



Joseph Henry: Inventor of the Telegraph?

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In 1885 Edward N. Dickerson dedicated a plaque at Princeton College that commemorated Joseph Henry's role in the invention of the telegraph. In his address, Dickerson not only outlined Henry's scientific achievements upon which telegraphy rested. He also claimed the scientist actually *invented* the telegraph in 1831, several years before Samuel F. B. Morse constructed and demonstrated his first crude prototype.¹ Beyond Henry's accomplishments, Dickerson asserted, "nothing is essential to the present telegraph, except that ordinary mechanical skill which is far below the level either of discovery or invention."²

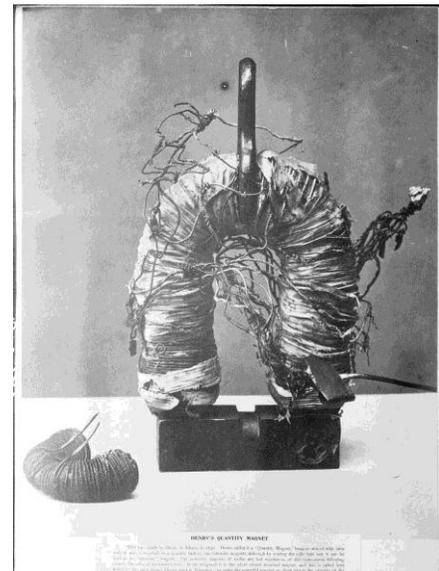
Samuel Morse, or the "American Leonardo," as one of his biographers labeled him, is remembered today as the inventor of the telegraph. But did he, as Dickerson suggested, possess only "ordinary mechanical skill," while Joseph Henry achieved the real breakthroughs? In brief, did Henry invent the telegraph?

The answer depends on how one defines the terms "invent" and "telegraph." On a more fundamental level, a full answer to this question must explore the nature of and connections between scientific research and technological innovation in a period when the legal, ideological, and economic foundations of intellectual property rights were particularly unstable.³

It is certain that Joseph Henry was important to the history of the telegraph in two ways. First, he was responsible for major discoveries in electromagnetism, most significantly the means of [constructing electromagnets](#) that were powerful enough to transform electrical energy into useful mechanical work at a distance. Much of Morse's telegraph did indeed rest upon Henry's discovery of the principles underlying the operation of such electromagnets.

Secondly, Henry became an unwilling participant in the protracted litigation over the scope and validity of Morse's patents. Between 1849 and 1852 the defendants in three infringement suits subpoenaed Henry in the hopes that his statements would weaken

or invalidate Morse's claims, and his testimony proved crucial to the Supreme Court's 1854 split decision that struck down Morse's broadest claim.⁴ Because of



Surviving Henry electromagnet, which he termed "quantity magnet." Smithsonian neg. no. 39040.



Henry's involvement in these suits, the two men engaged in a bitter dispute over issues of scientific and technological priority, a conflict that continued until their deaths in the 1870s. As petty and mean-spirited as this conflict was, it nevertheless revealed much about their differing attitudes concerning the relative importance of the work of scientists and inventors in the middle third of the nineteenth century.

Henry's Scientific Contributions to Telegraphy

Before reviewing Henry's scientific contributions to telegraph technology, it is necessary to outline the state of electrical science as he found it. Physicists had been investigating electrical phenomena since about 1700. By the close of the eighteenth century, two scientists, Benjamin Franklin in America and Charles Augustin Coulomb in France, had taken the science of electrostatics about as far as it could go.⁵ The development of battery technology after the turn of the century opened up the vast new field of electrodynamics, including electrochemistry and investigations into the behavior of electricity in circuits.

Electricians had also been experimenting with various methods for telegraphic communication since about 1775. In the last quarter of the eighteenth century, several Europeans had constructed telegraphs using static or machine electricity, and had so demonstrated the scientific possibility of electrical telegraphy. After the development of the battery at the turn of the century, researchers employed the chemical effects of galvanic electricity, either to mark treated paper or to decompose water, to form signals at a distance. Although these methods demonstrated electrical telegraphy was possible in theory, they proved cumbersome and unworkable in practice.

Then in 1820, the Danish physicist Hans Christian Oersted reported that an electrical current passing through a wire deflected a nearby compass needle. His publication immediately set physicists to work on the relationship between electricity and magnetism. Directly after this announcement, the German scientist Johann Schweigger constructed his "multiplier," or multi-turn coil, which greatly increased the magnetic power of an electrical circuit. Schweigger's multiplier became the first accurate electrical measuring device--the galvanometer--and remains the basis for modern voltmeters and ammeters. About four years later, William Sturgeon in England invented the electromagnet, a horseshoe-shaped piece of iron wrapped with a loosely wound coil of several turns; the electromagnet became magnetized when a current passed through the coil, and de-magnetized when the current ceased. Sturgeon's electromagnet, which could be regulated by closing and opening the circuit, converted electrical energy into useful and controllable mechanical work. The galvanometer and electromagnet soon became staples of the electrical laboratory and lecture hall.

As with machine and galvanic electricity, researchers quickly moved to investigate the applicability of electromagnetism to long-distance communication. Within a year of Oersted's publication, the eminent French physicist André-Marie Ampère suggested a

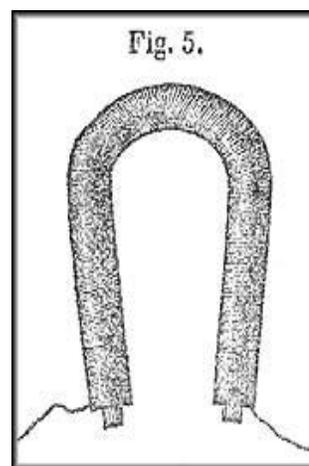


telegraph system employing Schweigger's multiplier, in which each letter or number had assigned to it a separate circuit and indicating needle. Ampère reported that his experiments were "completely successful," but he did not pursue the matter further. In 1824, however, the English researcher Peter Barlow dampened enthusiasm for needle telegraphs. "The details" of such a device, Barlow wrote, "are so obvious, and the principle on which it is founded so well understood," that the only open question was whether the electrical current could deflect a magnetized needle after passage through a long wire. To his disappointment, he "found such a sensible diminution" of the needle's deflection through only 200 feet of wire, "as at once to convince me of the impracticability of the scheme."⁶ Barlow's result seemed to present an insurmountable barrier to using this newly discovered physical force for long-distance communication.

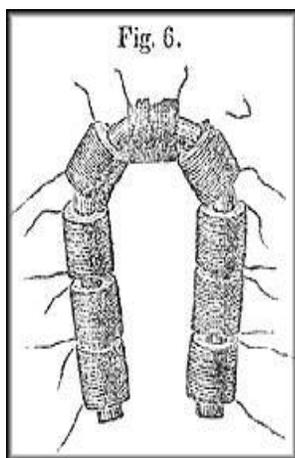
Joseph Henry began his research into electromagnetism in 1827, while he was an instructor at the Albany Academy in New York. By 1830, he achieved two major breakthroughs that overcame Barlow's barrier. His first crucial innovation, which he demonstrated in June 1828, was to combine Schweigger's multiplier with Sturgeon's electromagnet to obtain an extremely powerful magnet. While Sturgeon loosely wrapped a few feet of uninsulated wire around a horseshoe magnet, Henry tightly wound his horseshoe with several layers of insulated wire. In March 1829 he demonstrated an electromagnet with 400 turns, or about 35 feet, of insulated wire. This magnet, Henry

remarked later, "possessed magnetic power superior to that of any before known."⁷

Yet, Henry said, "the maximum effect was not yet obtained." He found that as he increased the turns beyond a certain length of wire, magnetic power dropped off, due to the increased resistance of the circuit. To investigate ways of maximizing the magnetic power of a battery, he embarked on his second important line of investigation. He wound a series of shorter coils, instead of one long coil, around the iron core in order to find the optimal configuration for obtaining magnetic power. Henry tested two methods. He connected the coils in parallel in order to reduce the resistance of the circuit; this allowed "a greater quantity," or higher current, of electricity "to circulate around the iron." He also connected the coils in series and employed a battery connected in series so as to increase voltage, or "the projectile force of the electricity."⁸



Sketch of Henry magnet. From Smithsonian annual report for 1857, p. 101.



Sketch of Henry's more powerful magnet. From Smithsonian annual report for 1857, p. 102.

The former method, connecting the coils in parallel, maximized the magnetic force obtained from a battery consisting of one element with a large plate area, a low voltage and high current

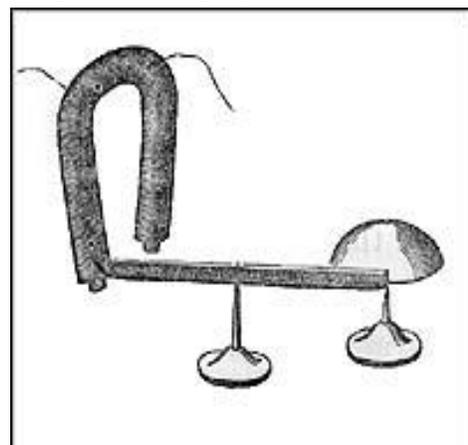


battery. Henry termed this a "quantity" magnet, because it was well suited for operation with a "quantity" battery. He called the latter method, connecting the coils in series, an "intensity" magnet, because it obtained the most magnetic force from an "intensity" battery, or a high voltage and low current battery consisting of several elements connected in series. Henry also found that a "quantity" magnet was well-suited to provide great mechanical power at short distances from the battery. An "intensity" magnet did not generate as much lifting power, but worked quite well at long distances from the battery.

Henry reported his findings in Benjamin Silliman's *American Journal of Science* (hereafter *Silliman's Journal*) in January 1831. This paper was of course important because it described both of his major advances: his improved electromagnet, a combination of Schweigger's multiplier with Sturgeon's magnet; and his investigations into obtaining maximum magnetic force from a given battery configuration. But this paper also became a point of contention between Henry and Morse during the later telegraph patent litigation. For both these reasons, a detailed discussion of this paper is necessary.

In a series of 23 experiments, Henry first confirmed Barlow's result, that the deflection of a galvanometer needle and the lifting power of an electromagnet both dropped off rapidly with wire length. He then replaced Barlow's one-element battery with one of 25 elements connected in series and repeated the experiments. He at first obtained the anomalous result that more magnetic force was generated when the current passed through a thousand feet of wire than when the magnet was directly connected to the battery. He explained this away by speculating that the battery chemistry was slightly different between these two trials. In discussing his first seven experiments, Henry concluded that "the magnetic action of a current" from a battery arranged in series "is, *at least*, not sensibly diminished by passing through a long wire." This result was "directly applicable to Mr. Barlow's project of forming an electro-magnetic telegraph; and also of material consequence in the construction of the galvanic coil."⁹

This was more than a casual, offhand remark. For Henry did set out to demonstrate the practicability of an electromagnetic telegraph immediately after his paper appeared. His prototype consisted of a small battery and an "intensity" magnet connected through a mile of copper bell-wire strung throughout a lecture hall. In between the poles of this horseshoe electromagnet he placed a permanent magnet. When the electromagnet was energized, the permanent magnet was repelled from one pole and attracted to the other; upon reversing battery polarity, the permanent magnet returned to its original position. By



Sketch of "telegraph" Henry showed his classes at the Albany Academy. From Smithsonian annual report for 1857, p. 105.



using a pole-changer to cycle the electromagnet's polarity, Henry caused the permanent magnet to tap a small office bell. He consistently demonstrated this arrangement to his classes at Albany during 1831 and 1832.

In 1832, Princeton hired him as professor of natural philosophy. He reconstructed his telegraph prototype on the Princeton grounds, this time stringing a wire between two campus buildings. He not only continued to demonstrate electromagnetic communication at a distance, but in 1835 he also developed a primitive relay. He used an "intensity" magnet, which worked well at low power over great distances, to control a much larger "quantity" magnet supporting a load of weights. By breaking the "intensity" circuit, he also de-energized the "quantity" circuit, causing the weights to crash to the floor--while he remained at a safe distance. Students remembered that he described the arrangement as a means to control mechanical effects at long range, such as the ringing of distant church bells. On a trip to England in 1837, Henry described this arrangement to Charles Wheatstone, who was casting about for a repeating arrangement for his needle telegraph.

So by 1835, Henry had demonstrated, at least in a laboratory and lecture-hall setting, that an electromagnetic telegraph was possible. His "intensity" magnet would become the basis of Morse's repeater, which allowed signals to travel great distances; his "quantity" magnet formed the heart of Morse's recording instrument; and his "intensity" to "quantity" relay became with some modification Morse's arrangement for connecting his local receiving circuit to a long-distance telegraph line. But Henry never sought to commercialize his system, or even to demonstrate it on a larger scale. He saw his telegraph as a particularly effective lecture-hall demonstration of the principles of electromagnetism. Princeton students vividly recalled Henry's telegraphic demonstrations just as they remembered him electrocuting chickens and shocking classmates.

Henry and Morse

It is one of the surprises of nineteenth-century history that Samuel Morse, a portrait painter with little formal scientific or technical training, established the first commercial telegraph system in the United States. He succeeded partly through his own hard work and perseverance, but also because he sought out the assistance of men who had the necessary skills and training. Joseph Henry was one of those men.

Morse claimed that he conceived of his recording telegraph during an Atlantic crossing in October 1832. By early 1836 he managed to construct a simple prototype, which used a one-element, or quantity, battery and a Sturgeon electromagnet. With this primitive apparatus Morse was able to mark signals, but only to a distance of about forty feet. To increase the range of his device, Morse sought the aid of Leonard Gale, professor of chemistry at New York University, where Morse taught painting. Upon seeing his prototype in the winter of 1836-37, Gale immediately made several



recommendations, first advising him to use an intensity battery of many elements arranged in series. He also recommended replacing the Sturgeon magnet with Henry's intensity magnet.

Most importantly, Gale urged Morse to read Henry's 1831 paper in *Silliman's Journal*, which described these improvements. After using a twenty-element series battery and an electromagnet of several hundred turns, Morse and Gale were able to record messages through ten miles of wire. This success emboldened Morse to reveal his invention to the world. He demonstrated his telegraph publicly for the first time on September 2, 1837; solicited government support from the secretary of the Treasury a few weeks later; and filed a caveat with the Patent Office at the beginning of October.

So Henry's first involvement with Morse's telegraph was indirect but still quite important. His work on electromagnets, as reported in *Silliman's Journal* in 1831 and communicated to Morse through Gale, helped the inventor take a crucial step forward in developing his telegraph. It is doubtful whether Morse would have exposed his invention to the public, to the secretary of the Treasury, and to the Patent Office had his range remained limited to forty feet.

Between 1839 and 1842, Morse frequently corresponded with Henry, seeking both scientific advice and public endorsements of his telegraph. Henry gave both willingly. But he also made it quite clear that he regarded Morse's machine as the application of scientific principles discovered by himself and other scientists. In an oft-quoted letter that he wrote in February 1842 to help Morse obtain Congressional funding, Henry asserted that "science is now fully ripe" for an electromagnetic telegraph, and that the idea "would naturally arise in the mind of almost any person familiar with the phenomena of electricity." Although Charles Wheatstone in England and Karl August Steinheil in Germany were working on needle telegraphs, Henry concluded, "I should prefer the one invented by yourself."¹⁰

As long as Morse needed Henry's scientific advice and public endorsement, he accepted these remarks uncritically. But as the inventor became embroiled in bitter litigation over the validity and scope of his patent, his need to establish originality and priority clashed sharply with Henry's assessment of the prior art.

The first sign of a break occurred in the fall of 1845. At that time, Alfred Vail, Morse's principal assistant and part owner of his patent, published a book giving a history and description of Morse's electromagnetic telegraph. Vail clearly acknowledged that "the electro magnet is the basis upon which the whole invention rests in its present construction; without it, it would entirely fail."¹¹ Yet Vail barely mentioned Henry's work, merely quoting another author who credited him with "making magnets of extraordinary power...able to lift thousands of pounds weight."¹² Henry was understandably angry at this snub, exclaiming to Wheatstone that he intended to "inform Mr. Morse if he suffers any more such publications to be made by his assistants he will array against him the



science of this country and of the world." However, Henry concluded, perhaps Morse "had no knowledge of the preparation of the book."[13](#)

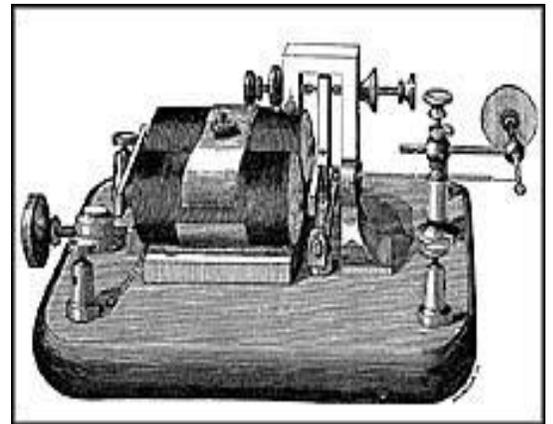
That indeed was the stance Morse took--that he had no knowledge of or control over the contents of Vail's book. Vail also claimed that his slight of Henry's work was an unintentional oversight, due to ignorance of the scientist's work.[14](#) Both men were being somewhat disingenuous, as their private correspondence reveals. While Morse may not have read Vail's book word for word, he was familiar with its contents; Morse also owned a one-quarter interest in the book. He also made it quite clear that he did not want the book to interfere with his application for a patent on the receiving magnet and local circuit.[15](#) This patent, granted in 1846, later proved central to Morse's successful infringement suits against two competing telegraph systems.[16](#)

Morse's desire to keep the receiving magnet a secret pending the outcome of his patent application provides a more realistic explanation of his assistant's omission of Henry's work. The receiving magnet was a crucial component of his telegraph, which enabled it to function as a long-distance communications system. Acting as a relay, at great distances from the main battery and sending key, it operated a much shorter local circuit containing a smaller battery and Morse's recording instrument.

The receiving and recording magnets were, respectively, little more than Henry's intensity and quantity magnets, which he described in his 1831 paper. Furthermore, the local circuit arrangement was quite similar to Henry's scheme, demonstrated to his classes since 1835, of using an intensity magnet to break the circuit of a quantity magnet supporting a load of weights. Vail, therefore, made only a passing reference to Henry's work, as a full acknowledgment of his contributions would have placed Morse's patent application for the receiving magnet in jeopardy.

The second major rupture occurred in the fall of 1849, when Henry was dragged into a patent infringement suit. The defendants, who were using a telegraph that clearly infringed Morse's patents, hoped Henry's testimony concerning the prior art would invalidate the patent's key claims.[17](#) Henry, for his part, claimed that he did not wish to become a party to this controversy and that he gave his statement unwillingly, only under subpoena.

In his deposition, Henry adhered to the main points he had stressed in his correspondence with Morse between 1839 and 1842. He claimed his 1831 paper "was



Sketch of Morse receiving magnet. From George B. Prescott, *History, Theory, and Practice of the Electric Telegraph* (Boston, 1860), p. 80.



the first discovery of the fact that a galvanic current could be transmitted to a great distance with so little a diminution of force as to produce mechanical effects, and of the means by which the transmission could be accomplished. I saw that the electric telegraph was now practicable."¹⁸ He also stressed that he demonstrated to his Princeton classes after 1833 "how the electro-magnet might be used to produce mechanical effects at a distance adequate to making signals of various kinds." He did not "reduce these principles to practice," because he regarded this to be "of subordinate importance" to his scientific work. Besides, Henry concluded, scientists were disinclined to "secure to themselves the advantages of their discoveries by a patent."

Henry regarded Morse's machine as "the best" of several telegraphs under development in the mid-1830s, all of them "applying the principles discovered" by himself and others. Morse did not make "a single original discovery, in electricity, magnetism, or electro-magnetism, applicable to the invention of the telegraph. I have always considered his merit to consist in combining and applying the discoveries of others in the invention of a particular instrument and process for telegraphic purposes."¹⁹

Henry said soon afterward that he had "always been careful to give Mr. Morse full credit for his invention, though I cannot award to him the exclusive right to use the scientific principles on which his invention is founded."²⁰ He had consistently taken this stance since he became acquainted with Morse's telegraph in 1839. The inventor had not previously objected to statements of this sort. But Morse now perceived Henry's views as a powerful threat to his patent.

Morse's reply, entitled "A Defence Against the Injurious Deductions Drawn from the Deposition of Prof. Joseph Henry," appeared in a short-lived telegraphers' journal in January 1855. It was, contrary to its title, a direct attack on Henry. Morse intended to show he was not indebted to Henry "for any discovery in science, bearing on the Telegraph, and that all discoveries of principles having this bearing, were made not by Prof. Henry, but by others, and prior to any experiments of Prof. Henry in the science of Electro-Magnetism."²¹ This statement was contrary to Morse's previous expressions of respect and gratitude, and was, of course, completely false.

Morse seized upon three particulars in Henry's 1831 paper to discredit his competence and integrity. First, Morse claimed that the anomalous result Henry had obtained, that magnetic force increased with wire length, demonstrated that Henry was either a bumbling experimenter or an incompetent theoretician. He then argued that Henry's remark, that his results were "directly applicable to Mr. Barlow's project of forming an Electro-magnetic telegraph," was proof that Henry was ignorant of prior work on telegraphy, since Barlow had no such project and his results showed that such a project was in fact impossible. And finally, Morse claimed that Henry had no intention to work on telegraphic communication, since he made his remark in an offhand way in the middle of his paper. He implied that Henry put forward his claims only after Morse had



done all the hard work and had assumed all the risks associated with developing and commercializing a new technology.

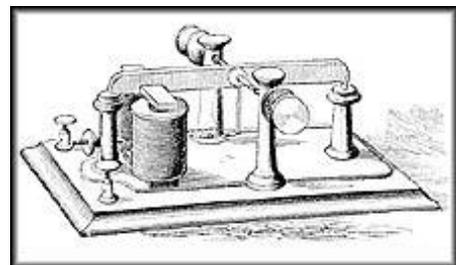
Henry chose to respond in a more dignified fashion. Claiming that Morse's assertions called into question his character and his scientific ability, and therefore his fitness to serve as the Secretary of the Smithsonian Institution, he asked the institution's Board of Regents to exonerate him. They did so in a series of brief resolutions and allowed him to attach a statement outlining his contributions to electromagnetism. Henry was not reticent about his accomplishments, but the difference in tone between the two pieces is quite striking. While Morse's "Defence" was polemical, bitter, and edgy, Henry's statement was measured, calm, and confident.

Conclusion

We are now in a position to return to the question posed at the beginning of this paper: Was Joseph Henry the inventor of the telegraph? A reasonable answer to this deceptively simple question is that Henry did not invent the telegraph, but that its invention would have been delayed for many years, if not been impossible, without him.

Henry never claimed to have invented a telegraph. In fact, he was quite clear in his depositions and other public statements that he did not concern himself with reducing his scientific discoveries to practice. Here Henry was perhaps conscious of the wide gulf separating a lecture-hall demonstration from a commercial communications system, between ringing a bell through a mile of wire and actually sending messages reliably between two distant cities. Furthermore, had he regarded himself as an inventor of a telegraph, he would not have provided Morse with valuable technical assistance and public endorsements between 1839 and 1842.

However, Henry did insist quite strongly and correctly that he discovered the principles upon which telegraphy rested, and that he demonstrated how they could be applied. His research and apparatus--his quantity and intensity magnets, and his relay--served as the basis for much of Morse's machinery. All that Henry required from Morse was an acknowledgment of his scientific achievements and his willingness to share them freely. This the inventor could not do without risking the invalidation of key claims in his patents.



Sketch of Morse sounder, widely used on telegraph lines after ca. 1855, and similar to Henry's classroom "telegraph." From Prescott, *History*, p. 92.

Henry's scientific work on electromagnetism and Morse's development of his telegraph occurred while the legal rights of inventors were in flux. Electrical science at this time was also in an unsettled state; there existed a wide gulf between theoretical understanding and technological practice. These two considerations interacted and



called into question the nature and relative importance of basic scientific research and applied technological innovation. Initially, both Henry and Morse generally agreed on these issues, but their conceptions diverged during the course of the protracted legal struggle over the validity of Morse's patents, a struggle lasting roughly from 1845 to 1854.

Both men fully developed and articulated their views only during the patent litigation, and they came to attach competing meanings and values to the work of scientists and inventors. Henry the scientist heralded basic research as the mainspring of social improvement, and thought of technological advances as the mere application of scientific discoveries. He conceived of his findings as contributions to the fund of human knowledge, freely available to anyone who found them useful. Also, Henry relied upon the open publication of his work to achieve professional respect and success. Morse the inventor regarded scientific discoveries as abstract and barren things, until someone like himself made them concrete and fruitful by embodying them in a machine. In his view, invention, and not basic research, was the engine of progress. Furthermore, an entrepreneur like Samuel Morse regarded inventions as intellectual property and relied upon the patent laws to protect his rights and to reap a financial reward for his labors.



Notes

1. Edward N. Dickerson, *Joseph Henry and the Magnetic Telegraph. An Address Delivered at Princeton College, June 16, 1885* (New York: Charles Scribner's Sons, 1885), pp. 42-43. [Return to [text.](#)]
2. Ibid, p. 52. [Return to [text.](#)]
3. For discussions of patent rights in this period, see Robert Post, *Physics, Patents, and Politics: A Biography of Charles Grafton Page* (New York: Science History Publications, 1976); Carolyn Cooper, *Shaping Invention: Thomas Blanchard's Machinery and Patent Management in Nineteenth-Century America* (New York: Columbia University Press, 1991); and Daniel Preston, "The Administration and Reform of the U.S. Patent Office, 1790-1836," *Journal of the Early Republic* 5 (Fall 1985): 331-353. For Henry's views on some of these questions, see Arthur P. Mollela, "The Electric Motor, the Telegraph, and Joseph Henry's Theory of Technological Progress," *Proceedings of the IEEE* 64 (Sept. 1976): 1273-1278. [Return to [text.](#)]
4. These suits were *Morse v. O'Reilly*, brought in Kentucky in 1849 against the Columbian Telegraph; *Smith v. Downing*, brought in Boston in 1850 against House's Printing Telegraph; and *French v. Rogers*, brought in Philadelphia in 1851 against Bain's Chemical Telegraph. The Morse interests were successful in *Morse v. O'Reilly* and *French v. Rogers*, but failed to obtain an injunction in *Smith v. Downing*; the judge in that case ruled that House's telegraph did not infringe Morse's patents. For the Supreme Court decision in 1854, including Chief Justice Taney's majority opinion and Justice Grier's dissenting opinion, see *Decision of the Supreme Court of the United States on the Patents of Professor Morse* (New York: Pudney & Russell, Printers, 1854). Taney's majority opinion sustained all of Morse's patents except the eighth and broadest claim in his 1840 patent (as reissued in 1848), while Grier's dissenting opinion held that all of Morse's claims, including the eighth, were valid. For the effect of Henry's testimony on the views of the Justices, see two letters from Amos Kendall to Morse, Feb. 1, 1853, and Feb. 5, 1853, Morse Papers, Library of Congress. [Return to [text.](#)]
5. For a discussion of electrical science before the discovery of the battery, see J. L. Heilbron, *Electricity in the 17th and 18th Centuries: A Study of Early Modern Physics* (Berkeley: University of California Press, 1979). [Return to [text.](#)]
6. As quoted in William B. Taylor, "Henry and the Telegraph," in *Annual Report of the Board of Regents of the Smithsonian Institution...for the Year 1878* (Washington: Government Printing Office, 1879), p. 279. [Return to [text.](#)]
7. "Communication from Prof. Henry, Secretary of the Smithsonian Institution, Relative to a Publication by Prof. Morse," in *Annual Report of the Board of Regents of the Smithsonian Institution...for the Year 1857* (Washington: William A. Harris, Printer, 1858), p. 109. [Return to [text.](#)]
8. Ibid, p. 102. [Return to [text.](#)]
9. Joseph Henry, "On the Application of the Principle of the Galvanic Multiplier to Electro-Magnetic Apparatus, and Also to the Developement of Great Magnetic Power in Soft Iron, with a Small Galvanic Element," *American Journal of Science and Arts* 19 (January 1831): 404. [Return to [text.](#)]
10. Henry to Morse, Feb. 24, 1842, in *The Papers of Joseph Henry*, Vol. 5, Nathan Reingold, ed. (Washington: Smithsonian Institution Press, 1985), p. 151. [Return to [text.](#)]



11. Alfred Vail, *The American Electro Magnetic Telegraph: With the Reports of Congress, and a Description of all Telegraphs Known Employing Electricity or Galvanism* (Philadelphia: Lea & Blanchard, 1845), p. 13. [Return to [text.](#)]
12. Ibid, p. 134. [Return to [text.](#)]
13. Henry to Wheatstone, Feb. 27, 1846, in *The Papers of Joseph Henry*, Vol. 6, Marc Rothenberg, ed. (Washington: Smithsonian Institution Press, 1992), p. 385. [Return to [text.](#)]
14. Both these points appear in a letter to Henry which Morse dictated and Vail signed, July 17, 1846, in *The Papers of Joseph Henry*, Vol. 6, Marc Rothenberg, ed. (Washington: Smithsonian Institution Press, 1992), p. 450. [Return to [text.](#)]
15. About a year before publication, Morse wrote to Vail that the book "ought to be a joint concern of yours and mine," and that it should outline "the abortive attempts of the first plans abroad" in order to bolster Morse's claims to priority of invention. Morse to Vail, June 3, 1844, Vail Telegraph Collection, Smithsonian Institution Archives. In other letters, Morse repeatedly asked Vail to withhold information on the receiving magnet until he could obtain American and European patents on it. See especially Morse to Vail, Oct. 8, 1845, Vail Telegraph Collection. In his book, Vail finessed his explanation of how the telegraph operated over long distances in order to avoid describing the receiving magnet and local circuit, which had been in use on the first Washington to Baltimore line. See especially p. 18. [Return to [text.](#)]
16. These were the Barnes & Zook, or Columbian, telegraph; and Bain's chemical telegraph. [Return to [text.](#)]
17. Morse brought suit in 1849 in the US District Court in Kentucky against the telegraph entrepreneur Henry O'Reilly, seeking to enjoin him from using the Columbian Telegraph, a system which tried to evade Morse's patents by slightly modifying his machinery. Judge Monroe granted the injunction, but O'Reilly appealed to the Supreme Court. The Supreme Court ruled against O'Reilly and sustained the injunction, but struck down Morse's broadest claim--the exclusive use of electromagnetism for the purposes of recording signs at a distance. [Return to [text.](#)]
18. "Deposition of Joseph Henry, in the Case of Morse vs. O'Reilly," Sept. 1849, reprinted in *Annual Report of the Board of Regents of the Smithsonian Institution...for the Year 1857* (Washington: William A. Harris, Printer; 1858), p. 110. [Return to [text.](#)]
19. Ibid, p. 113. [Return to [text.](#)]
20. Henry to Cambridge Livingston, May 13, 1850, in *The Papers of Joseph Henry*, Vol. 8, Marc Rothenberg, ed. (Washington: Smithsonian Institution Press, 1998). [Return to [text.](#)]
21. Morse's "Defence," in *Shaffner's Telegraph Companion*, Jan. 1855, p. 8. [Return to [text.](#)]