Scanning Our Past From London

Inventors of the Telegraph

One of the papers by this author presented at the IEEE Conference on the History of Telecommunications, July 2001, compared three of the pioneers responsible for the introduction of the electric telegraph.

I. Three Pioneers

This month, our story brings together a portrait painter, an anatomical modelmaker, and a musical instrument maker who were all interested in the telegraph. The three are an American, Samuel Finley Breese Morse (1791–1872), and the Englishmen William Fothergill Cooke (1806–1879) and Charles Wheatstone (1802–1875). Cooke and Morse saw the commercial possibilities, but lacked scientific understanding. Wheatstone had the scientific and technological skills, but did not see the commercial potential.

II. W. F. Cooke

Cooke (see Fig. 1), the son of a professor of anatomy, made wax models of anatomical sections for medical teaching. By chance, he saw a demonstration of Schilling's single-needle telegraph—and immediately changed his career. The concept of telegraphy gripped him. His first telegraph, in March 1836, was developed from a musical box. When a musical box is in operation, pins projecting from a turning drum strike reeds. Cooke's idea was that the drum should indicate letters in sequence and the drum should stop briefly at each desired letter. An electric current moved a lever that allowed the clockwork mechanism to run or stop as desired. At the sending end, the operator sent a signal to start the indicators turning and then to stop them when the desired letter was shown. The recipient noted the letter indicated each time the mechanism stopped. It worked—across a room.

Unfortunately, it did not work at longer distances such as through a mile of wire. That mile of wire was strung up in the office of his friend and solicitor, Burton Lane, who must have been very understanding!

III. Charles Wheatstone

The Wheatstone family were music publishers and musical instrument makers. Charles (see Fig. 2) became interested in the physics of musical instruments and the way in which the sound was transmitted through solid rods and stretched wires. He later set up demonstrations in his father's shop, including his "Enchanted Lyre," a reproduction of a classical Greek lyre hanging from the ceiling on a brass wire. Unseen musicians in the room above played instruments whose sounding boards were connected to the brass wire and the public paid to hear concerts that appeared to come from the lyre. Wheatstone speculated that sounds might be carried for miles through stretched wires or wooden rods and concerts "broadcast" to people's homes.

Wheatstone soon concluded that it was not realistic to transmit sound vibrations very far in this way and turned to electricity. His growing reputation as a physicist led to his appointment as professor of experimental physics at King's College London. There he also made a speaking machine which he demonstrated to visitors—including a young Scot, who later emigrated to North America, called Alexander Graham Bell.

Charles obtained a research grant of £50 to buy several miles of wire, which he arranged in the basement of the College, and began work on an electric telegraph. By 1837, he had two achievements. One was his "permutating principle," the idea that the telegraph sender and receiver should be linked by several wires and that letters should be indicated by selecting two wires. With five wires, there are ten ways of selecting two and, since the current can be made to flow in either direction, 20 distinct signals are possible. Twenty different letters are quite sufficient for intelligible English and so the well-known five-needle telegraph was born.

Wheatstone also brought an understanding of what is now known as Ohm's Law. The work of Georg Simon Ohm (1789–1854), stating that the current in a circuit is proportional to the electromotive force driving it, was published in German in 1827. Wheatstone was one of the few English scientists who understood German. Ohm's work gave Wheatstone an insight into the necessary relationship between the resistance of the windings in the telegraph instruments and the resistance of the line connecting them.

The use of several wires and several needles was unnecessary. A single indicator is adequate, using a code such as Morse's. Understanding Ohm's Law, however, was vital. The resistance of the instrument had to be a significant fraction of the total circuit resistance. Cooke's problem was that when

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Fig. 1. William Fothergill Cooke. (IEEE History Center).

Fig. 2. Charles Wheatstone. [From *Engineers & Electrons* by Ryder and Fink (Piscataway, NJ: IEEE Press, 1984)].

he had a mile of wire in circuit the resistance of that wire was far greater than the resistance of his instruments. He sought scientific advice and was referred to Wheatstone. They met on February 27, 1837, when Cooke found that Wheatstone was already operating a telegraph through his four miles of wire.

IV. Cooke and Wheatstone

Our British pioneers obtained the first patent for a practical electric telegraph system a few months later and built the first practical telegraph installation in 1838 on the Great Western Railway from Paddington to West Drayton. Fame

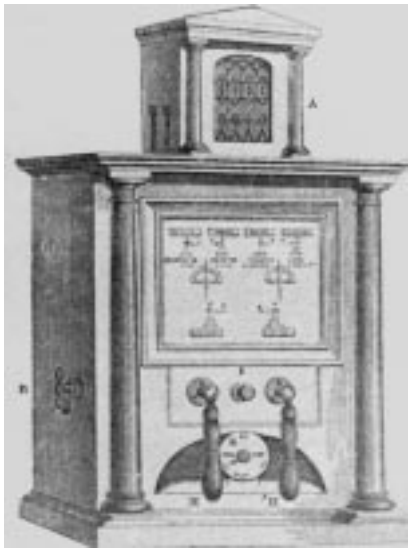

Fig. 3. Double-needle telegraph of Cooke and Wheatstone, which was used in England in the 1840s. [From *Engineers & Electrons* by Ryder and Fink (Piscataway, NJ: IEEE Press, 1984)].

came in August 1844 when Queen Victoria's son, Prince Albert, was born at Windsor Castle. The news was printed in *The Times* next morning, with the additional information that it had taken a rider on horseback eight minutes from the Castle to the telegraph office at the railway station and then it took only three minutes to wake the telegraph operator, send the message to London, and receive an acknowledgment. A few months later, the telegraph was in the news again when it was used to send a message to London that a murder had been committed and the suspect had just got on the London train. Thanks to the telegraph, a policeman met the train in London (see Fig. 3).

The Electric Telegraph Company was set up in 1846, but by then Cooke and Wheatstone had parted on bad terms, arguing about who was entitled to what credit. The quarrel was quite unnecessary. Their differences were referred to formal arbitration by Marc Brunel (1769–1849) and John Frederic Daniell (1790–1845) who produced a "statement of award" in April 1841, which apparently satisfied both parties. It was, in fact, a bland statement of the obvious and could be regarded as an attempt to bang their heads together like silly children. Historians, however, are grateful for the arbitration proceedings, which generated a wealth of documents on the early history.

V. S. F. B. Morse

Morse (see Fig. 4), the eldest of my trio, was one of the first Honorary Members of the Society of Telegraph Engineers—later the Institution of Electrical Engineers—founded in 1871 in London. Unfortunately, the following year he became the subject of the first obituary in the Society's *Journal*. Trained in the fine arts, he was destined for a career as a painter. He visited Europe several times and, on a visit from 1829 to 1832, became acquainted with the idea of an electric telegraph. Like Cooke, he was "hooked" on the possibilities. He conducted his own telegraphic experiments, devised

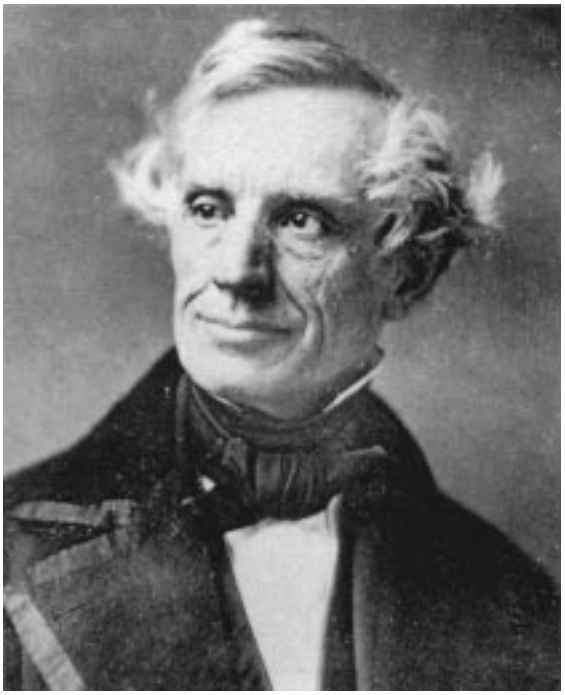

Fig. 4. Samuel Finley Breese Morse. [From *Information Highways & Byways* by Irwin Lebow (Piscataway, NJ: IEEE Press, 1995). Photo Courtesy Western Electric.]

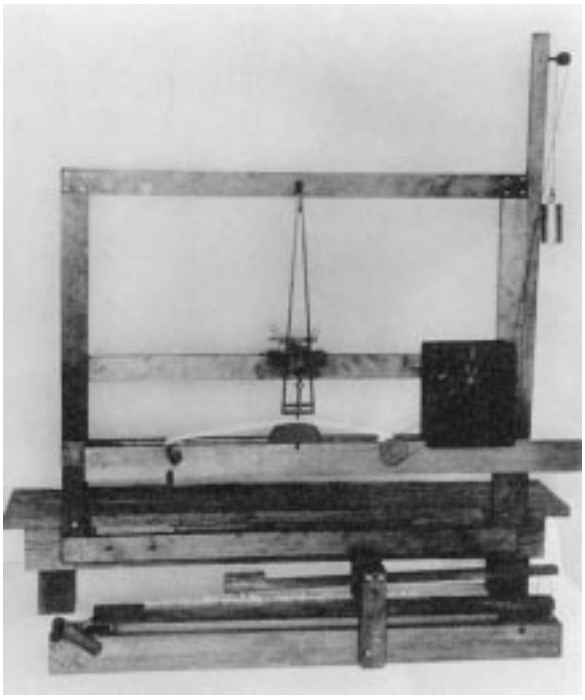

Fig. 5. Morse's 1837 telegraph. [From *Information Highways & Byways* by Irwin Lebow (Piscataway, NJ: IEEE Press, 1995). Photo Courtesy Western Electric.]

a workable telegraph, and obtained a United States patent in 1840.

In 1838, Morse sought an English patent, which was opposed by Cooke and Wheatstone, among others. Morse did not appreciate the difference between English and U.S. patent law at that time. In England, a patent had to be applied for before the idea was published. In the USA, it was possible to get a patent after the idea was published if you could prove that you had the idea earlier. Morse failed to get an English patent, which he regarded as most unjust, though he found some consolation in getting a seat in Westminster Abbey for the coronation of Queen Victoria (1819–1901). He returned to the USA and successfully promoted electric telegraphs there, using the code known ever since by his name.

Morse's first telegraph-receiving instrument (see Fig. 5) was built around a frame for stretching canvas. It was a printing telegraph, recording the dots and dashes of what was subsequently called Morse code. A hanging pencil made a continuous mark on a paper tape, which was pulled slowly through the device. The message signal was applied to an electromagnet that pulled the pencil to one side—briefly for a dot and longer for a dash. According to Morse, it was the fact that his telegraph left a printed record that really distinguished his telegraph from Cooke and Wheatstone's. Morse said his own instrument was a "telegraph," whereas Cooke and Wheatstone's was a "semaphore." In Morse's own words, a semaphore conveys an *evanescent* signal and a telegraph (Fig. 6) conveys a *permanent* sign.

In 1840, Cooke and Wheatstone wrote to Morse suggesting that they join forces, but Morse rejected the proposal. He bore no grudge against Wheatstone and told his daughter

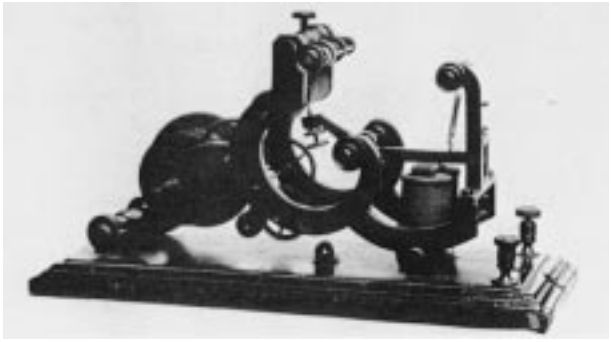

Fig. 6. Morse receiving instrument of 1860. [From *Engineers & Electrons* by Ryder and Fink (Piscataway, NJ: IEEE Press, 1984)].

"Wheatstone ... is a man of genius and one with whom I was personally much pleased."

After returning to the USA, Morse consulted Joseph Henry, who had also been in London in 1837 where he conducted experiments with Faraday and Wheatstone. It is pure speculation, but perhaps Henry learned about Ohm's law while in London. Congress eventually funded the telegraph from Washington to Baltimore over which, on May 24, 1844, Morse sent the biblical quotation "What God hath wrought."

VI. Conclusion

Morse also became embroiled in litigation, to the ultimate benefit of the historian. It would be a sad comment on society, however, to conclude that the best way for an inventor to get in the history books is to go to the law!

None of our three heroes originated the *idea* of electrical communication and none devoted their whole lives to it.

All three made money, though the impetuous Cooke lost his in another venture. Wheatstone's musical instrument inventions, especially the concertina, and Morse's work as a painter would have assured both men a place in the history books even if they had never become involved with the telegraph.

If Cooke, Wheatstone, and Morse were with us now, they would have moved on to e-mail, the logical development of what they were doing. All three are entitled to a place of honor in history, but we cannot extract a recipe for success. All three possessed originality and drive, but they were so different in background and character that it is quite impossible to draw any conclusions about who will or will not succeed in a new venture.

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