a long-distance telephone service to be provided at a time the demand for such service was not really established. It was not therefore thought economic to provide the separate and isolated telephone roots that would otherwise have been needed.

1.6.1 The Belgian network

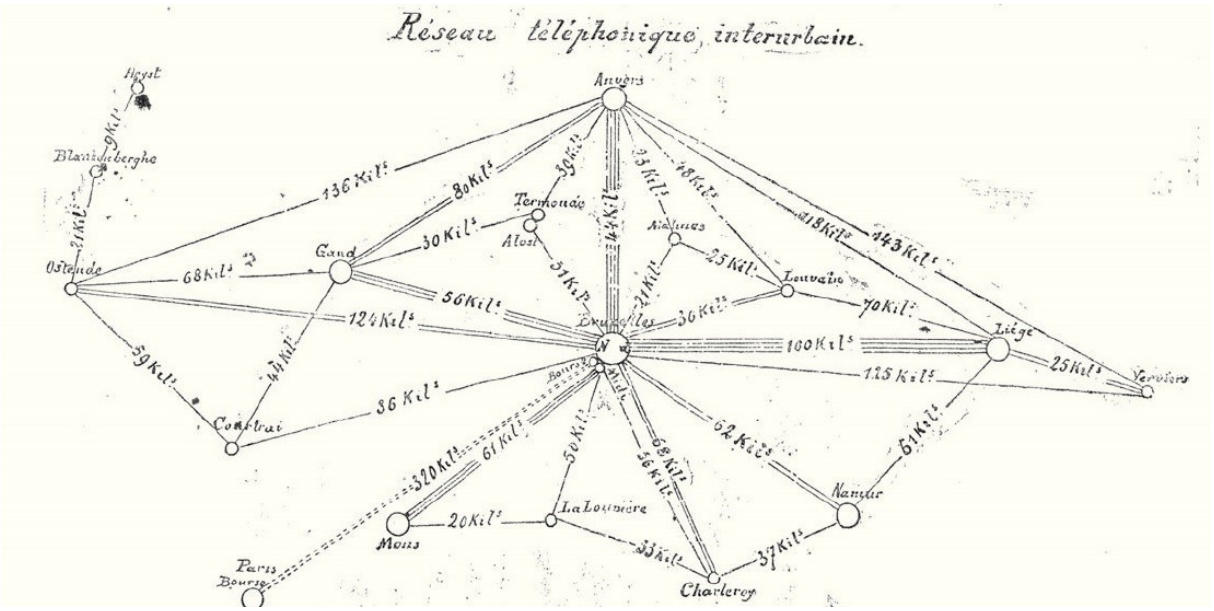


Figure 7: Drawing of the Belgian Long Distance telephone network, superimposed on the telegraph network (1885)

After the successful experiments the Belgian government reconsidered his program to foresee 600 km of new telephone lines, which would cost 3 million Belgian Francs. Finally they choose for the cheaper plan of fitting existing telegraph lines with *the Van Rysselberghe system* of simultaneous telephony and telegraphy at a cost of 150000 Belgian Francs, only 5 percent of the original cost!

The first long-distance telephone network over telegraph lines came commercially in service in Belgium on September 1, 1884.

phonic perception of the actors on a set; it was this invention which gave the first stereo transmission of opera performances, over a distance of 2 miles.
Ader is still admired for his early powered flight efforts, and his aircraft gave the French language the word "avion" for a heavier-than-air aircraft. In 1938, France issued a postage stamp honoring him. Airbus named one of its aircraft assembly sites in Toulouse after him. Clément Ader has been referred to as "the father of aviation". (source: https://www.sciencesource.com °

Figure 8: People at the world fair in Antwerp listen to a concert from Brussels (1885)

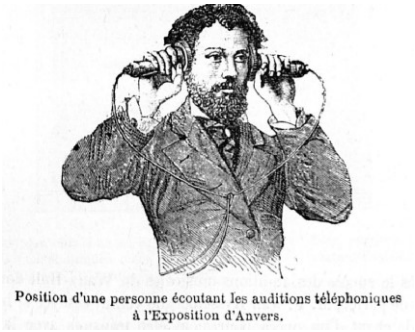

Position d'une personne écoutant les auditions téléphoniques à l'Exposition d'Anvers.

Figure 9: Listener in Antwerp

At the world fair in Antwerp in 1885 there was a demonstration of long distance telephony over Van Rysselberghe circuits sent from a concert hall in Brussels to a hall at the world fair in Antwerp. A concert was relayed from an number of microphones of Van Rysselberghe 's design in the concert hall, over a Van Rysselberghe 's circuit to listeners in Antwerp[3]. 35 people could simultaneously listen to the concert: 1885 "streaming" technology!

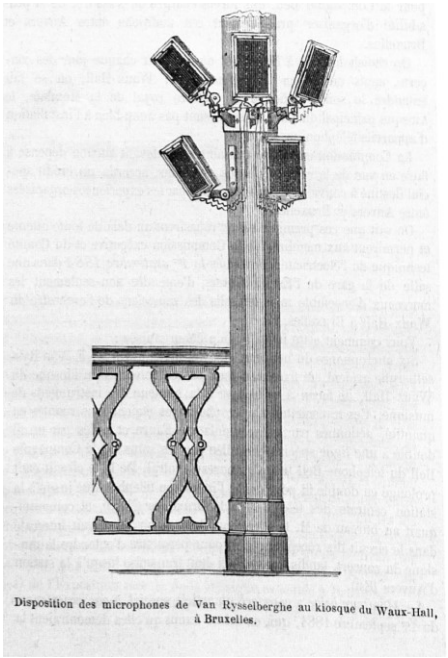
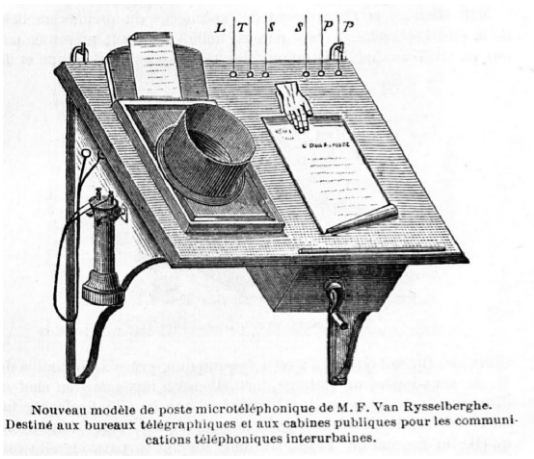

Disposition des microphones de Van Rysselberghe au kiosque du Waux-Hall, à Bruxelles.

Figure 10: Microphones of Van Rysselberghe at the concert hall in Brussels

Listeners were astonished, here a reaction (translated): *"Not only were the orchestral pieces reproduced with the greatest clarity, but the violin sole executed by M. Herman, Gounod's 'Meditation' could be heard in Antwerp without any detail of execution being missed by the listeners."*

[3] In 1884 several tests were performed. One particular concert was sent from Brussels to the royal cottage in Ostend, since the queen seemed to be interested in the new technology… and music!



Nouveau modèle de poste microtéléphonique de M. F. Van Rysselberghe. Destiné aux bureaux télégraphiques et aux cabines publiques pour les communications téléphoniques interurbaines.

Figure 11: Van Rysselberghe phone for phone booth

New telephone designed by Van Rysselberghe intended for use at the telegraph offices and phone boots for long-distance calls. One of the enhancements is the ebonite cylinder above the microphone, so the "sound waves" of the voice are guided to the microphone.

On the world fair there was also a phone booth where people could make phone calls to all major cities in Belgium, "long-distance calls" were new at that point in time!

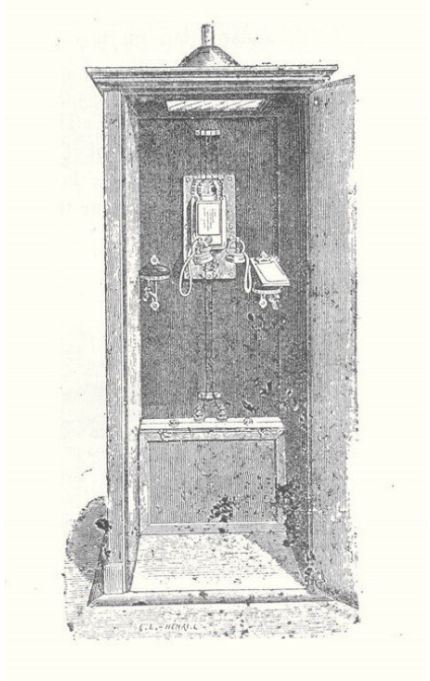


Figure 12: Phone booth at the Paris Stock Exchange (1887)

One of the first customers to use the link Brussels-Paris also for telephony was the Paris Stock exchange. Seven phone booth were installed at the Paris Stock exchange. The customer had a small desk to make notes during their conversation with people i.e. at the Brussels Stock exchange.

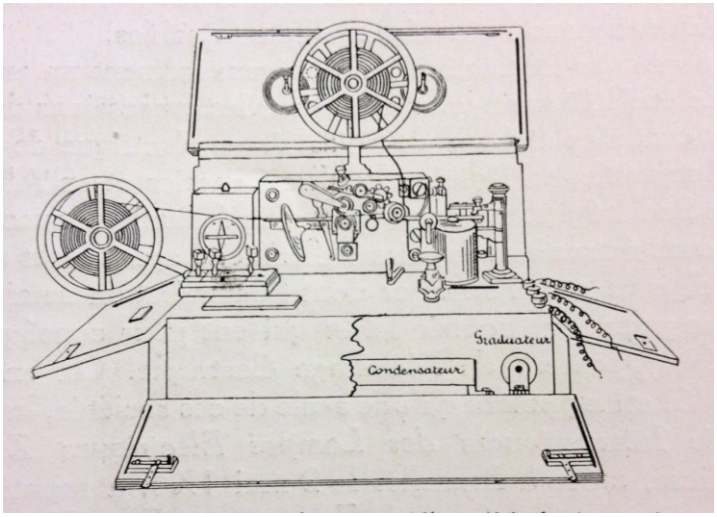


Figure 13: Army Telegraph unit equipped with anti-induction circuit of Van Rysselberghe

Model as was used by the armed forces for simultaneous transmission of telegraphy and telephony over the same wire.

1.6.2 Expansion worldwide

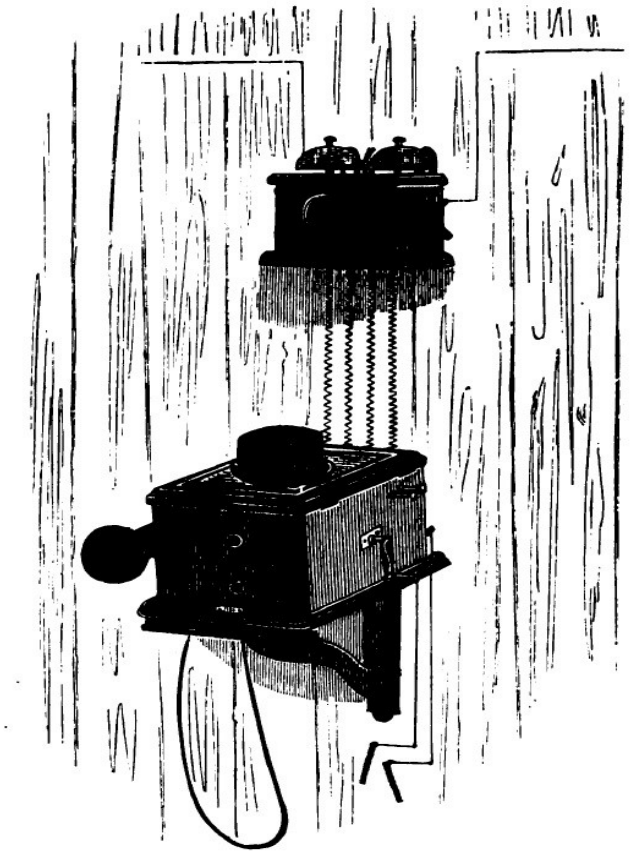


Figure 14: Telephone designed by Van Rysselberghe

A new telephone, designed by Van Rysselberghe and assembled at the Mourlon works, with provisions for long distance telephony.

Soon the Van Rysselberghe system was installed on telegraph networks in the *Netherlands, France, Germany, Austria, Switzerland, Spain and Portuga*l. The total extent of Van Rysselberghe lines in Europe was about 17000 km.

In the United Kingdom the responsible persons were wondering if the system should work with the high speed telegraph system used in the UK, but they never performed a test. They came up a couple years later with their own system.

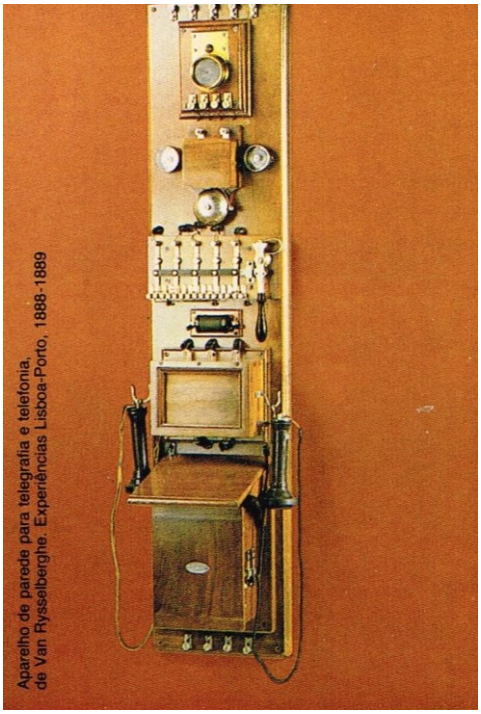


Figure 15: Van Rysselberghe wallphone used in Portugal

Used during the trials on the link Lisbon-Porto, Portugal (1888-89)

In 1889 Mourlon and Van Rysselberghe approached the British and French governments about setting up a cross-channel telephone line. It would be paid for by their company and repaid by a royalty on the voice and telegraph calls made on it. This proposal was turned down by both governments, they did not like not to be in control.

The system was also installed in several South American countries such as *Argentina, Brazil, Venezuela* and finally also Mexico.

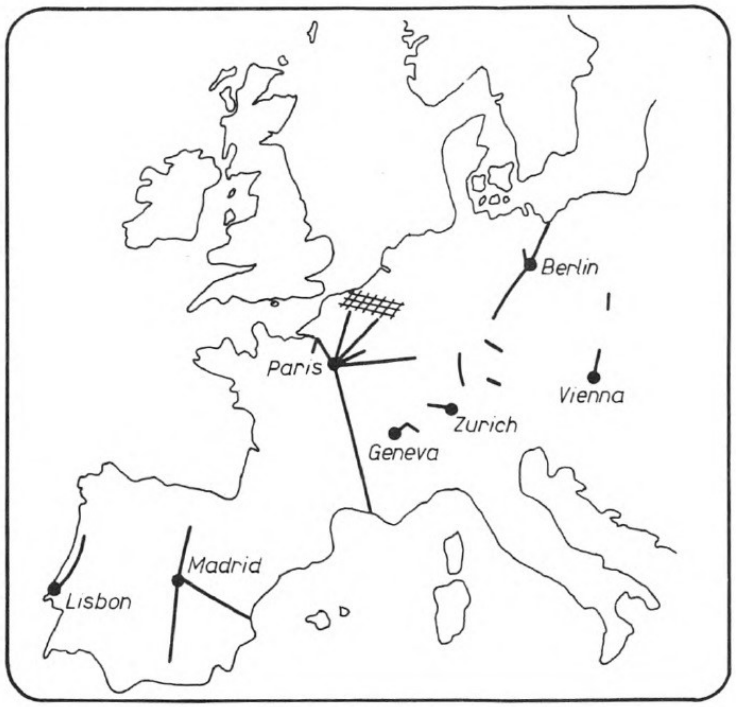


Figure 16: European use of the Van Rysselberghe system (1890)

1.7 Tests performed in the USA

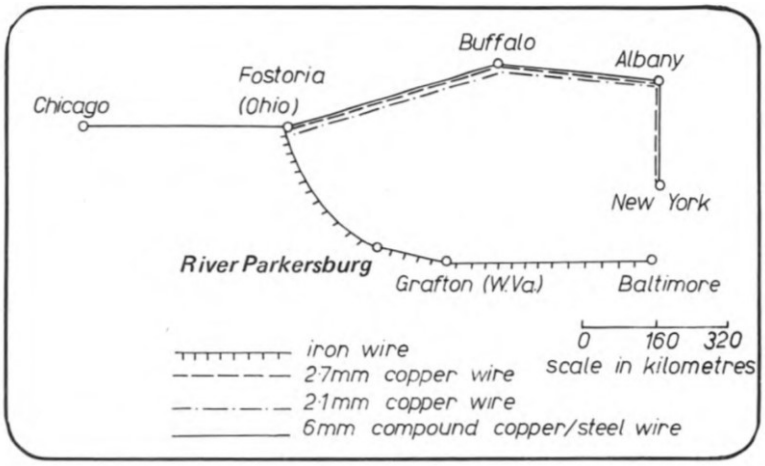


Figure 17: Route diagram of Van Rysselberghe 's American experiments (1885-86)

Van Rysselberghe went to the US in the winter of 1885-86 and performed some successful test on telegraphic links between Chicago and New York, a distance of 1000 miles! The best results were reached on copper wire of 5 mm. Unfortunately due to local legislation his system could not be installed in the US. The separation of telephony and telegraphy under the Bell system and Western Union Telegraph made exploitation of simultaneous telephony and telegraphy difficult.

It was not until Pupin's invention of the loading coil many years later that Bell was able to provide true long-distance calls, and by then the Van Rysselberghe 's work has been forgotten.

Van Rysselberghe had the opportunity to do measurements on very long distances in the US (i.e. 1000 miles) and came back very enthusiastic: *it must be possible to connect all European capitals by the same wires with simultaneous use of telegraphy and telephony!*

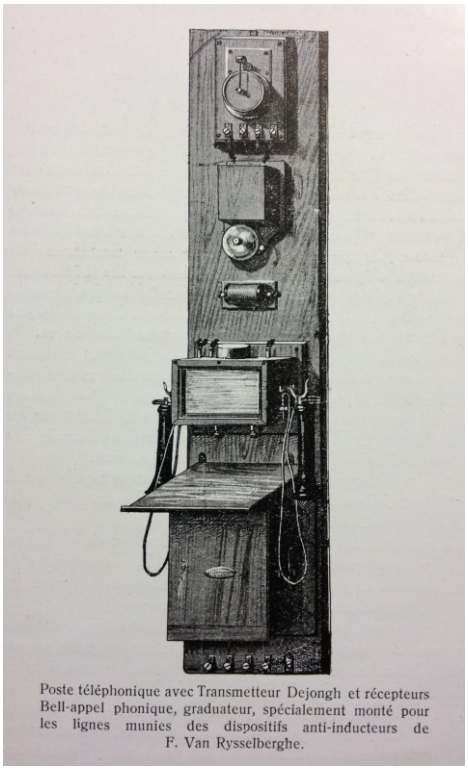


Figure 18: Van Rysselberghe phone

Telephone with Dejongh Microphone and Bell receivers, mounted for lines with the Van Rysselberghe system

1.8 The phonopore, a telephone connected to a telegraphy network

Figure 19: The Phonopore

Source: https://www.vintagephones.com.au/Pages/AustPostOffice/TeleNo45.htm

Mr Langdon-Davies of the UK developed a telephone called the Phonopore used in many cases at railway companies over their telegraph network.

The Phonopore was a telephone which allowed speech to be sent and received over the same circuit as used for the telegraph. He contained elementary filter circuits which reduced the low frequency telegraph impulses from interfering too much with the telephone receiver.

It is not known if Van Rysselberghe and Langdon-Davies knew each other, but it looks like there is some resemblance in their circuitry.

Railway companies used telegraph networks already for decades to communicate. The phonopore was merely used by railway companies in the UK and Australia.

1.9 The decline of the system later on

The Van Rysselberghe system worked pretty good at a time the demand for long-distance telephony was rather small. When the traffic grew large and pole routes car-

ried a high density of lines, cross talk between telephone circuits would become intolerable, and other solutions had to be found.

The Van Rysselberghe system served its purpose: it accelerated long-distance telephony for a small period of time, but it was in that timeframe successful.

1.10 Further inventions of Van Rysselberghe

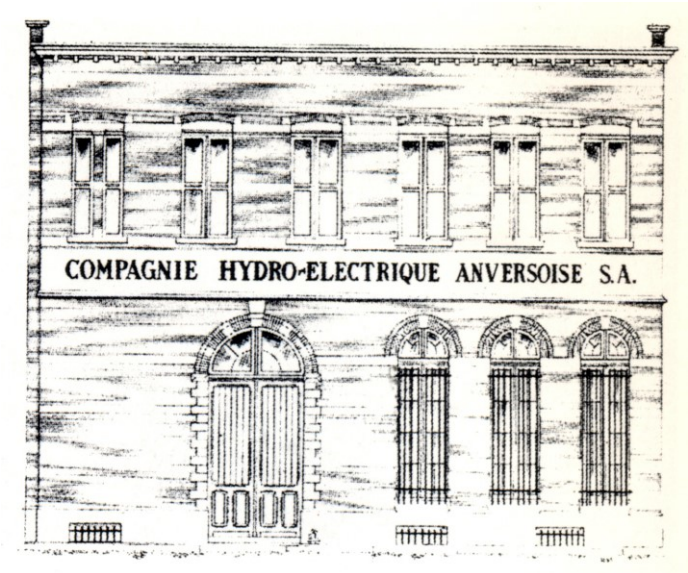


Figure 20: Building of the Hydro-electric company in Antwerp (1890s)

In the early 1890s Van Rysselberghe focused on economic distribution of energy. He developed a system with water under high pressure steering hydro-electric turbines in substations. Finally he obtained a license for the public lighting of the city of Antwerp. Unfortunately he passed away unexpected at the age of 46 (most likely due to a a brain stroke at a very young age perhaps he had hypertension[4]), while he was still experimenting with this system. It was a very revolutionary design, but not efficient.

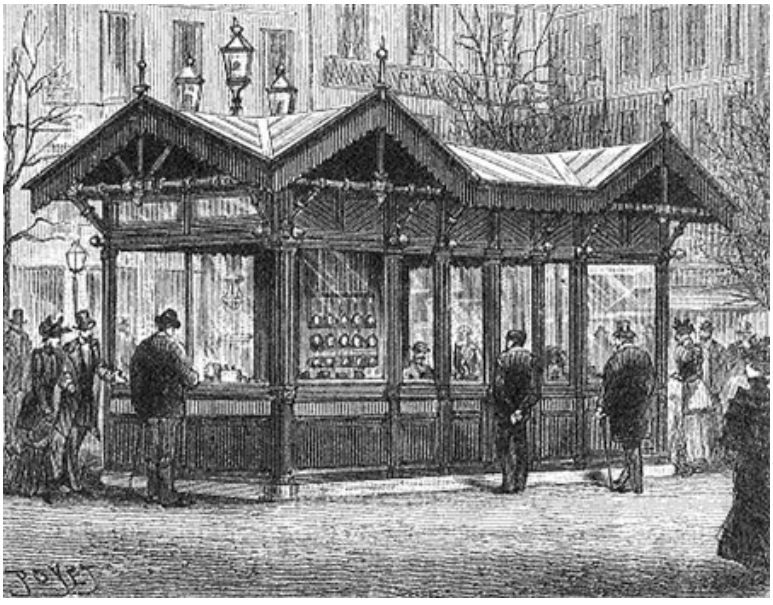


Figure 21: Equipment of the "Compagnie hydro-électrique Anversoise"

Experiment in generating electricity with water pressure in 1892. Pavilion on « Groenplaats », a square in the Antwerp city center with a dynamo.
Source:
http://www.retroscoop.com/maatschappij.php?artikel=223

The company called “Compagnie hydro-électrique Anversoise” went broke in 1898, five years after his inventor passed away.

[4] As told by his great-grandson Dr Maximiliano Montero Van Rysselberghe (Chili)

Figure 22: Gravestone of François Van Rysselberghe (1893)

Van Rysselberghe ‘s gravestone can be still seen at the Antwerp Communal Cemetry “Schoonselhof”.

UNITED STATES PATENT OFFICE.

FRANÇOIS VAN RYSSELBERGHE, OF SCHAERBEEK, BELGIUM.

MEANS FOR PREVENTING INTERFERENCE IN COMBINED TELEGRAPHIC AND TELEPHONIC SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 322,333, dated July 14, 1885.

Application filed June 6, 1885. (No model.) Patented in Germany June 9, 1882, No. 22,633; in Belgium November 16, 1883; in France November 16, 1883; in England November 23, 1883; in Luxemburg December 8, 1883; in Italy December 31, 1883; in Portugal January 18, 1884; in Canada January 24, 1884; in India January 29, 1884; in Sweden February 12, 1884; in Spain April 23, 1884; in Denmark June 18, 1884; in Brazil July 5, 1884; in Argentine Republic July 19, 1884; in Austria September 13, 1884, and in Uruguay December 12, 1884.

To all whom it may concern:

Be it known that I, FRANÇOIS VAN RYSSELBERGHE, a Belgian subject, residing at Schaerbeek, Belgium, have invented new and useful Improvements in Telegraphic and Telephonic Apparatus, (for which I have obtained the following Letters Patent, viz: Germany, June 9, 1882, No. 22,633; Belgium, November 16, 1883; France, November 16, 1883; Great Britain, November 23, 1883; Italy, December 31, 1883; Austria, September 13, 1884; Canada, January 24, 1884; Portugal, January 18, 1884; India, January 29, 1884; Spain, April 23, 1884; Sweden, February 12, 1884; Denmark, June 18, 1884; Luxemburg, December 8, 1883; Brazil, July 5, 1884; Argentine Republic, July 19, 1884, and Uruguay, December 12, 1884,) of which the following is a specification.

This invention relates to an improved system or arrangement of devices for producing the gradual telegraphic currents required in carrying out my method of simultaneous telegraphy and telephony, which forms the subject-matter of prior patents, and depends upon the removal of the effects of induction between telegraph and telephone lines by retarding the rise and fall of the prime telegraphic currents, whereby the same line wire or wires or the same net-work or system of wires can be used for the transmission of telephonic and telegraphic messages, and the effects of such telegraphic currents are not perceptible in the telephone-instrument, telegraphic sounds being no longer audible in such telephone.

The invention consists in introducing permanently into the circuit of a telegraph system a pair of magnets and a condenser, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a diagram view of a telegraph system provided with my improved means of retarding the rise and fall of the telegraphic current, and showing a telephone-wire arranged in the vicinity of the telegraph-wire. Fig. 2 is a similar view showing the use of the same line-wire for the transmission of telegraphic and telephonic messages.

The reference-numeral 1 designates the manipulator or transmitting-key for opening and closing the circuit of the battery 2, and sending to the line 3, each time the key is closed, a current of the same polarity, and interrupting it when opened. The numeral 4 represents a telegraphic receiving-instrument, the electro-magnet of which must have a resistance of not less than five hundred ohms.

The above parts constitute the ordinary Morse telegraphic system, and require no special description.

For the purpose of graduating the emission and extinction of the currents, or reducing the sudden rise and fall of such currents, I place an electro-magnet, 6, of about five hundred ohms resistance, between the battery and the manipulator, and I introduce a second electro-magnet, 7, between the manipulator and the main line, said magnet 7 offering the same degree of resistance as the magnet 6. I also place a condenser, 8, of two micro-farads, between the two electro-magnets 6 7, one of the faces of said condenser being connected with a wire, 9, in derivation of the main line, and the other face being connected with the earth by the wire 10.

It is evident that when the key of the transmitting-instrument is depressed the current from the battery passes into the two magnets and the condenser introduced between them in derivation of the main line. In this manner the current is caused to pass to the main line in a gradual manner, or is retarded in its passage to the main line, since it is evident that the magnets and condenser are first charged and that the initial strength of the current emitted upon manipulating the key is never carried to the main line. When the manipulating-key is raised, the connection with the battery is broken and the charge of the condenser and the magnet introduced into the main line passes to the latter in the form of a current, whose extinction is as gradual as was its emission upon the original depression of the transmitting-key.

I have found by experience that the best arrangement of devices for producing gradual telegraphic currents is the two electro-magnets and condenser arranged between the same,

Figure 23: US patent 322,333 as of July 14 , 1885 – first page only

US patent of the Van Rysselberghe system- first page only

1.11 Sources

We consulted several sources to do this research: in Dutch, French and English:

1) **English sources**

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2) **French sources**

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