J. Casale - W2NI

The Vail Register

The Vail Register as it appears today at Cornell University

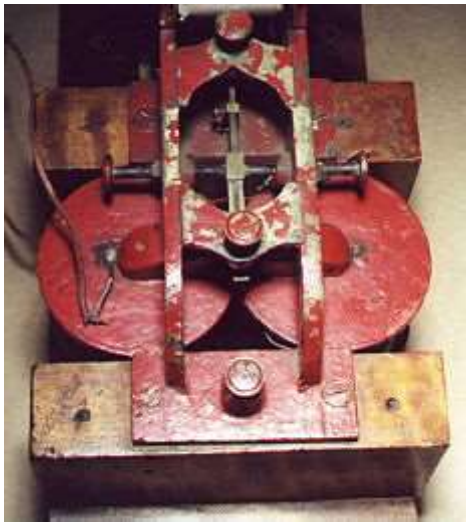
On Friday, May 24, 1844 at 8:45AM, the beginning of the telecommunications era in the United States began with the successful receipt of *"What Hath God Wrought"*. That message was received on a telegraph register designed by Alfred Vail.

In preparation for the article about Samuel Morse's farewell message, I started to accumulate material about the Vail register and felt its historical significance demanded its own article. The register, as with the labors of its designer, have received minimal recognition over the years. I recently had the unique opportunity to spend two days examining this National treasure at Cornell University. In this article, I will attempt to describe and document what I found there.

On March 3, 1843 a bill granting 30,000 dollars for an experimental telegraph line was passed by the U.S. Senate and signed that same day by President Tyler. Samuel Morse named Alfred Vail as one of his three assistants, giving him the responsibility to superintend the machinery requirements for the new line between Washington and Baltimore. Vail, in his March 21st acceptance letter to Morse states his responsibilities in part :*"As an assistant...I can superintend and procure the making of the instruments complete according to your direction, namely; the registers, the correspondents with their magnets, the batteries, the reels, and the paper..."* Work began on the instruments shortly thereafter. Vail's design for two registers was finalized in early 1844 and his drawings were given to Mr. John Stokell, a New York City clock maker, for final assembly. On April 1, 1844 the construction of the aerial line began in Washington under the supervision of Ezra Cornell. One of the two registers built, was placed at the Capitol under Morse's control. The second register was transported from place to place by Vail, in order to test each new segment of the line with Morse, as they progressed north towards Baltimore.

After Vail received that historic message in Baltimore, he kept the register in a hallway case at his home. Alfred Vail passed away in January of 1859 and, in his will, bequeathed all his telegraph instruments to Samuel Morse with the exception of his Baltimore register, which he willed to his eldest son Stephen. Stephen Vail had the register until 1873 when it was loaned for two consecutive exhibitions, first at The Metropolitan Museum of Art in New York City until 1876/77, then, at the National Museum in Washington until 1898. During 1897, Vail decided to sell his father's register and offered it to Mr. J. Schurman, the president of Cornell University at a

"reduced" price of 1000 dollars. Schurman, who; *" knew of no one willing to give 1000 dollars for this purpose"* gave Vail's letter to Professor R.H. Thurston, who suggested to Vail that he write each of the seven trustees of the University. A positive response was returned from representatives of the estate of Hiram Sibley, who provided the funds for its purchase. Sibley, as with the University's founder, Ezra Cornell, have deep roots in the history of the telegraph in America. In March of 1898, Vail directed the Smithsonian to box the register and ship it to Cornell University, where it has been ever since. The Smithsonian was obviously disappointed with its departure, but, according to Vail ; *"..they have expressed great desire to purchase it, but funds were too low".*



At first glance, photographs of the register give the appearance of a large imposing instrument; but it's not. The dimensions are 13 11/16" long, by 5 15/16" wide, with an overall height of 8 inches. The register actually consists of two separate assemblies; a register and a clockwork. The register portion consists of the magnets, the pen lever, the pens, and a grooved roller. The magnets, which are imposing, measure 3 inches in both diameter and height. The coils of the magnet are wound around a core of soft iron joined together by a bottom plate that form a horse shoe pattern. The copper wire is insulated with cotton that has been saturated in shellac. Wooden discs are at each end of the coils and are held together using binding wire. It has been documented that the magnets, used in the relays on the Washington-Baltimore line, were wound with 16 gauge wire. Morse and Vail thought the wire size needed to be as close as possible to the size used for the line. (16 gauge) When measuring one of the stubs protruding from the top of the register's magnets, with a set of outside calipers, it was not surprising to find 16 gauge wire used here too. Also, because of this wire size, it was not surprising to find the resistance across the two coils, measured at the stubs with a Fluke 87 DVM, to be 1.2 ohms.

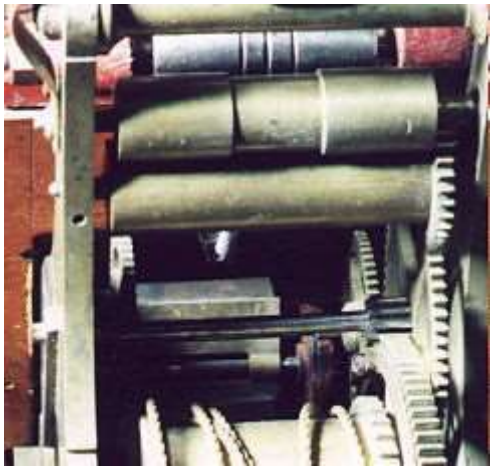
All later embossing registers used Vail's design of a steel pen with a grooved roller.

The three pens pointing upwards to the roller.

Three steel pens with blunt points are used. The center pen is threaded directly through the pen lever. The other two pens are held against the sides of the lever with straps. They thread into a top plate which allowed the center pen to pass straight through. When current passes through the coils of the magnets, the pen lever pivots upwards forcing the pens against the paper and into the grooves of the roller. The steel roller, with three grooves, spins freely on its pivots and allows the paper to flex within its grooves by the pressure of the pens, embossing a mark. (lines indicating dots and dashes) Early pen experiments included the use of lead and ink, but Vail's design using a steel stylus was the most efficient and maintenance free way to print. Morse referred to Vail's steel stylus as *point se'che*. With the high reliability of Vail's steel stylus, the redundancy of 3 pens, a left over

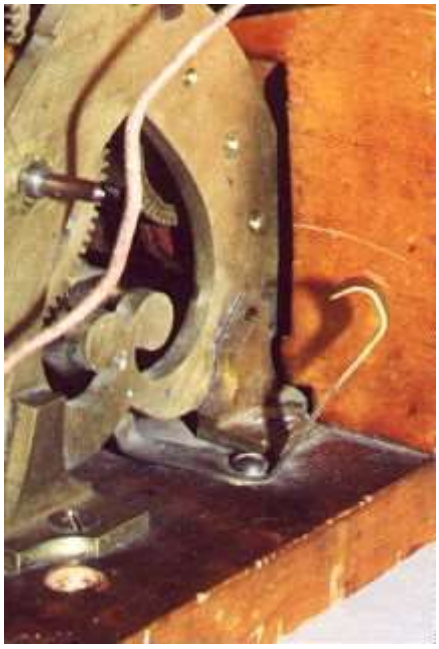
from earlier designs, proved unnecessary. A single pen was used in later designs found in the U.S.

The original pen lever return spring is missing. Vail originally used a long steel wire spring that went from a binding post, on the top end of the register, to a yoke on the bottom of the lever near the pens. This wire ran almost parallel with the lever. In its place is a much newer coil spring going between the bottom of the pens to a new arm near the clockwork. The original spring still appeared in photographs taken in 1895. A replacement spring could easily be made, though, and all the original hardware is still there.



A close-up view of the governor. You can see a copper strip attached to one of the horizontal vanes in the center of the photograph.

The clockwork's sole function is to transport the paper. The power to drive it was supplied from a weight suspended below the register by a cable, that went through an opening in the register's base, and then through a hole in the operating table. As with early weight driven clocks, the weight was wound up by using a clock key or crank that turned the brass drum within the clockwork, which, in-turn ratcheted up the cable unto the drum. The clockwork is set in motion by the releasing of a "break", a brass lever on the side of the register that pressed up against a small wheel on the axle of the governor.



The "break" consists of a simple brass strip that pivots on a screw and presses up against a rubber wheel on the axle of the governor. You can see the wheel in the governor photo on the left.

Located near the bottom of the clockwork and nestled into the wood by one inch, is a simple, fixed-pitch, two vane governor that was used to help maintain a constant speed by spinning against the resistance of the air. The governor shows a very early modification. On top of the leading edge of each vane is a copper strip that was attached by poured solder. This modification increased the overall surface area of the vanes by 31 percent, providing the additional drag to slow down the clockwork.

The paper is 1.5 inches wide and a small amount can be wound on a metal spindle that is supported by two pivots. The brass half-circles, which are fixed, and part of the frame, serve as guides. A separate 15" diameter reel was used to supply the paper after the experimental line became operational.

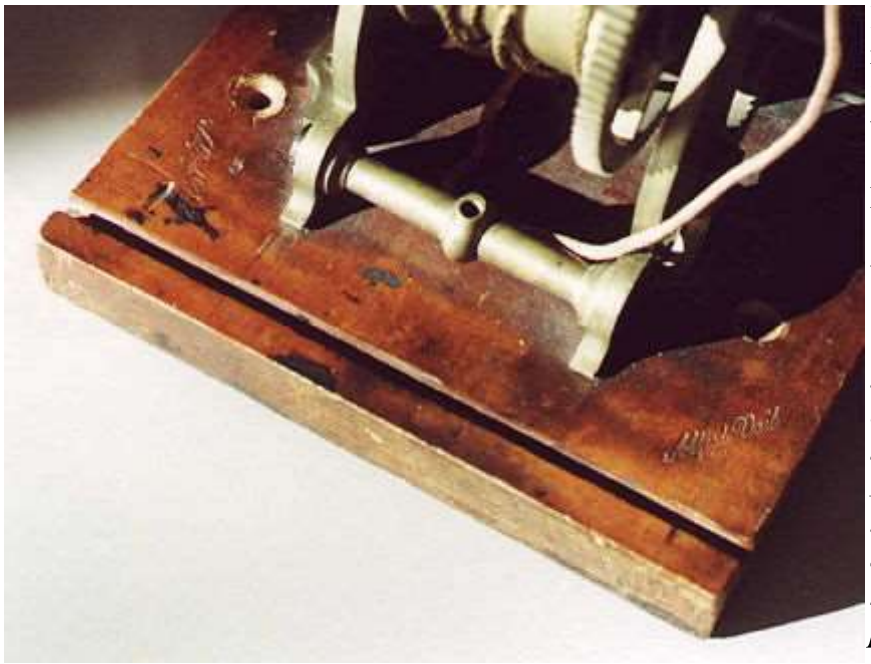
**A sample of the print from the register.
It was produced manually by pulling the paper through while depressing the lever.
Three letters, " A W A "**

Cosmetically, the magnets and brass frame are painted in a bright red paint that is fading and chipping from the brass. A carpenter's scribe marks are still visible where they were used for centering, and to outline the cutting of the dovetail joint. The hardwood base appears to have been coated with shellac and the bottom was left untreated. The brass clockwork is just press fitted in place within its four anchors.

Unlike the angelic harp-like-patterned registers that were used in the 1850-60's, this register's design is a practical one. The solidly built, 157 year old register could go back to work tomorrow if required. With fresh connections to its magnets, a weight, and a reel of paper, it would perform effortlessly all day long. All of its stops are still adjusted perfectly to produce a clear print sample; almost as if it was just pulled out of service. The last significant demonstration of its abilities appears to have been in 1944, for a centennial encore of the first message.

The sound of it is quite impressive. When depressing the pen lever against its stops, it produces a deep solid sound that is fully absorbed within its base. None of its resonance makes it to the table underneath. There is only a trace of reverberation coming from the "new" spring.

You may be wondering what happened to the register at Morse's station in Washington. In a conversation Stephen Vail had with Morse, Morse told him: *"that the instrument in his charge at Washington had disappeared and he knew nothing of its existence."*



Two of the nine signatures by Alfred Vail.

It is clear that Vail wanted it known that this register was designed by him. His signature is engraved in nine different places into the wood base. When the register was loaned for the Morse tribute on June 10,1871, a hand written note signed by Alfred Vail was found attached to the bottom of the register when it was moved.

"This lever and roller were invented by me in the sixth story of the New York Observer office, in 1844, before we put up the telegraph line between Washington and Baltimore... I am the sole and only inventor of this mode of telegraph embossing writing. Professor Morse gave me no clue to it... and I have not asserted publicly my right as first and sole inventor, because I wished to preserve the peaceful unity of the invention, and because I could not, according to my contract with Professor Morse, have got a patent for it. "

Vail's attached note to the singular telegraph heirloom of his last will and testament, is convincing evidence that his wish was to isolate, protect, and provide for history, his

register, along with a record of its significance. Vail's 1837 contract with Morse gave him one quarter interest in the invention, (later reduced to one eighth) but he never realized any wealth from it. Significant wealth was made, though, by stockholders of successful telegraph companies. Fortunately, due to the generosity of Ezra Cornell and Hiram Sibley, Alfred Vail's original wishes are effectively being granted.....

Special thanks to Cornell University, College of Engineering for allowing me to examine and photograph Alfred Vail's register.

Back to the Telegraph-History home page

A version of this article was originally published in the May 2001 issue of "The OTB," the quarterly journal of The Antique Wireless Association. (A nonprofit historical society)

E-Mail

Sources:

New York Census Index, 1830
New York City Directories, 1842-1847
Description of The American Electro Magnetic Telegraph, Alfred Vail, 1845
Appleton's Dictionary of Mechanics and Engineering, 1852
The Telegraph in America, James D. Reid, 1879
The Century Magazine, April 1888
The Electric World, August 17, October 12, 1895
The Dr. R.H. Thurston Papers, Rare and Manuscript Collections, Cornell University, 1897-1898.
Early History of the Electro-Magnetic Telegraph, J. Cummings Vail, 1914