A GREAT BOOK ON TELEGRAPHY WITH GREAT OVERVIEW DIAGRAMS

28 October 2021

During my modest research work in preparation for my fifth book (*1), I stumbled upon the book " **The Invention of the Communication Engine Telegraph** " (480 pages), one of the many books written by **Mr. Bauke van der KOOIJ** (*2). On the back cover of the book, I read: *"Part of an in-depth series on the interactions between technological innovation and social-economic change, the author tells a fascinating story about people, their inventions, and the roiling economic mechanism at work around them. In examining the richly layered context for this catalytic general-purpose technology, this book provides a unique lens for looking into the future by understanding the past."*
Further below you can read an expanded abstract (*3).

The book is part of a research project into the 'Nature of Innovation' where – in a series of case studies under the name of *Invention-series* – major inventions are explored, both their content (the invention itself), as well as the context in which it happened. It is therefore not a book in the classical sense as it has, what I would call, also a 'practical philosophical' approach. Indeed, it has in the first part, called 'Context for the Discoveries', many explorations on technical, social, political, economic and scientific events. In the second part there is a great deal to learn about the history of telegraphy (with Chappe, Cooke & Wheatstone, Bain and, especially, Morse).

The book has 480 pages and not less than 223 illustrations. One of the things I admire is the fact that the author has succeeded in summarizing his analysis, historical events, technical evolutions &c. in clear diagrams (many of them being "time-lines"). The purpose of my short article here is to present you the diagrams out of his book. I am full of admiration for the author for making this happen. What a job this must have been... I am very grateful to him for allowing me to introduce you, the reader, to these very didactic diagrams. To fully appreciate them, I recommend you to study the context in his book; see the URL below in (*2).
The author, apart from his books on 'The Deep History of Innovation', has also in his Invention-series published his case studies, amongst others, focusing on Electricity, Telephony and Wireless Communications.

NOTES

(1*) My coming book (I am writing this comment today on 28 October 2021), lavishly illustrated, will be about Samuel Morse and about Codes. It will deviate from the traditional books and bring to light a lot of lesser-known facts In it I will use and comment several of Bauke's diagrams.

(*2) I would like to say here a word about the author Drs. B.J.G. van der Kooij (b. 1947). In 1975 he obtained his MBA at the Rotterdam Erasmus University and in 1977 his MSEE (Master of Science in Electrical Engineering) at the Delft University of Technology. He became well known as a Dutch 'guru' on the topic of innovation and microelectronics. In 1982-1986 he was a member of the Dutch Parliament. He then became a part-time professor at the Eindhoven University of Technology. In 1986 he started his own company, Ashmore Software BV. He retired in 2013. Innovation being the focus of attention of all his many activities during his life, he wrote several books on the subject and published several articles. Those can be found via:
https://repository.tudelft.nl/islandora/search/author%3A%22Van%20der%20Kooij%2C%20B.J.G.%22
I can also warmly recommend you his following article (25 pages): "What did Morse, Bell and Marconi have in common?"
http://pure.tudelft.nl/ws/portalfiles/portal/50383066/Act_of_Invention_in_the_GPT_Electricity_What_did_Morse_Bell_and_Marconi_have_in_common.pdf

(*3) ABSTRACT

This case study is a historic analysis of the developments that resulted in the electric telegraph. It describes a fascinating development in the early nineteenth century. It is a story about communication. Long distance communication, that had already developed with the optical semaphore system created by Claude Chappe in revolutionary France. But now electricity became—next to its capability to transport power—also a carrier of information. On two different places in the same period of time, based on different concepts, two parallel developments took place that would change the world. It was the development of both the needle telegraph and of the electro-magnet telegraph. In Britain it were the cooperative efforts of William Fothergill Cooke and Charles Wheatstone that created the first telegraphic engines; the needle telegraph. After experiments with railway telegraphy proved its viability, it resulted in a telegraph fever when also the public and companies discovered this new means of communication. Combined with the continuous improvements in telegraph machines—such as the ABC telegraph—, it created an industrial bonanza of telegraph service providers and equipment manufacturers. However, soon the sprawl of non-standardized systems, combined with traffic congestions and numerous delays, created disgruntled users. Then, the 'public interest', a concern for British policy makers of that time, resulted in the nationalization of the telegraph industry in 1870. In the US is was Samuel Finley Breese Morse, an artist that turned into an inventor, who constructed—with the help of some friends like the "mecanicien" Alfred Vail—the Morse telegraph that would dominate electric telegraphy in the decades to come. From the first idea in 1832, to the awkward prototype of 1837, to the 1840-patented Morse system with his system of "dots and dashes", took a while. Then, after the first telegraph line in 1843—publically funded by the US-Congress in 1843—would start a similar industrial bonanza when investors grasped their opportunities and created a multitude of telegraph lines in the Eastern US. This pioneering phase of telegraphy resulted in dozens of syndicates offering telegraph services. The following period of mergers and acquisitions would lead to the dominance of a private monopoly by the Western Union Telegraph Co. This is a story about totally different basic innovations that were both were part of clusters of innovations that in totality represents the invention of the electric telegraphy. The book describes the work of the many individual entrepreneurs, engineers and scientists. It places—analysing the French Revolution and its aftermath in detail—the inventions in the context of Europe in the first half of the nineteenth century; the 'madness of times', its wars and revolutions. It tells about the contributions of 'the gentlemen of science' and the 'engineers', but also the 'entrepreneur inventors'. Their contributions resulted in several 'clusters of innovations' and 'clusters of businesses', described in detail (including patent wars, mergers and acquisitions, and applications). Both from the micro-perspective of the individual entrepreneur, scientist and inventor, as well as the macro-perspective of their influence on society, the basic innovations are described. The book gives the reader a view on the effects of technical change caused by the application of 'electricity', how it influenced daily private and working life, and how it affected society. It shows an important aspect of the Second Industrial Revolution that created the foundations for our present society. This book is part of series of books (the Invention Series) that covers the inventions within the General Purpose Technologies that fuelled breakthrough technological changes. Other titles include: 'The Invention of the Steam Engine', 'The invention of the electro-motive Engine', 'The Invention of the Electric Light', 'The Invention of the Communication Engine 'Telegraph'', and 'The Invention of the Communication Engine 'Telephone''. Commercial versions are available through Amazon.

See now the next pages to discover those great diagrams!

Invention of Telegraphy

The invention of telegraphy was the result of long trajectory of development in which many Experimental scientists and Engineering scientists explored new ways to communicate over longer distances. From the optical telegraphy systems (e.g. Chappe) to the electric systems took some decades. The discovery of electricity in all its forms (figure below, upper left) offered the experimentalist the opportunity to explore its properties, and the Theoretical scientist to explain the new phenomenon. It was in this context that two parallel inventions took place, that would create the foundations of a new system of communication over distance with the speed of light; the electric telegraphy.

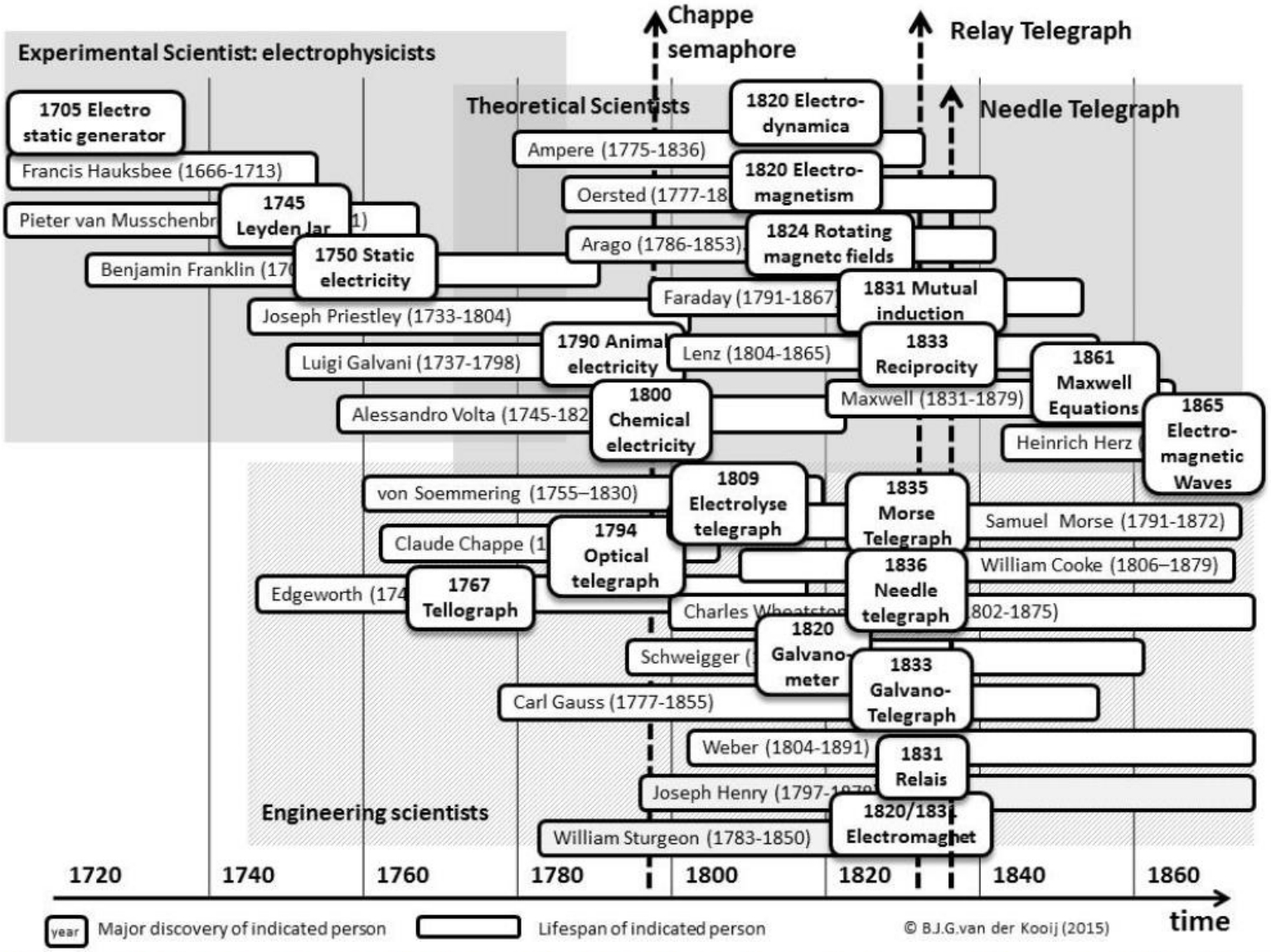

Figure 216: Experimental, theoretical and engineering scientists contributing to the application of electricity in communication.

A time-line ‘Cooke & Wheatstone/Morse’

The invention of the telegraph was a consequence of the discovery of electricity that culminated in Alessandro Volta’s discovery of the electro-chemical battery (Figure below). A trajectory of activities to which many scientists of those time contributed. Some approaches proved to be a dead-end (e.g. the electro-static Telegraphy). It took some three decades in which two development trajectories resulted in a telegraph system; the “Needle Telegraphy” and the “Relay telegraphy”. These parallel inventions took place in two different contexts; the British context for Cook & Wheatstone, and the American context for Morse.

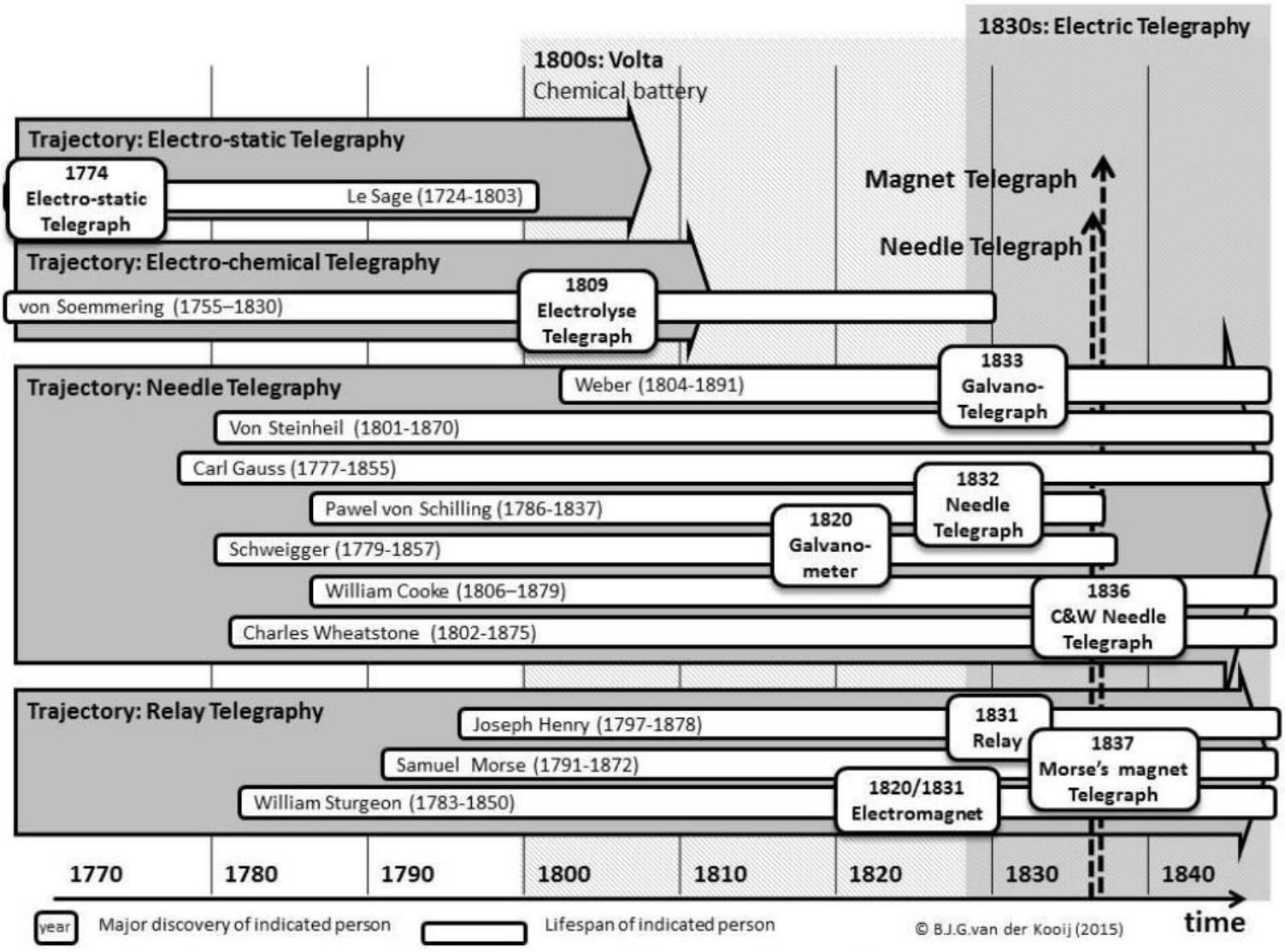

Figure 97: Trajectories for electric (cabled) telegraphy.

Source: Figure created by author

The Invention of Cooke & Wheatstone

In the timeline of the events that took place during Cooke & Wheatstone conception of their telegraph (Figure below, lower part) different periods can be distinguished in which their 'ideas' were resulting in a prototype and a commercial product. From the *period of conceptualization* (with prototype building, patent activity, etc.) up to the *entrepreneurial period* in which their company was created to commercialize their invention. It illustrates that their work was both of a technical nature as well of a commercial nature.

The fundamental importance of their invention (aka a basic innovation) is shown by the following Cluster of Innovations as well as the Cluster of Business that emerged.

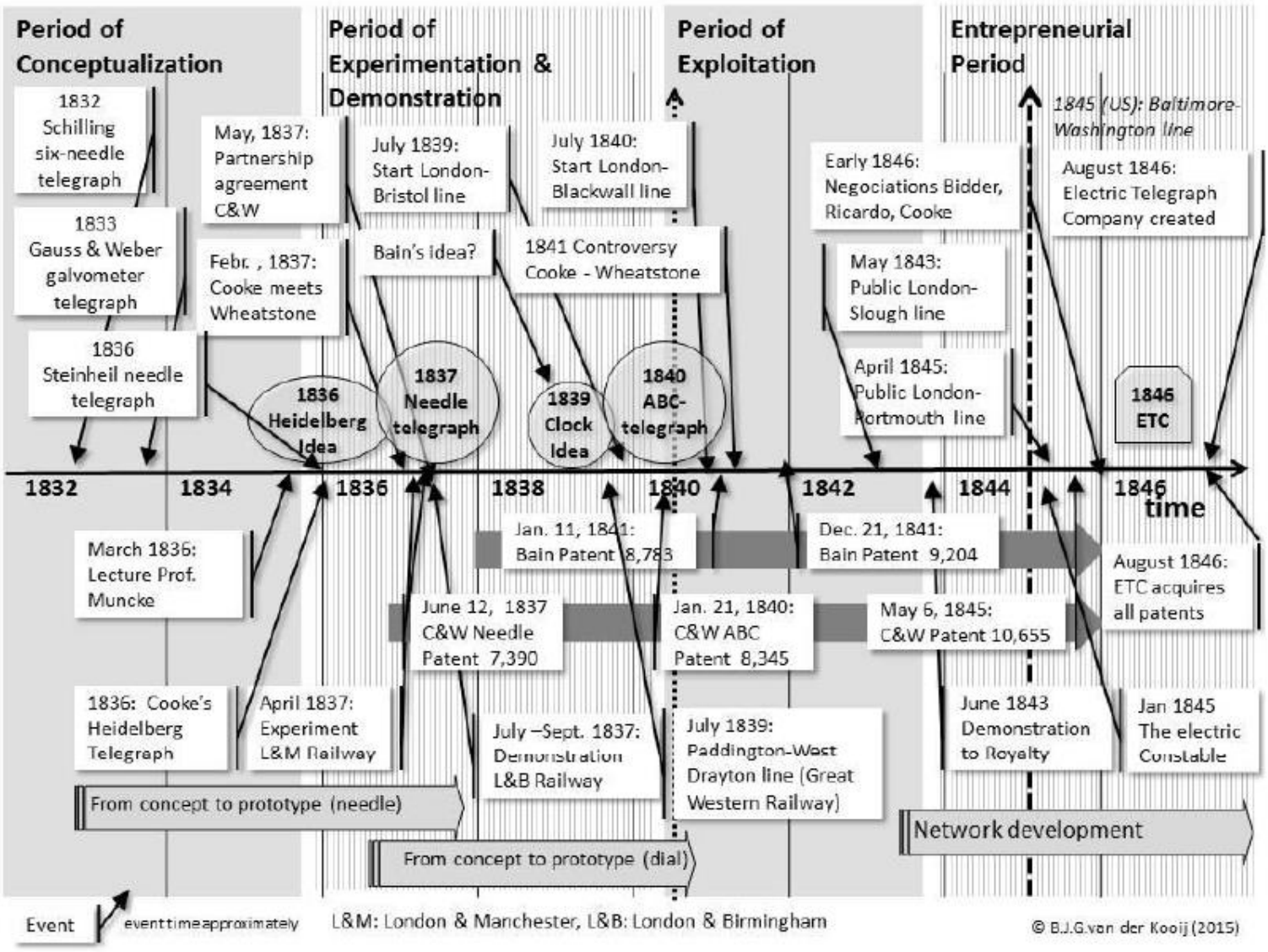

Figure 152: Timeline of Cooke's and Wheatstone's endeavors around telegraphy.

See text about Alexander Bain's telegraph for details about Bain's idea.

Source: Figure created by author

Cluster of Innovations

After their patented invention had resulted in a usable system by 1837, a range of technical improvements (aka derived innovations) took place. The needle telegraph was improved (also by others), as was the dial/pointer-telegraph. And all those experimenters protected their improvements by patents

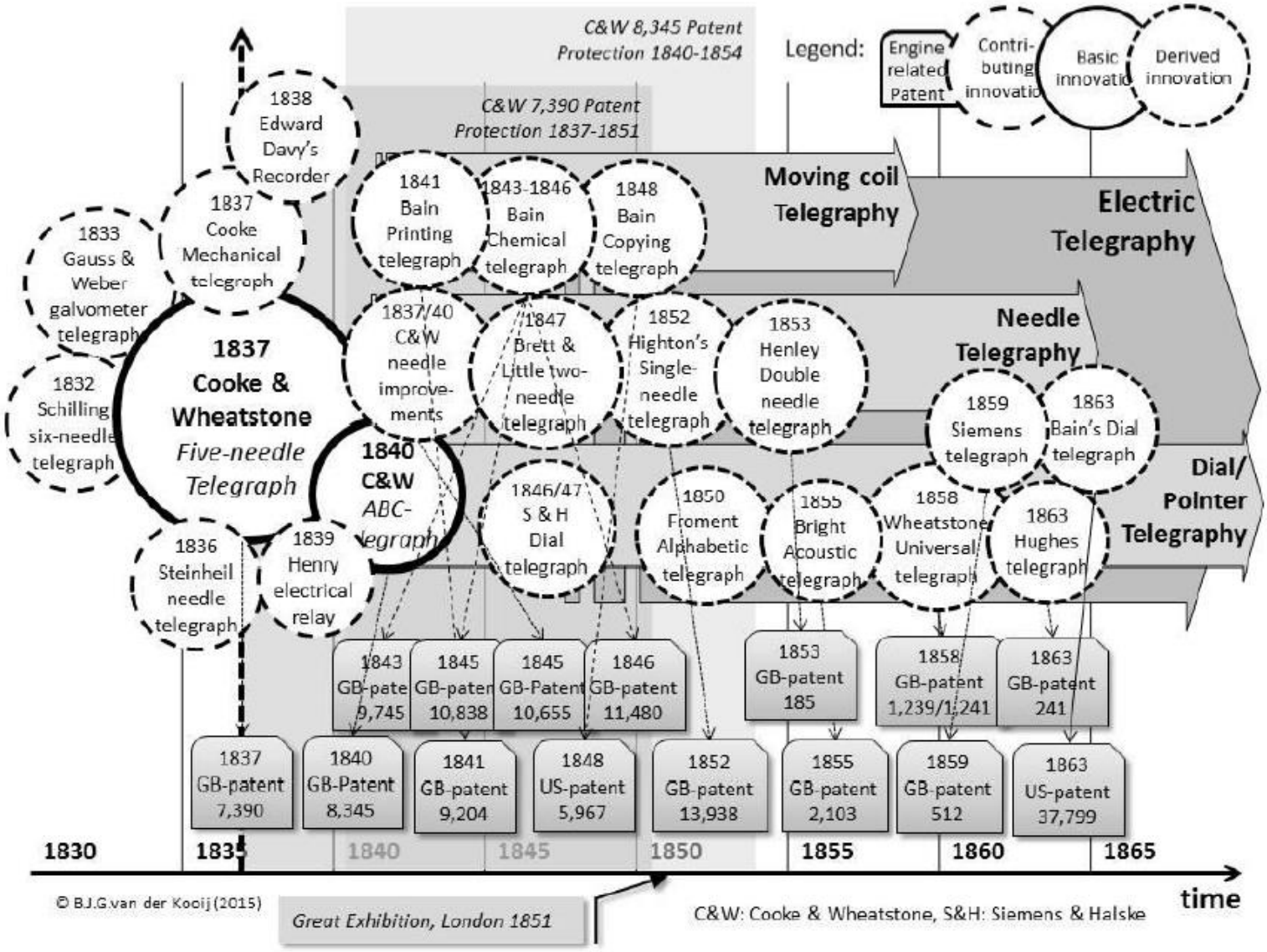

Figure 153: The cluster of innovations around Cooke & Wheatstone's 1837-needle telegraph and 1840-dial telegraph.

Source: Figure created by author

Cluster of business

As the protection of the Cooke & Wheatstone patents ended in 1851 resp. 1854, a range of companies using the telegraph system to provide telegraphy services was created in Britain. (Figure below). It resulted in a Cluster of Business that saw new start up's as well a range of Mergers and Acquisitions, and a great diversity in system performances and services.

It took some time but finally, in the British tradition of entrepreneurship, the state took over and created a state monopoly of the Post Office.

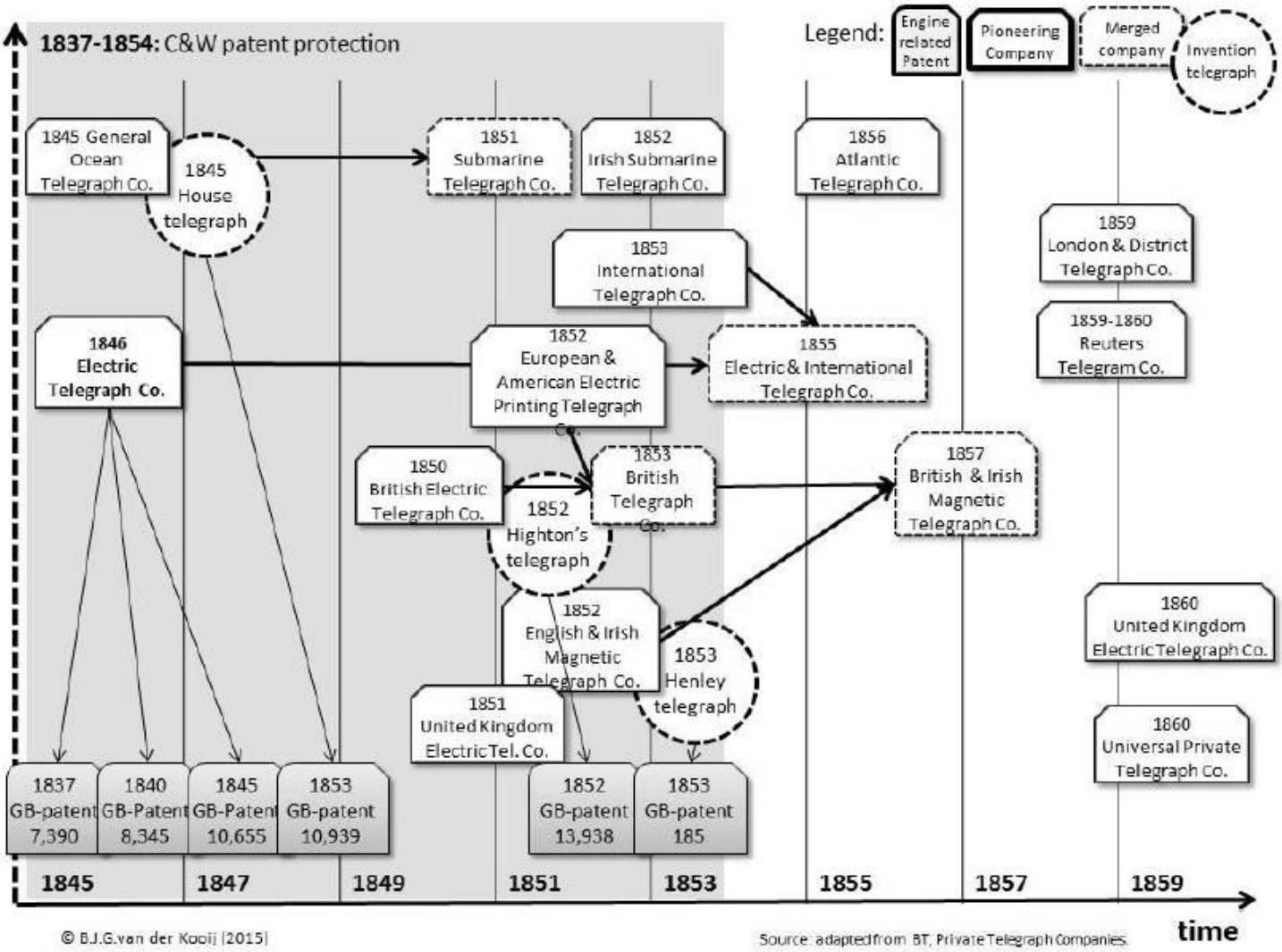

Figure 157: Cluster of business of telegraph companies (service providers) in Britain.

Source: Figure created by author

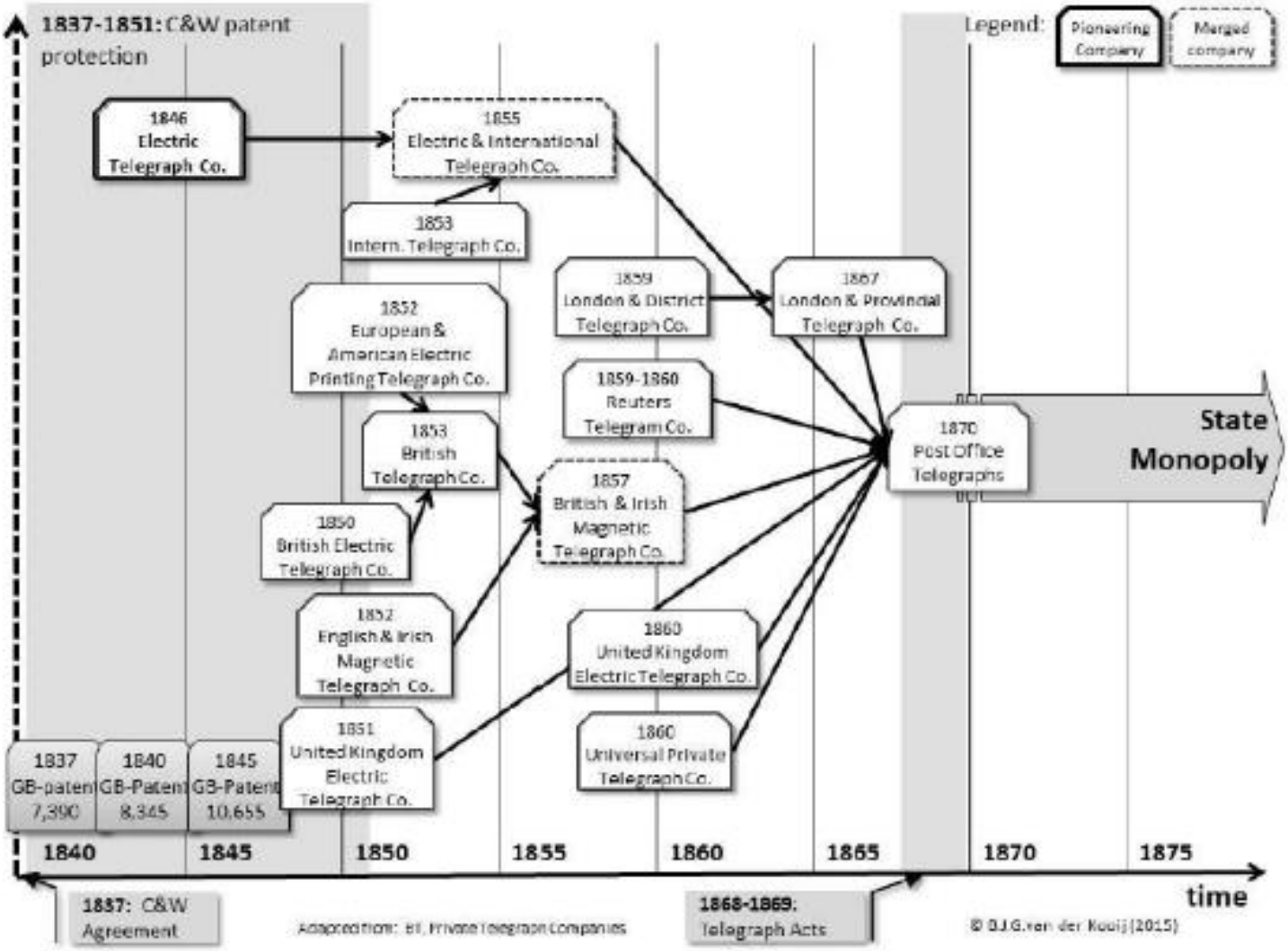

Figure 161: Some of the mergers and acquisitions of telegraph companies resulting the British Post Office Telegraphs.

Source: www.imgkid.com

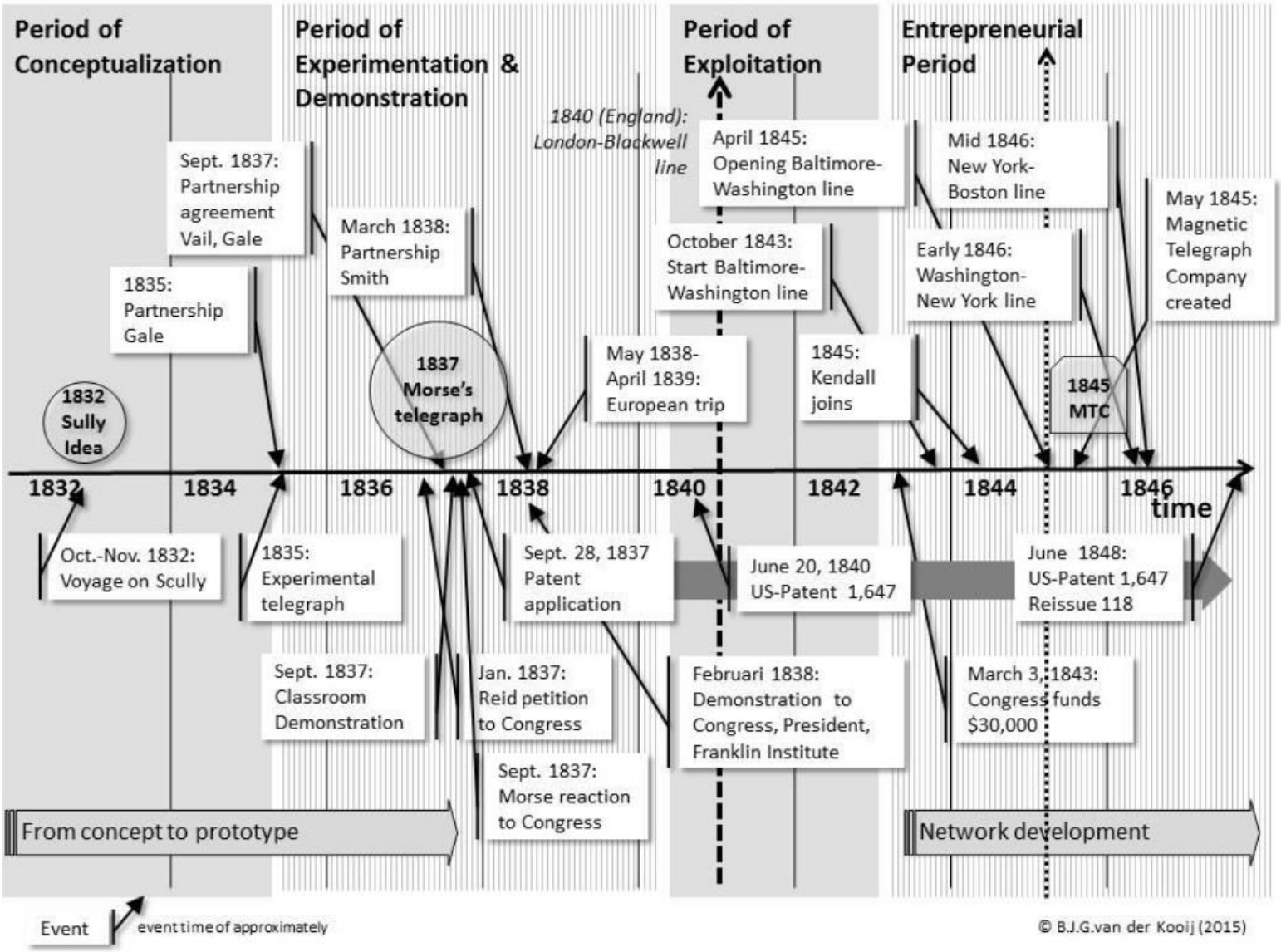

Figure 200: Timeline of events related to Morse's invention.

Source: Figure created by author

Cluster of Innovations

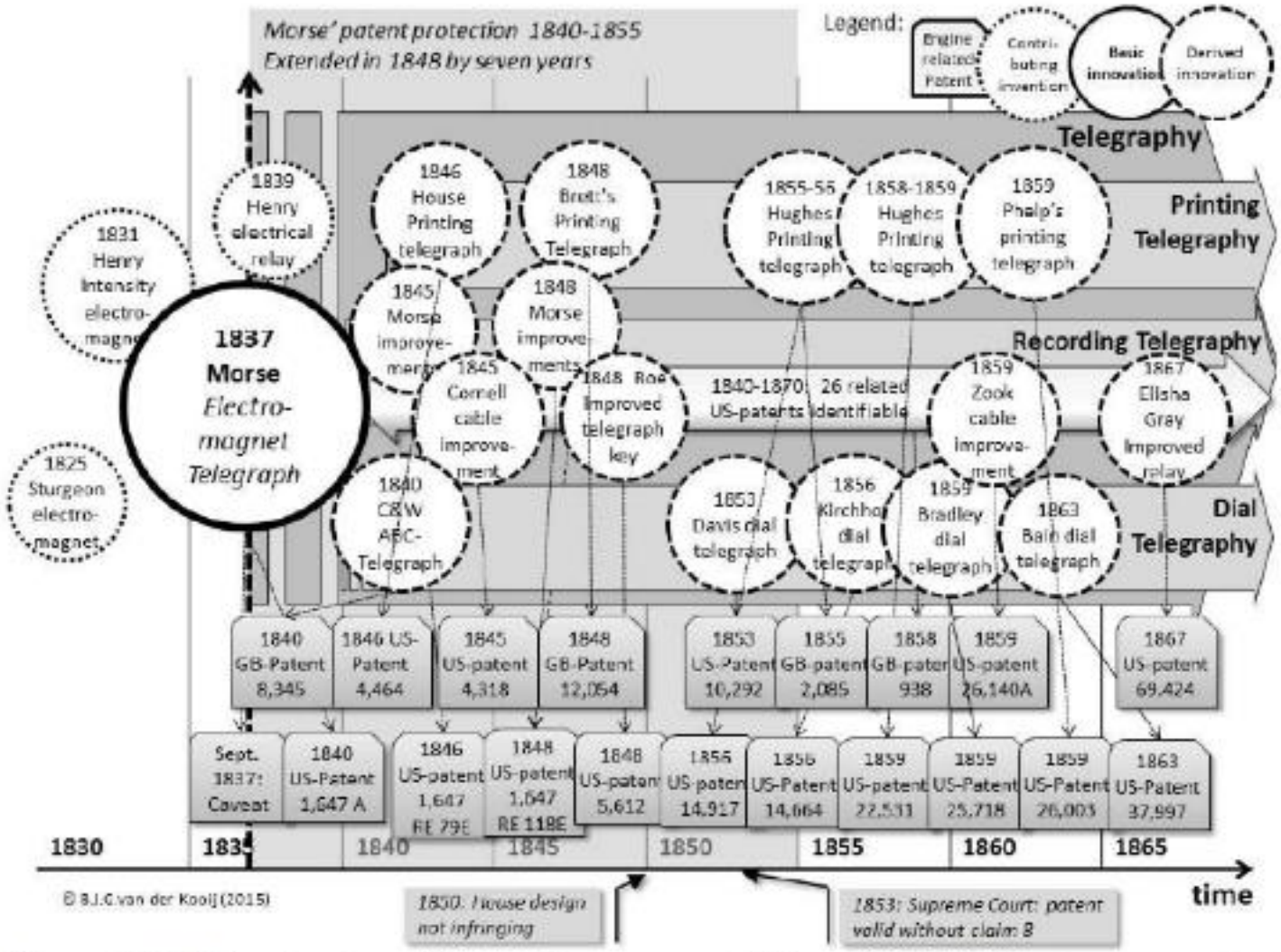

Figure 201: The cluster of innovations around Morse's 1837 electro-magnet telegraph.

Source: Figure created by author

Cluster of business

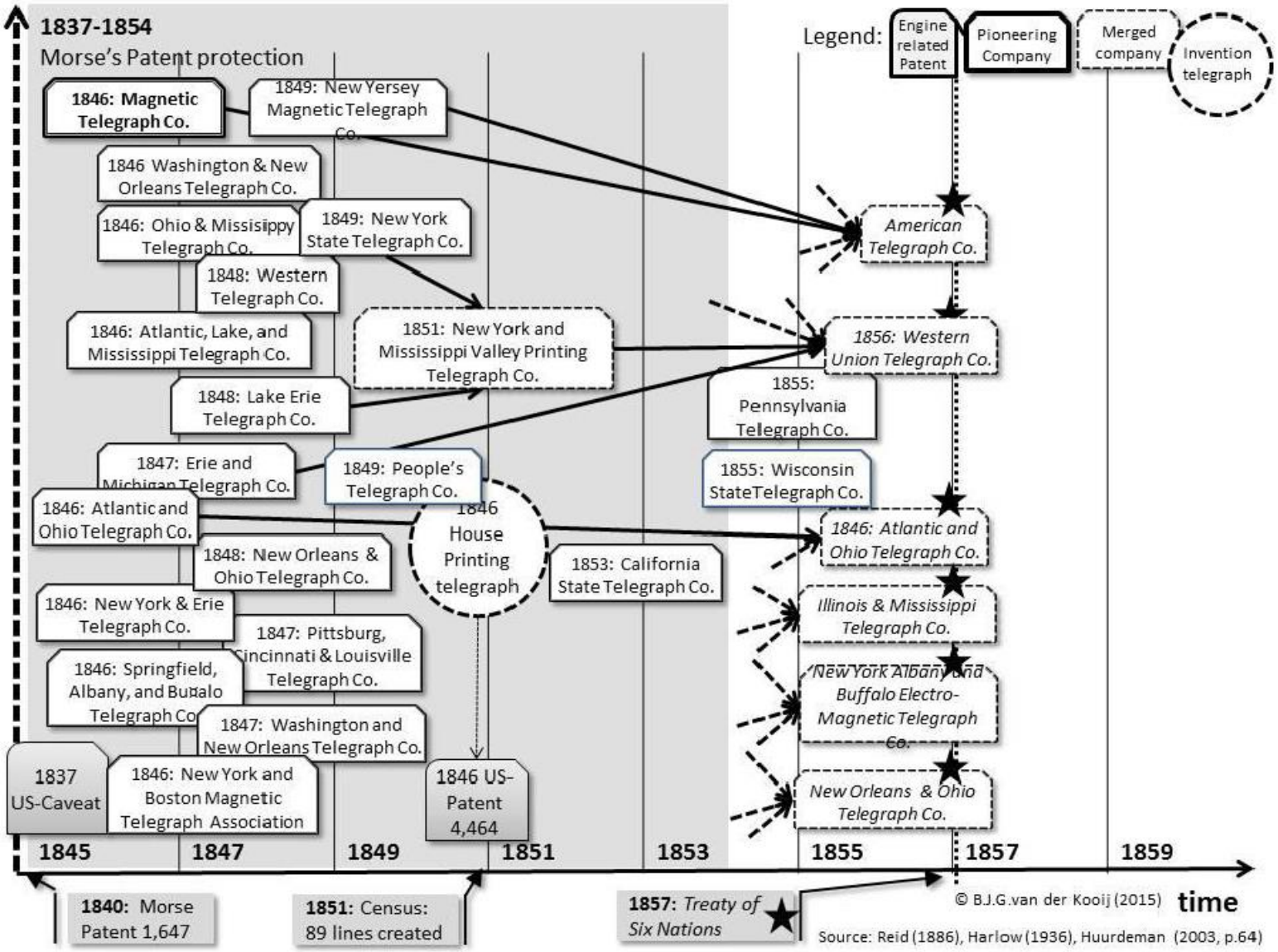

Figure 203: Cluster of business of telegraph companies (service providers) in the United States.

Source: Figure created by author

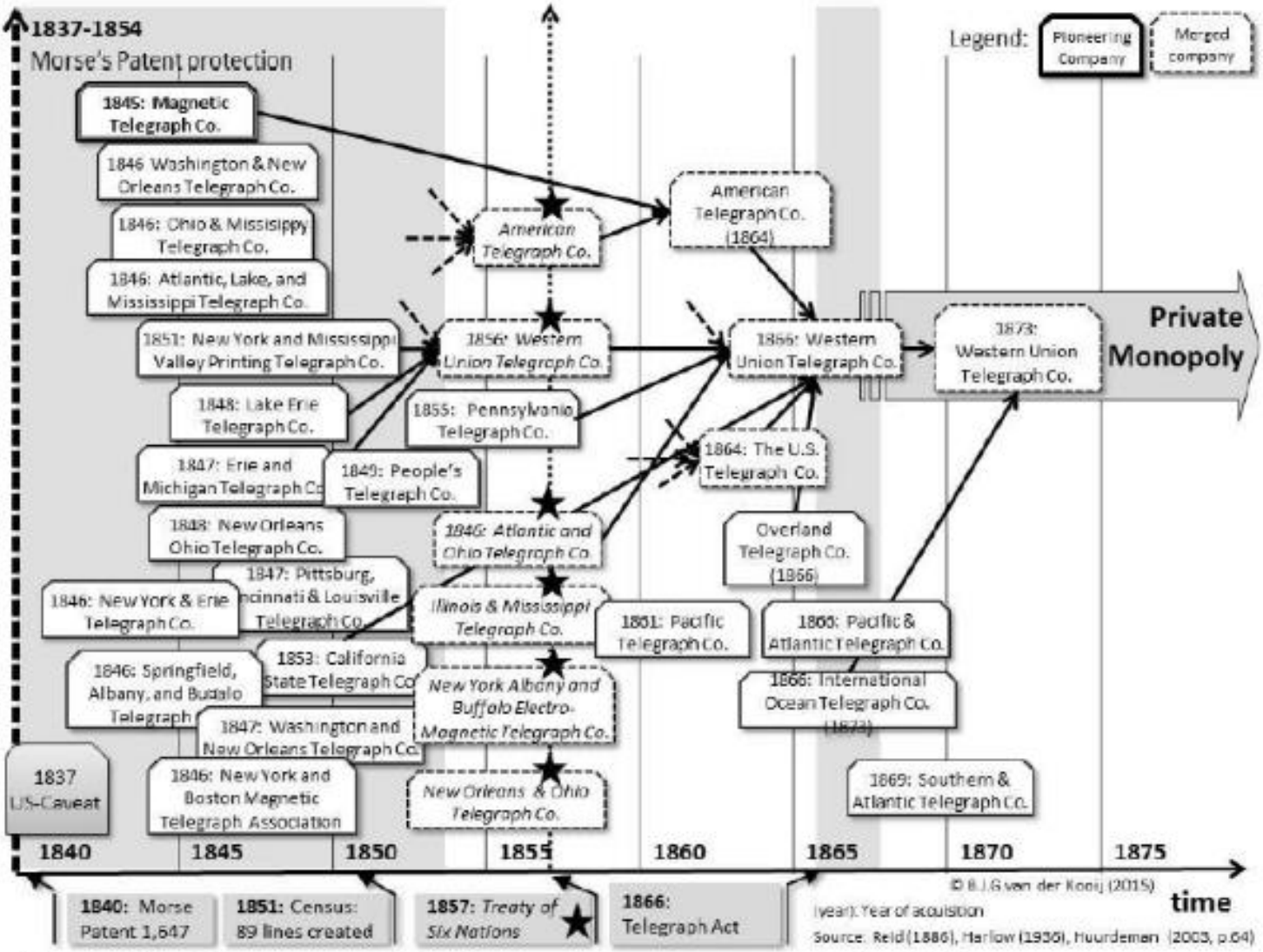

Figure 212: Some new US telegraph companys and their Mergers and Acquisitions.

Source: http://atlantic-cable.com/Ephemera/Broadsides/1856-Atlantic-Cable-Map_D1.jpg

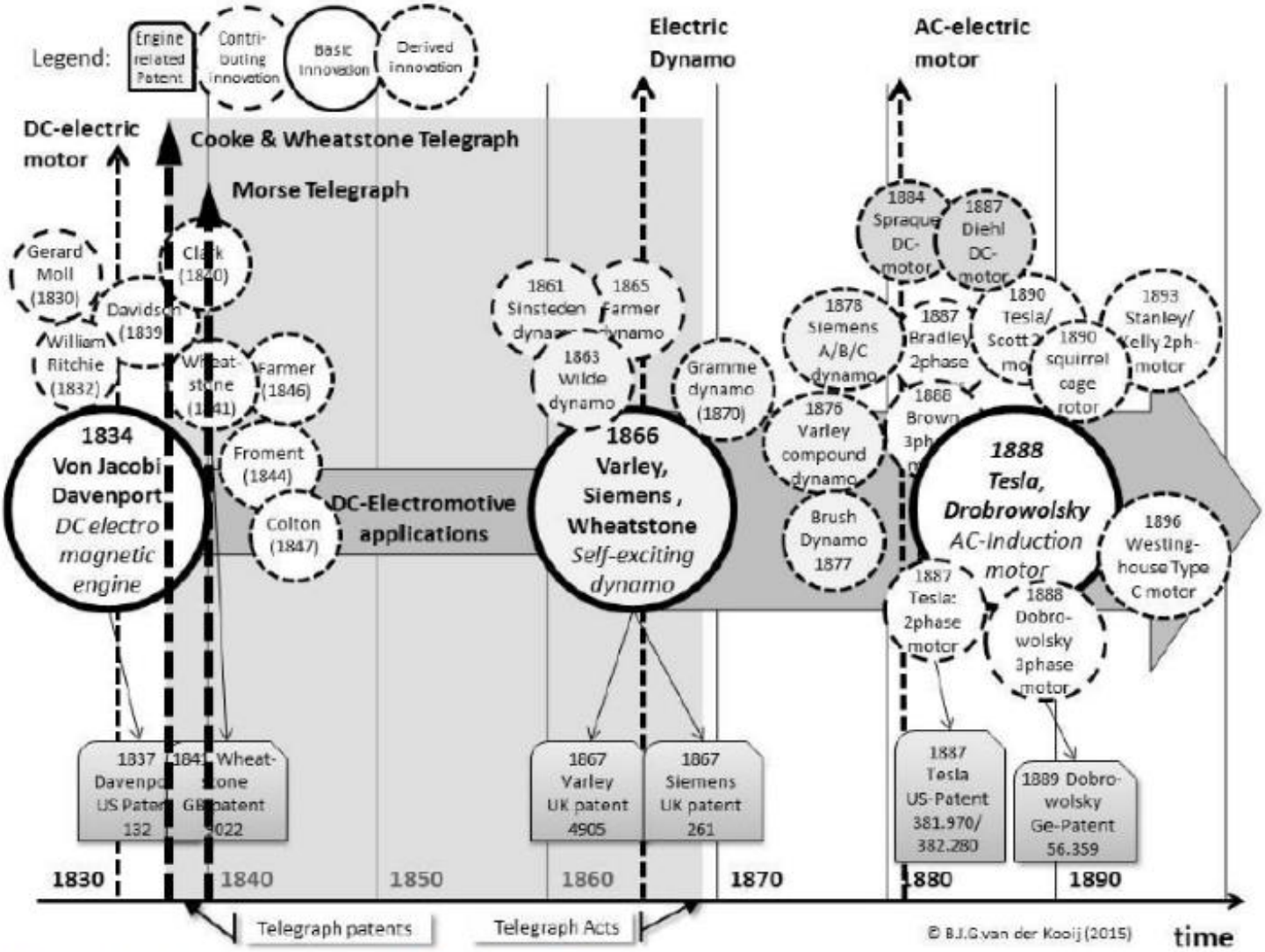

Figure 215: Telegraphy related to the cluster of electro-motive engines.

Source: Figure created by author, adaptation of figure published *in The Invention of the electro-motive engine.* (2015)

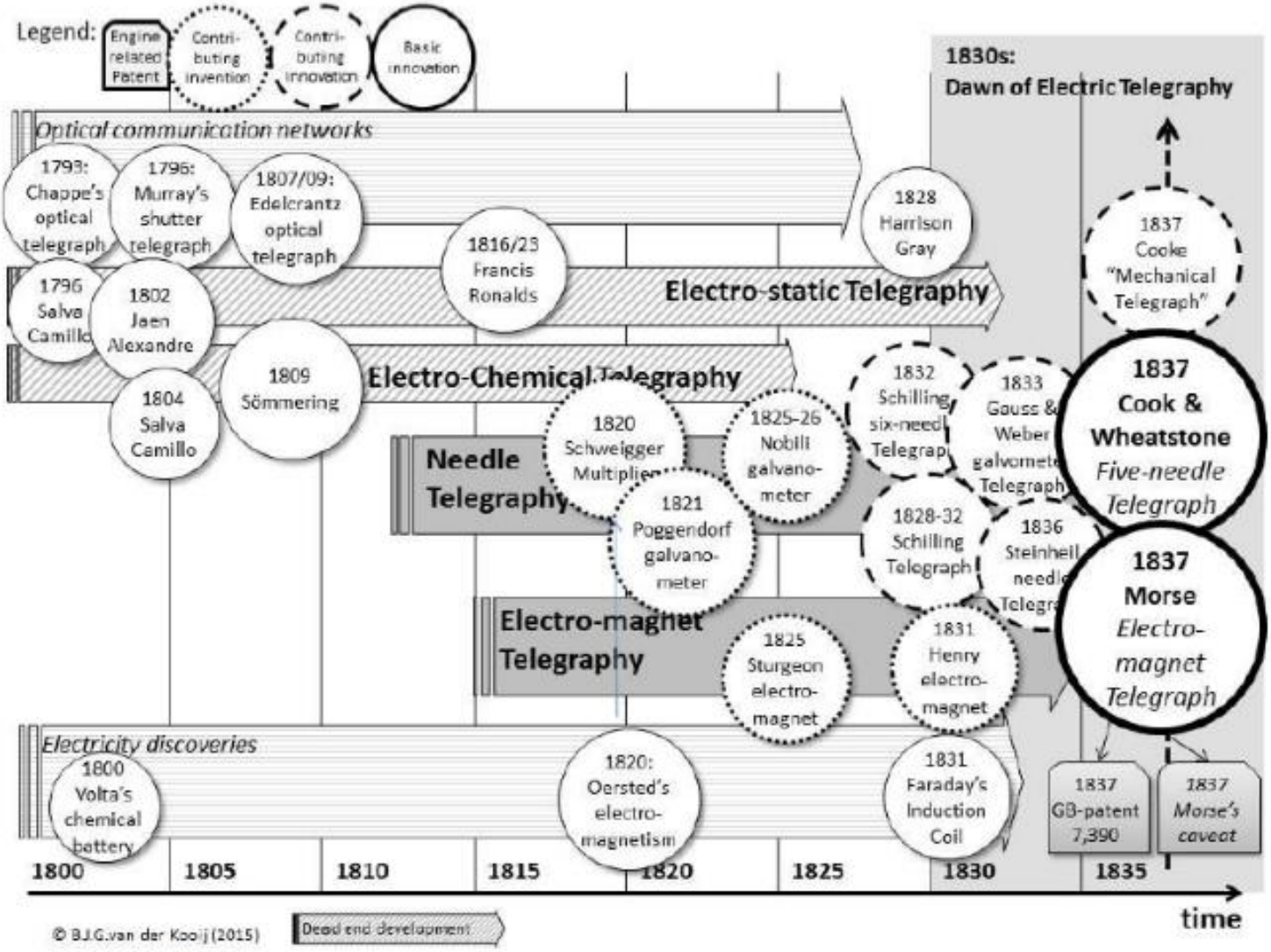

Figure 217: Technical contributions from science and engineering to electric telegraphy in different development trajectories.

Source: Figure created by author

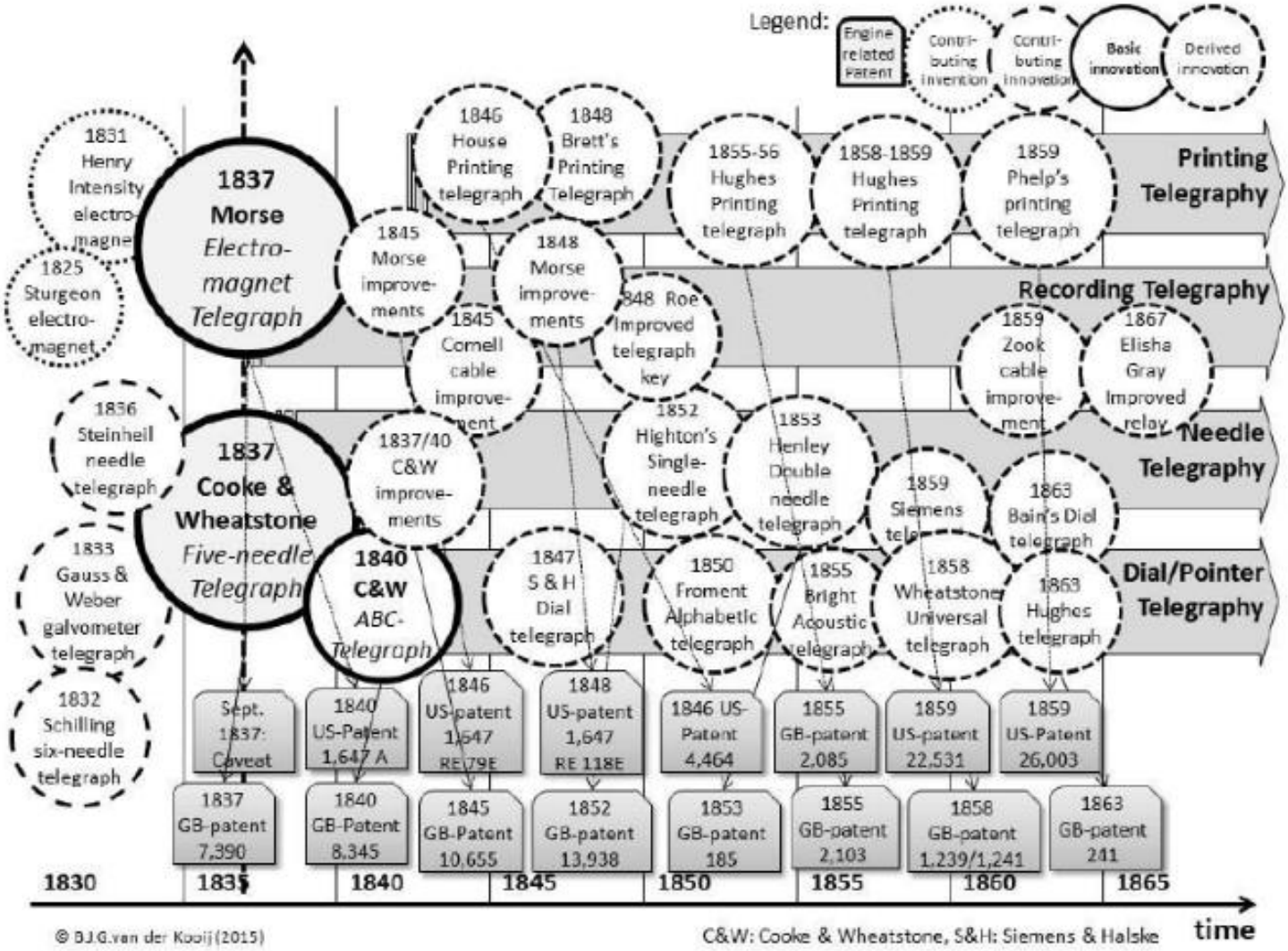

Figure 218: The improvements of Cooke and Wheatstone's telegraph (top) and Morse's telegraph (bottom) within different improvement-trajectories.

Source: Figure created by author

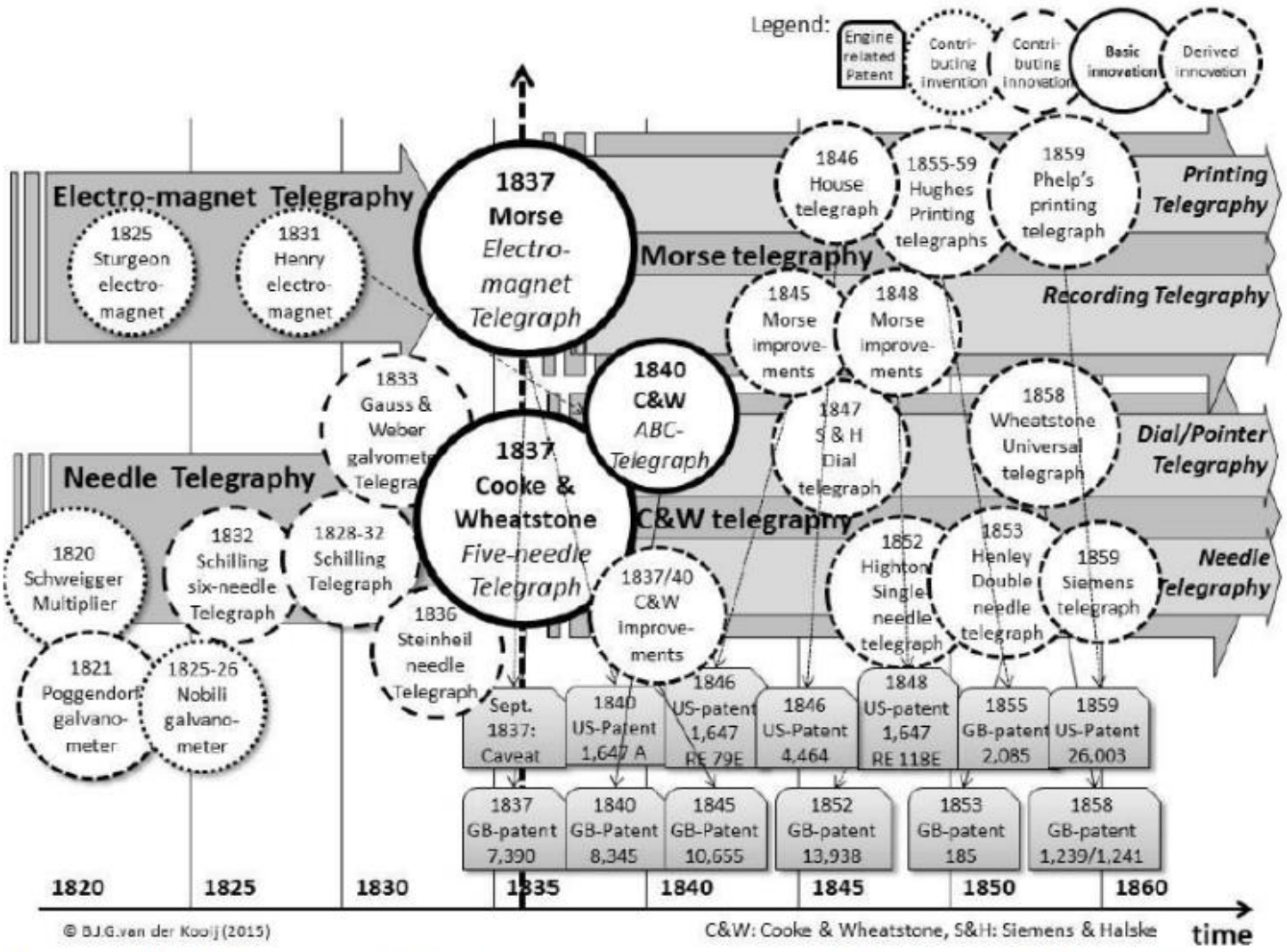

Figure 219: Overview of the clusters of innovations for electric telegraphy.

Source: Figure) created by author

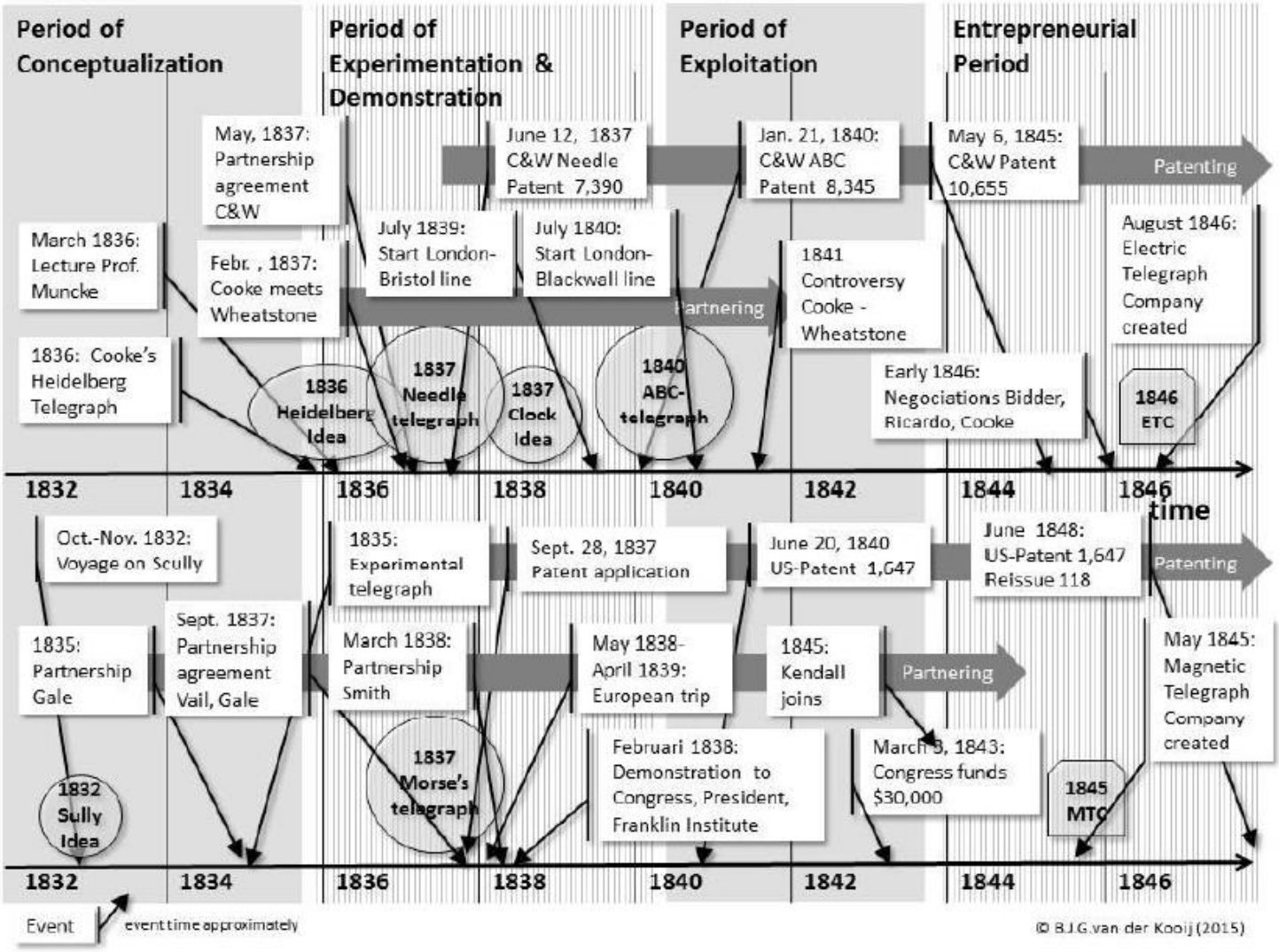

Figure 220: Combined timeline of events related to Cooke and Wheatstone's invention (top) and Morse's invention (bottom).

Source: Figure) created by author

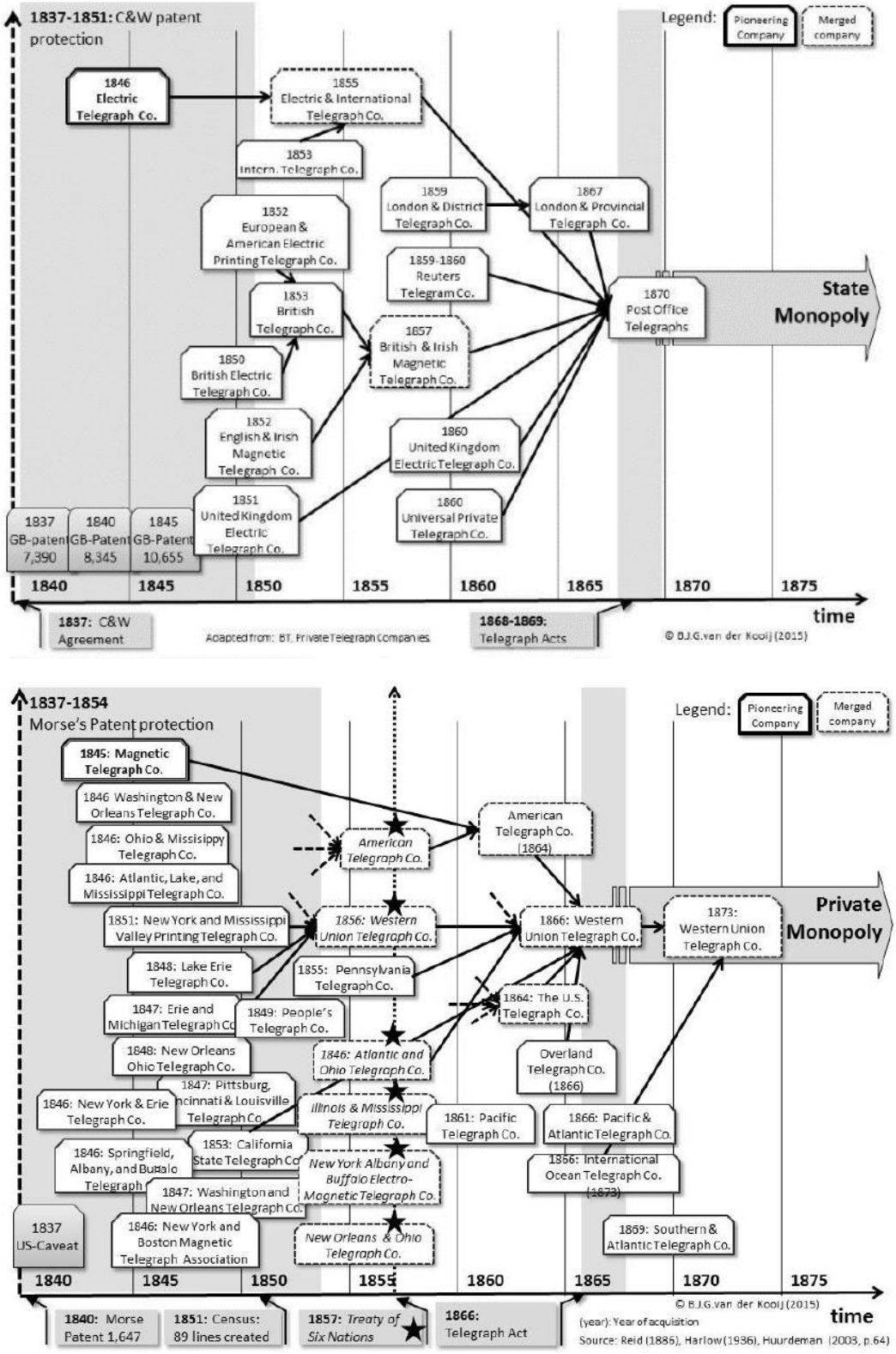

Figure 221: Clusters of businesses: the development in England (top) and the US (bottom).

Source: Figure created by author

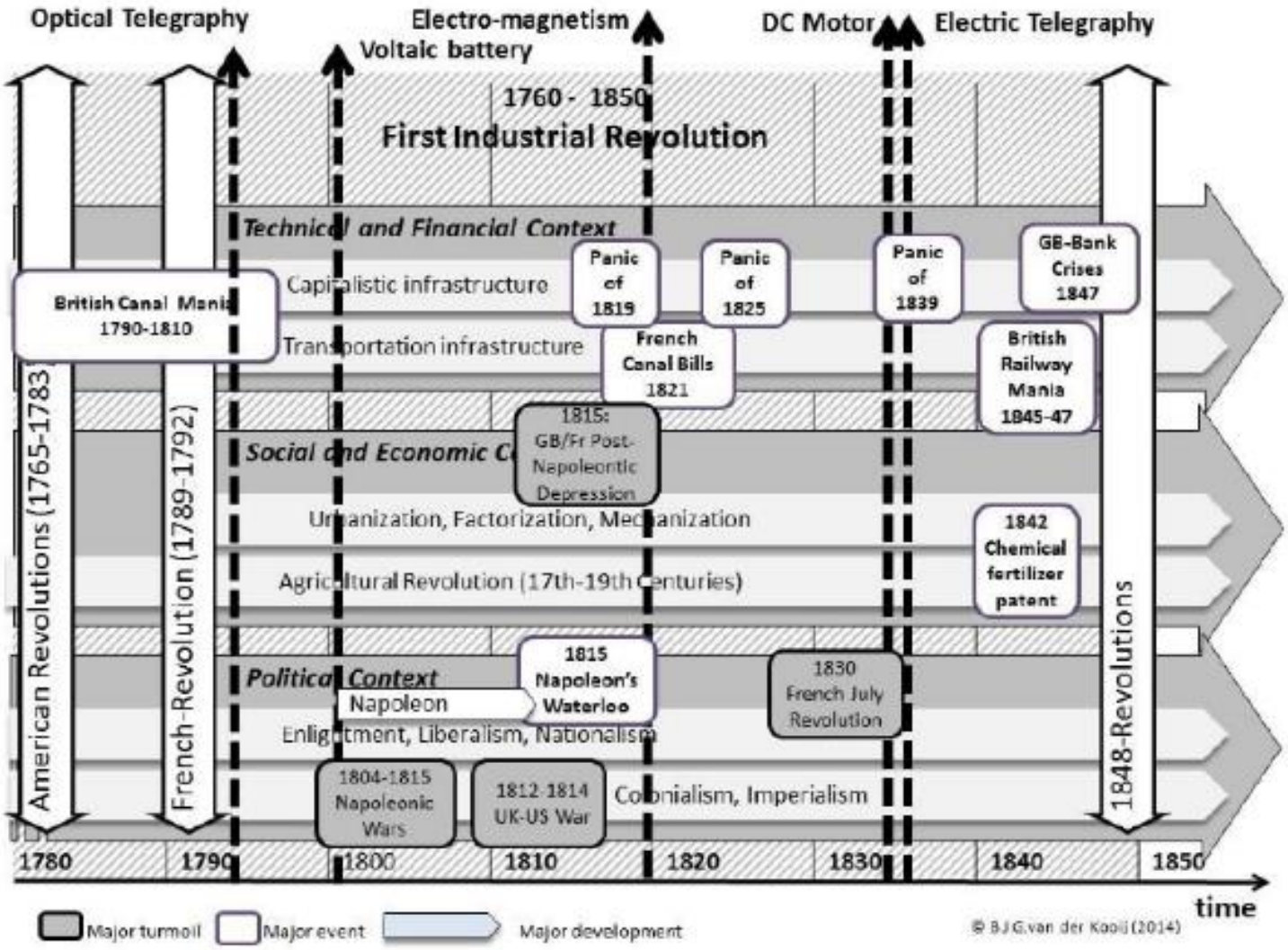

Figure 222: The context related to the invention of electrical telegraphy (First Industrial Revolution).

Source: Figure) created by author

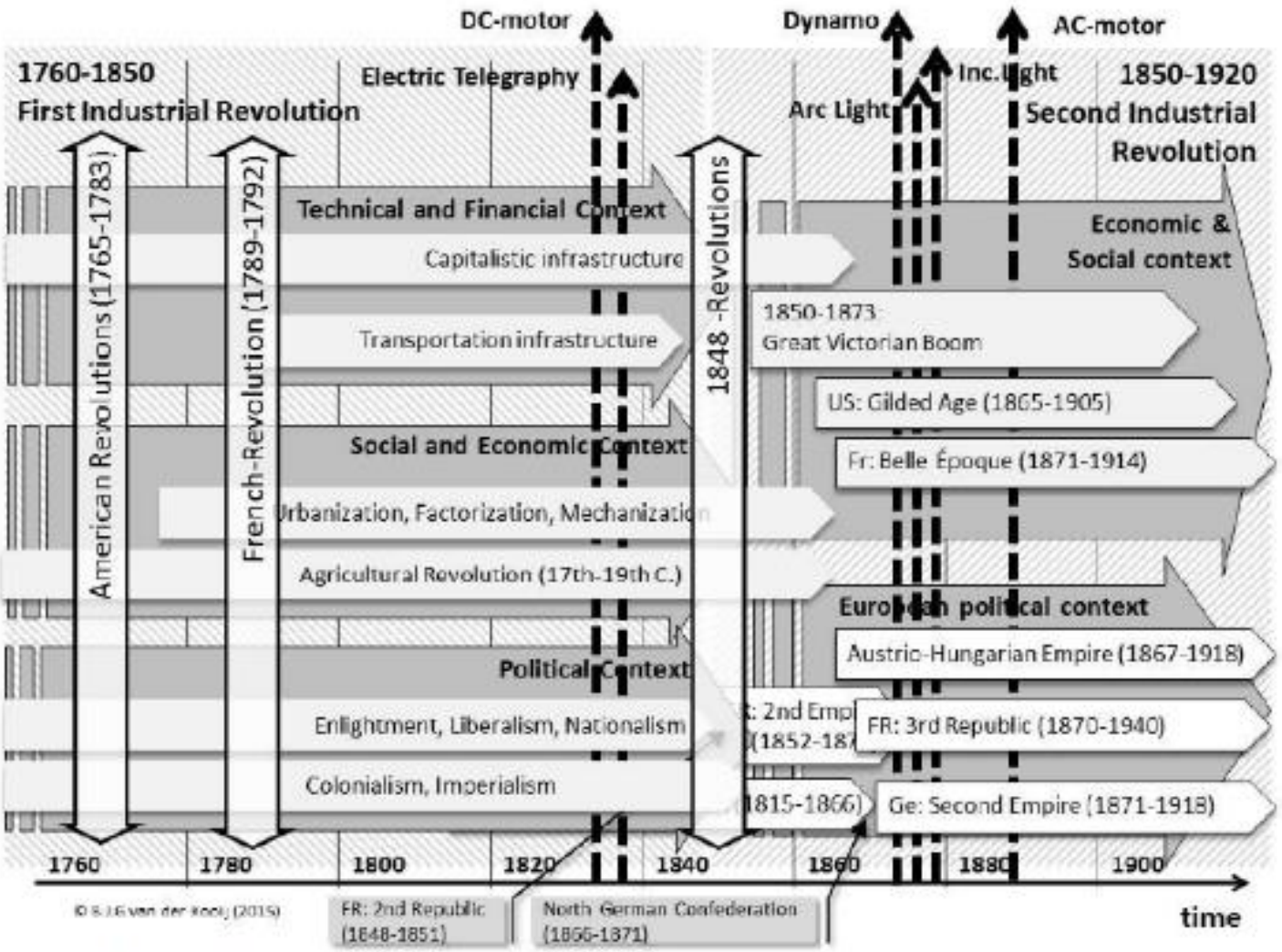

Figure 223: The context related to the invention of electrical telegraphy (First and Second Industrial revolution).

Source: Figure) created by author

THE END