THE VAIL REGISTER

By John CASALE

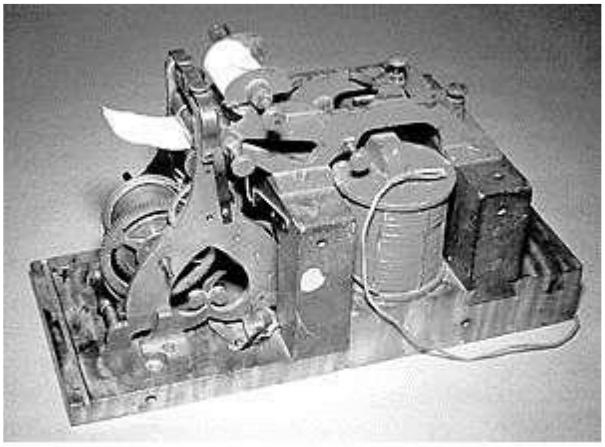
This is the reproduction of an article written by my email friend John CASALE, which was published in the 2001 issue of “The OTB”, the quarterly Journal of the American Wireless Association (AWA, a non-profit historical society).
I myself found this article, a true ‘hands-on’ description of the 1844 Morse register made by Samuel Morse’s assistant Alfred VAIL, very exciting and I think it will also be interesting for many visitors of this website.
My heartfelt thanks and credit go to John and the AWA, who gave me the authorisation to publish it here!

Key and Telegraph

The Vail Register

Edited by John Casale, W2NI

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



The Vail Register as it appears today.

In preparation for my article, in the last issue, about Morse's farewell message, I started to accumulate material about the Vail register and came to feel that its historical significance demanded a separate article. The register, along with the labors of its designer, has 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.

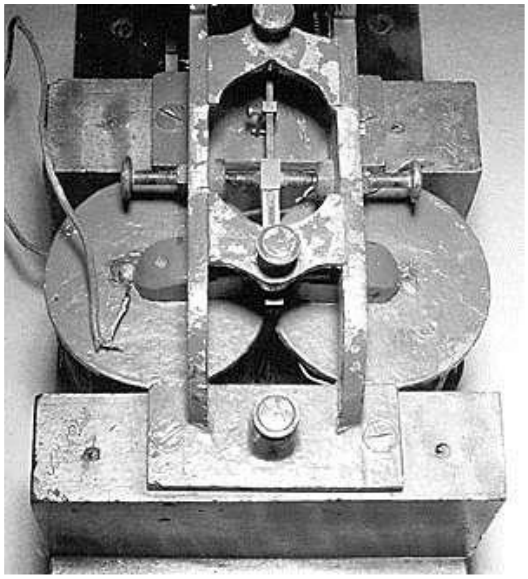
On March 3, 1843, a bill granting 30,000 dollars for an experimental telegraph line was passed by the U.S. Senate and signed that same day by president Tyler. Samuel Morse named Vail as one of his three assistants, giving him responsibility for superintending the machinery requirements for the new line 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

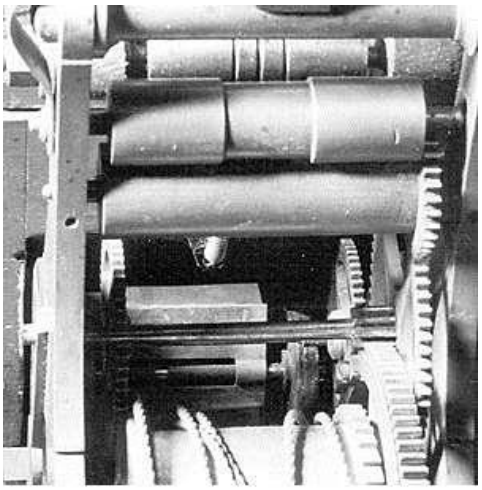
control. The second register was transported from place to place by Vail, in order to test each new segment of the line with Morse as they progressed north towards Baltimore.

After Vail received that historic message in Baltimore, he kept the register in a hallway case at his home. He 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. That was 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.



View looking straight down at coil tops shows pen lever in its pivots

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 that Vail write each of the seven trustees of the University. A positive response was returned from representatives of the estate of Hiram Sibley, which provided the funds for its purchase. Both Sibley and the University's founder, Ezra Cornell, had deep roots in the history of the telegraph in America.



Vanes of governor can be seen directly above cable drum.

In March of 1898, Vail directed the Smithsonian Institution to box the register and ship it to Cornell University, where it has been ever since. The Smithsonian was obviously disappointed with its departure. 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 that the instrument is large and imposing; but it's not. The dimensions are 13 11/16" long, by 5 15/16" wide, with an overall height of 8 inches. The device 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 magnets are wound around cores of soft iron joined together by a bottom plate to form a horse shoe pattern. The copper wire is insulated with cotton that has been saturated in shellac. The wooden discs capping the windings at the ends of each coil are held in place by being pulled together with binding wire.

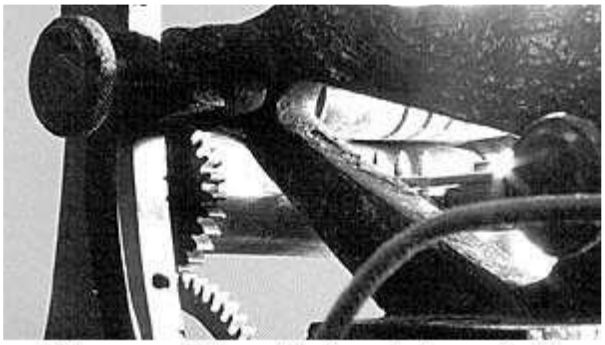
It has been documented that the magnets used in the relays on the Washington-Baltimore line were wound with 16 gauge wire. Morse and Vail thought the wire size needed to be as close as possible to the size used for the line (16 gauge). Measuring one of the wire stubs protruding from the top of the register's magnets, using a set of outside calipers, it was not surprising to find that 16-gauge wire used here too. The resistance across the two coils, measured at the stubs with a Fluke 87 DVM, was 1.2 ohms, consistent with the wire gauge wire used in the windings.

Three steel pens with blunt points are used in the register. 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 the marks that indicated 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 sèche*. With the high reliability of Vail's steel stylus, the redundancy of three pens, a left-over from earlier designs, proved unnecessary. A single pen was used in later designs found in the U.S.

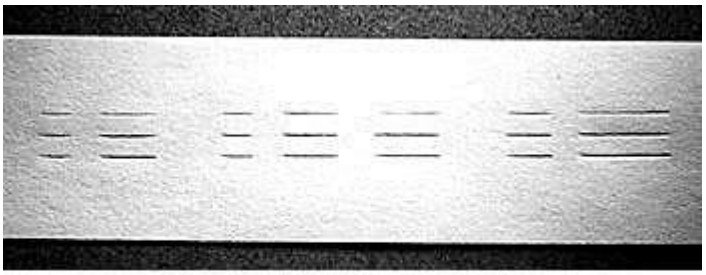
The original pen lever return spring is missing. Vail had used a long steel wire spring that went from a binding post, on the top end of the register, to a yoke on the bottom of the lever near the pens. This wire ran almost parallel with the lever. In its place is a much newer coil spring going between 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 of the original mounting hardware is still there.



Triple-grooved roller, and the three steel pens directly beneath it, are visible through slot in register frame.

The sole function of the clockwork was to transport the paper. The power to drive it came from a weight suspended below the register by a cable that passed through holes in the register's base and 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 the cable up onto 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 simple fixed-pitch, two-vane governor is set an inch into the wood near the bottom of the clockwork. It helped 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 increased the overall surface area of the vanes by 31 percent, providing additional drag to slow down the clockwork.



Sample tape made by pulling tape through register with one hand and manually actuating pen lever with the other.

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.

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 registers that were used in the 1850-60's, this instrument'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 had been 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 this instrument is quite impressive. When the pen lever is depressed against its stops, it produces a deep solid sound that is fully absorbed within the 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."

One of the nine Alfred Vail signatures engraved in the register's wood base.

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

> *"This lever and roller were invented by me in the sixth story of the New York Observe 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.*

The note Vail attached to this singular heirloom is convincing evidence that his wish was to isolate, protect, and provide for history both the register and a record of its significance. Vail's 1837 contract with Morse gave him a 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, thanks to the generosity of Cornell and Sibley, Mr. Vail's original wishes are effectively being honored.

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