Henry, Morse and the Telegraph

Discovery by Scientist – Design by Artist-Entrepreneur

Many dates – pay attention only to ones in boxes

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Computers for NOTETAKING ONLY
Please - NO Cell Phones, Texting, Internet use
Connecting the Continent
1830 – 1883

Information - Transportation

Edward Hopper’s “Railroad Sunset”
Connecting the Continent
1830 – 1883
Information - Transportation

Edward Hopper’s “Railroad Sunset”

Electricity

Morse - intelligence at a distance
Edison - lighting a city
Westinghouse - power at a distance
Marconi – wireless global telegraphy
Electricity

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Morse by Morse

Jed Morse (Father - Geographer) by Morse
Morse by Morse

Lucretia Morse (his wife) by Morse
Samuel Morse

1825: painter - president, National Academy of Design

1835: Professor of Art, NYU

1840: engineer - telegraph patent

Morse by Morse
Samuel Morse

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Eli Whitney by Morse
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Buffalo

Albany

Dewitt Clinton by Morse
Samuel Morse painting of his Yale geology teacher, Benjamin Silliman

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Science and Math HS Teacher
Joseph Henry holding the first sounding telegraph

Silliman’s Journal of Science
Science and Math HS Teacher
Joseph Henry holding the first sounding telegraph
Telegraph - Discovery

- 1820: Electricity linked to Magnetism
- 1825: First Horseshoe Electromagnet
- 1831: Henry’s Strong Electromagnet and Sounding Telegraph
- 1832: Henry comes to Princeton

Science and Math HS Teacher
Joseph Henry holding the first sounding telegraph
Demonstration of compass needle deflection by electric current

Telegraph - Discovery

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Demonstration of compass needle deflection by electric current.

**Why is this demonstration important?**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
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Electromagnet in circuit with two copper-zinc-acid batteries and on-off switch

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\[ R = \frac{\rho L}{A} \]
Resistance

\[ I = \frac{V}{R} \]
Ohm's Law
$B = k I N$

Magnetic Field

$R = \frac{\rho L}{A}$

Resistance

$I = \frac{V}{R}$

Ohm's Law
How does Henry’s sounding telegraph work?

Poles in horseshoe electromagnet reverse when current is reversed

\[ \mathbf{B} = \mathbf{k} \mathbf{I} \mathbf{N} \]

Magnetic Field

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Ohm’s Law
B = kIN
Magnetic Field

- Demo of telegraph and weakening effect of a long line
- Multiple batteries in series compensate for long line

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Resistance

\[ I = \frac{V}{R} \]
Ohm's Law
The greater the voltage, the greater the current.

The longer the path, the greater the resistance.

\[ R = \frac{\rho L}{A} \]

**Resistance**

Long-path magnetic force can match short-path by using a greater voltage.

- Demo of telegraph and weakening effect of a long line
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\[ I = \frac{V}{R} \]

**Ohm's Law**

The greater the voltage, the greater the current.
Parallel – more available current

Series – greater voltage

**B = k I N**

Magnetic Field

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1 volt and up to 1 amp
“The electro-magnetic telegraph was invented by me in Albany in 1830.”

“I think that the first actual line of telegraph using the earth as a conductor was made in the beginning of 1836. A wire was extended across the front campus of the College grounds from the upper story of the Library building to the Philosophical Hall on the opposite side, the ends terminating in two wells. Through this wire, signals were sent from time to time from my house to my laboratory.”

- Joseph Henry

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Philosophical Hall

Library

Telegraph - Design

1832 – Morse’s shipboard idea
1836 – Gale and Vail help out
1838 – Morse shows Van Buren
1842 – Henry helps Morse

Joseph Henry’s House in 1836
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Digital signals in use today – WiFi, Ethernet

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MORSE’S PRINTING TELEGRAPH

ARTIST’S CANVAS STRETCHER
Copper-Zinc Battery
MORSE’S PRINTING TELEGRAPH

ELECTROMAGNET

PEN HOLDER FRAME DEFLECTED BY E-MAGNET

MOVING PAPER TAPE
MORSE’S PRINTING TELEGRAPH

ELECTROMAGNET

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DEMONSTRATION

MOVING PAPER TAPE
MORSE’S PRINTING TELEGRAPH

MOVEABLE TYPE HOLDER

CONTACTS USING MERCURY
Judge Vail – Morse Investor
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Morse patents a Binary Code
TELEGRAPH - Early

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Morse - hires Vail & Cong. Smith
Smith - hires Ezra Cornell

38 miles connecting Baltimore to Washington

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Telegraph Wires along B&O RR
Right-of-Way
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38 miles connecting Baltimore to Washington

Ezra Cornell
May 24, 1844 at 8:45am

MORSE CODE – dots and dashes embossed on moving tape

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Science and Engineering

Discovery
Scientist rings bell

Development
Gov’t Grant, Private Company

Design
Artist plans network

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7th and E St, Washington, DC
Morse idea - replace Post Office
Telegraph Lines in 1853
CONNECTING CITIES

7th and E St, Washington, DC
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TELEGRAPH - Later

1845 – independent companies; wire services; patent disputes

1856 – Western Union – Cornell becomes the major stockholder

1861 – Western Union completes Transcontinental Telegraph Line

1872 – Stearns invents Duplex Telegraph

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CONNECTING THE CONTINENT

Pacific Telegraph Act of 1860 (Pony Express ends service)
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US Capitol in 1861

Smithsonian Castle in 1862
Joseph Henry
Peter Cooper
Telegraph Register
Samuel Morse
Christian Schussele’s “Men of Progress”

US Capitol in 1861
Smithsonian Castle in 1862
Stearns Duplex Idea-1872
TWO MESSAGES ON ONE WIRE

DEMONSTRATION

sounders
keys

Joseph Henry
Peter Cooper

Telegraph Register

Samuel Morse

Christian Schussele’s “Men of Progress”
Christian Schussele’s “Men of Progress”

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Telegraph Register

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Vail telegraph register at Cornell

SIBLEY COLLEGE at CORNELL
Mathew Brady daguerreotype of his photography teacher, Samuel Morse

Vail telegraph register at Cornell

SIBLEY COLLEGE at CORNELL
Mathew Brady daguerreotype of his photography teacher, Samuel Morse
Key Ideas

Scientific
- Strong Electromagnet
- Binary (dot-dash) Code

Social
- Government Investment
- Private Telegraph Company
- Wire Services inform Public

Symbolic
- Artist as Innovator