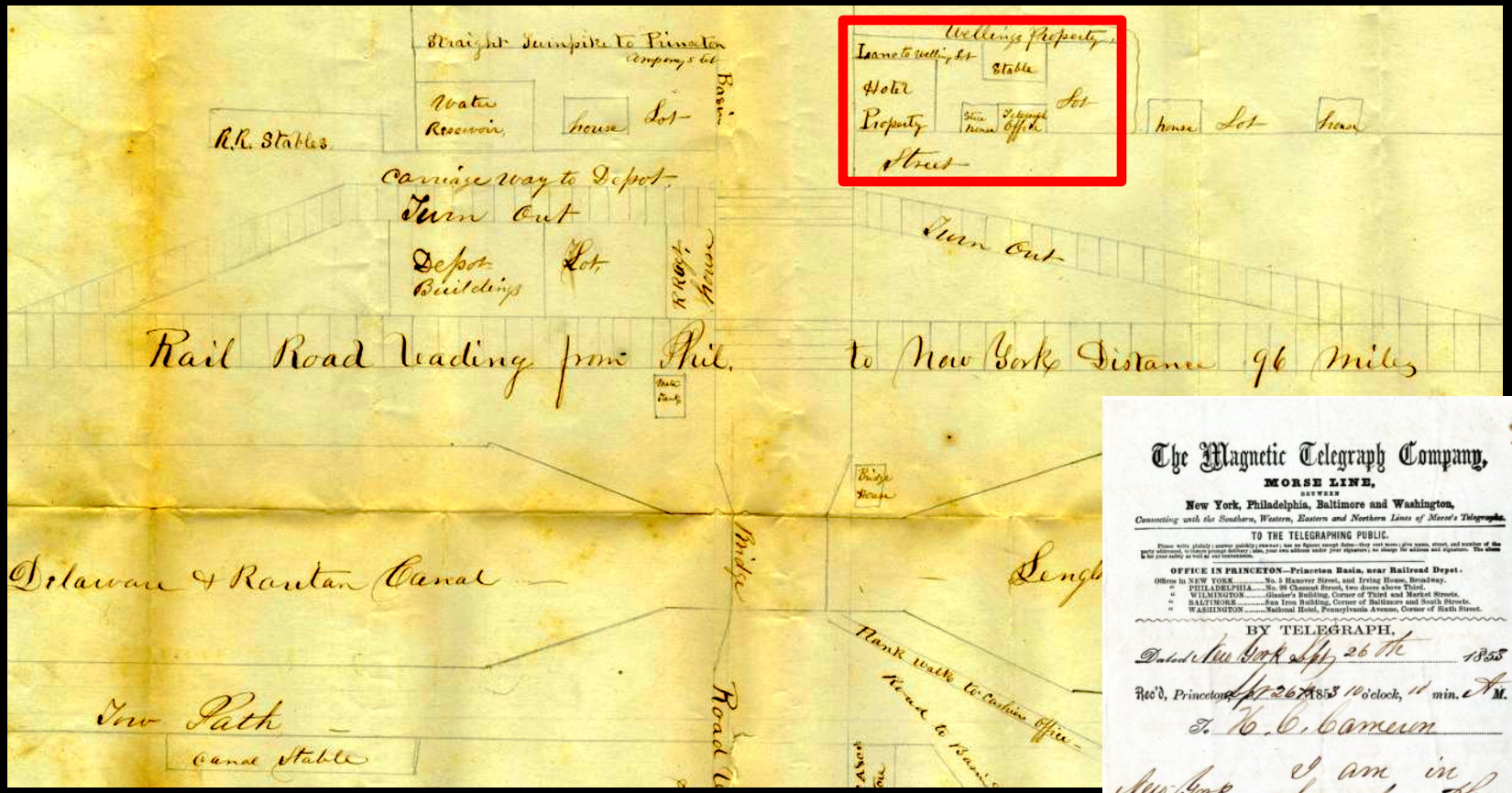
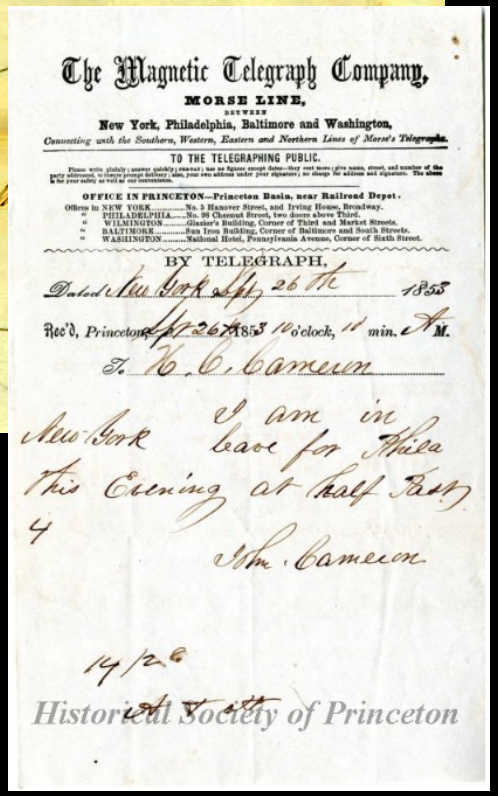
Grif Teller's Painting of Princeton Turning Basin as it would have looked in 1862. John Bull Locomotive shown on the Camden & Amboy Branch Line. Steamboat on the Delaware & Raritan Canal. Princeton Hotel (left) and Store and Telegraph Office (right).





The Magnetic Telegraph Company,

MORSE LINE,

BETWEEN

New York, Philadelphia, Baltimore and Washington,

Connecting with the Southern, Western, Eastern and Northern Lines of Morse's Telegraphs.

TO THE TELEGRAPHING PUBLIC.

Please write plainly; answer quickly; correct; use as figures except dates—they cost more; give name, street, and number of the party addressed, to insure prompt delivery; also, your own address under your signature; no charge for address and signature. The above is for your safety as well as our convenience.

OFFICE IN PRINCETON—Princeton Basin, near Railroad Depot.

Offices in NEW YORK.....No. 5 Hanover Street, and Irving House, Broadway.
" PHILADELPHIA.....No. 98 Chesnut Street, two doors above Third.
" WILMINGTON.....Glasbe's Building, Corner of Third and Market Streets.
" BALTIMORE.....Sun Iron Building, Corner of Baltimore and South Streets.
" WASHINGTON.....National Hotel, Pennsylvania Avenue, Corner of Sixth Street.

BY TELEGRAPH,

Dated New York Sept 26th 1855

Rec'd, Princeton Sept 26th 1855 10 o'clock, 11 min. A M.

T. H. Cameron

I am in New York leave for Phila this Evening at half past 4

Wm. Cameron

14/26

1803 – Trenton to New Brunswick Road – gravel road including straight line segment – now US1

1825 – Erie Canal completed – New York to Buffalo using steamboats and canal boats

1830 – Joseph Henry in Albany rings a bell a mile away using electromagnetism – shows to his High School students

1831 – Mohawk & Hudson Railroad starts operation

1832 – Delaware & Raritan Canal and Camden & Amboy Railroad operational – Princeton Turning Basin

1832 – Joseph Henry comes to Princeton as Professor of Natural Philosophy

1832 – Samuel Morse conceived of an electromagnetic telegraph using a dot-dash code

1836 – Joseph Henry and the Campus Wire – a single wire telegraph from lab to home using earth for return to request his lunch

1838 – Samuel Morse and Alfred Vail demonstrate a telegraph system in Morristown NJ (Speedwell Iron Works)

1840 – Morse patent of Telegraph Signals (US1647)

1844 – Morse, Vail, and Ezra Cornell send a telegraph message between Baltimore and Washington

1846 – Morse patents the Receiving Register (US4453)

1847 – Morse starts the Magnetic Telegraph Company with offices between Phila and NYC – one at Princeton Basin

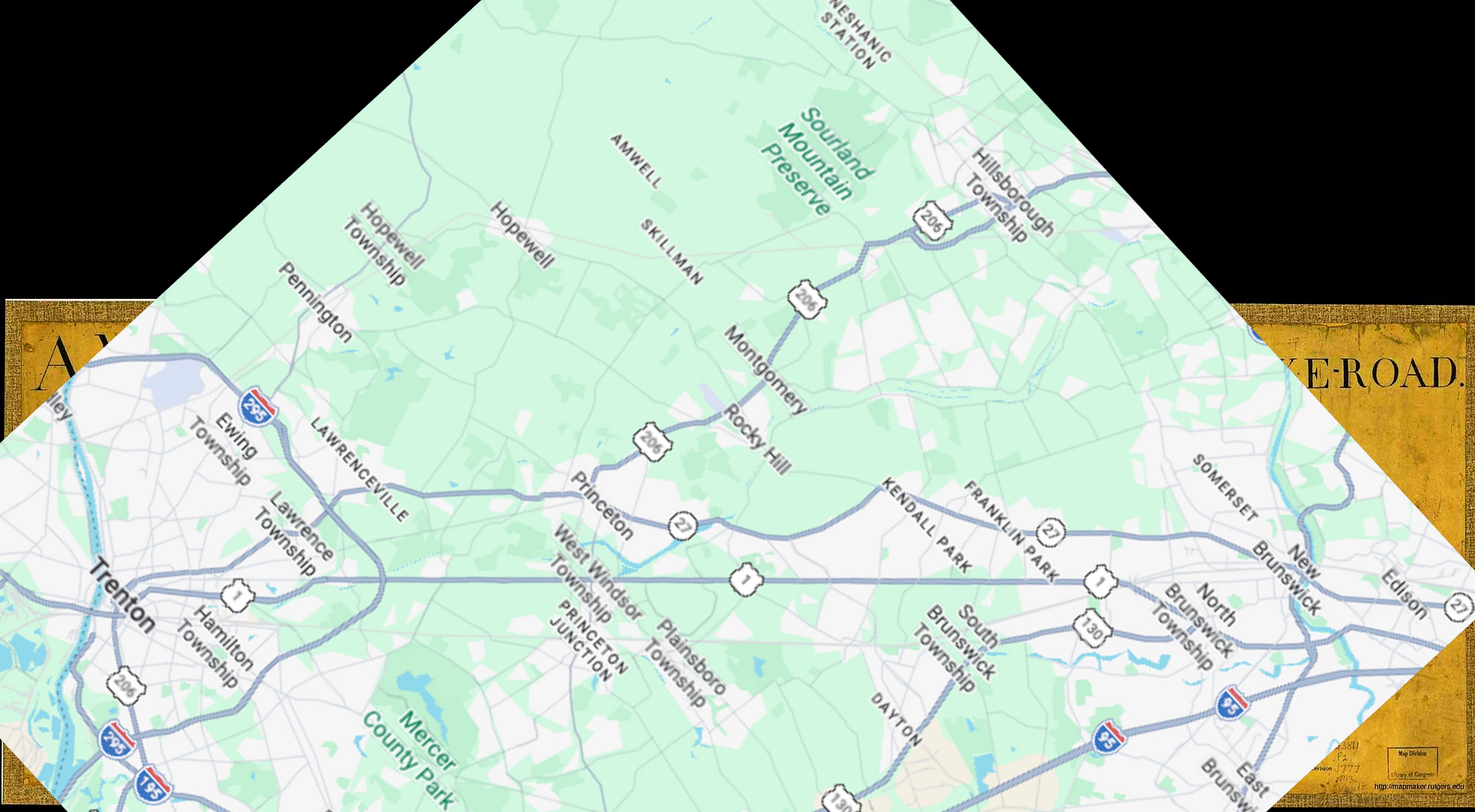
1848 – Morse reissues 1846 Patent (USRE118) showing receiving magnet – his claim to the relay

1853 – Telegram to Henry Clay Cameron received at Princeton Basin

1857 – Western Union formed

1858 – Transatlantic Telegraph Cable – it lasts only 3 weeks

1861 – Transcontinental Telegraph



What is now Rt. 1 between Trenton and New Brunswick was originally chartered as the Trenton and New Brunswick Turnpike in 1803. Throughout its history, the Trenton and New Brunswick Turnpike faced stiff competition from canals such as the D&R Canal and railroads such as the Camden and Amboy Railroad. In the later part of the 19th century, the turnpike company folded and the Pennsylvania Railroad took over ownership of the turnpike. When the charter for the Trenton and New Brunswick Turnpike expired in 1903, it became a public road. When the first numbered highways were legislated in New Jersey in 1916, the present-day US 1 between New Brunswick and Elizabeth was to become a part of Route 1, a route that was to connect Trenton and Elizabeth.

MAIN CANAL
Main Canal
Distance Between Access Points (in Miles)
Parking
1.2 Mulberry Street No
1.7 Whitehead Road No
0.6 Carnegie Road Yes
0.5 Basin Road No
1.8 U.S. Route 1 Yes
2.6 Port Mercer (Quaker Bridge Road)
0.6 Alexander Road
0.6 Washington Road
0.4 Harrison Street
2.2 Millstone Aqueduct
1.9 Kingston Lock (Route 27) Yes
1.0 Rocky Hill (Route 518) Yes
1.4 Little Valley No
0.7 Griggstown Lock No
3.5 Griggstown Causeway Yes
2.1 Blackwells Mills
2.1 Amwell Road
0.6 Weston Causeway
Trenton
Bordentown
Assunpink Creek
Mulberry Street
Whitehead Road
Carnegie Road
Port Mercer
Stony Brook
Alexander Road
Washington Road
Harrison Street
Millstone Aqueduct & Footbridge
Mapleton Road
Cook Natural Area
Kingston
Carnegie Lake
Princeton
Princeton Battlefield State Park
Trenton Battle Monument
Pennington
Hopewell
Rocky Hill
Little Valley
Griggstown Lock
Griggstown Causeway
Griggstown
River Road
Canal Road
Blackwells Mills Causeway
Blackwells Mills
Millstone River
Millstone
Millstone Causeway
East Millstone
Rockingham Historic Site
Six Mile Run Reservoir Site
Demott Lane
Demott Lane Footbridge
Landing Lane Bridge
New Brunswick
5 Mile Lock
South Bound Brook Lock
10 Mile Lock
Raritan River
Zarephath
Weston Causeway
Weston Canal Road
Upper Ferry Road
Wilburtha Road
Lower Ferry Road
Cadwalder Footbridge
Calhoun Street Bridge
Route 1 Bridge

A M
RNPIKE-ROAD.
PRINCETON
TRENTON
NEW BRUNSWICK
Raritan Landing
HIGHTSTOWN
DELAWARE
RARITAN
CANAL
CAMDEN & AMBOY
NORTH BRUNSWICK
SOUTH BRUNSWICK
WEST WINDSOR
EAST WINDSOR
LAWRENCE
MONTGOMERY
FRANKLIN
WASHINGTON
Turnpike
Ten Mile Run
Nine Mile Run
Six Mile Run
Cranberry
Library of Congress, Geography and Map Division
Map Division
http://mapmaker.rutgers.edu

STATE OF NEW-JERSEY

JOINT STOCK
OF THE
DELAWARE & RARITAN CANAL COMPANY & CAMDEN & AMBOY
RAIL ROAD
AND TRANSPORTATION COMPANY

No. 150

OFFICE OF THE

SHARES 13

RAIL ROAD COMPANY

This is to Certify, that George Platt
is entitled to Thirteen Shares in the
CAPITAL STOCK OF THE CAMDEN & AMBOY RAIL ROAD & TRANSPORTATION COMPANY,
transferable on the Books of the Company, and on surrender of this
Certificate only, by him or his legal Representative.
Witness our Hands, and the Seal of the Company,
at Camden N. J. this 16th day of Jany 1834

CAPITAL STOCK THREE MILLIONS

Secretary

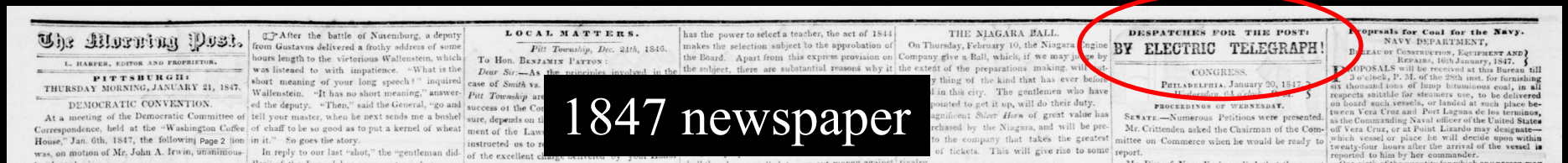
Robt L Stevens President

100 $ EACH SHARE

Millstone River
Princeton
Kingston
Rocky Hill
East Millstone
Somerville
Middlebush
Voorhees
CAMDEN & AMBOY
BRANCH R.R.
DELAWARE & RARITAN CANAL
MILLSTONE R.R.
Monmouth Junction
Deans
Dayton
Plainsboro
Princeton Junction
Lawrence
Windsor
Newtown
Hightstown
Cranberry
Prospect Plains
Jamesburg
FREEHOLD & J
New Brunswick
Raritan
Washingtons Crossing
Scudders Falls
Greensburg
Asylum
Warren St.
Coalport
TRENTON
Lamberton
Yardville
MERCER
SOMERSET
MIDDLESEX

Henry, Morse, and the Telegraph

Discovery by Scientist – Design by Artist-Entrepreneur
Radical Innovation: Instant news by wire from afar



Many dates – pay attention only to those in boxes

CEE 102: Prof. Michael G. Littman

Course Administrator: Conghao (Kevin) Yi cy6164@princeton.edu

Computers for note-taking and course-related searches only

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

Morse by Morse

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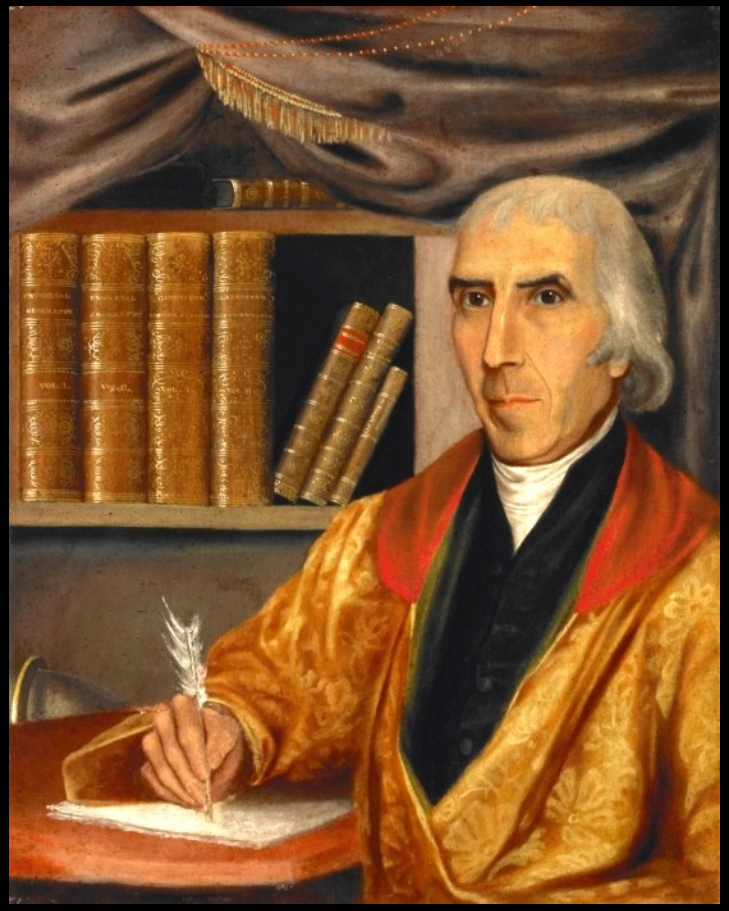

Jed Morse (Father - Geographer) by Morse

Morse by Morse

West by West

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

Aside – in 1840 Morse also introduces Photography into America

Morse daguerreotype at the Metropolitan Museum of Art

20-30 minute exposure of unknown sitter

Morse's painting of his Yale geology professor Benjamin Silliman

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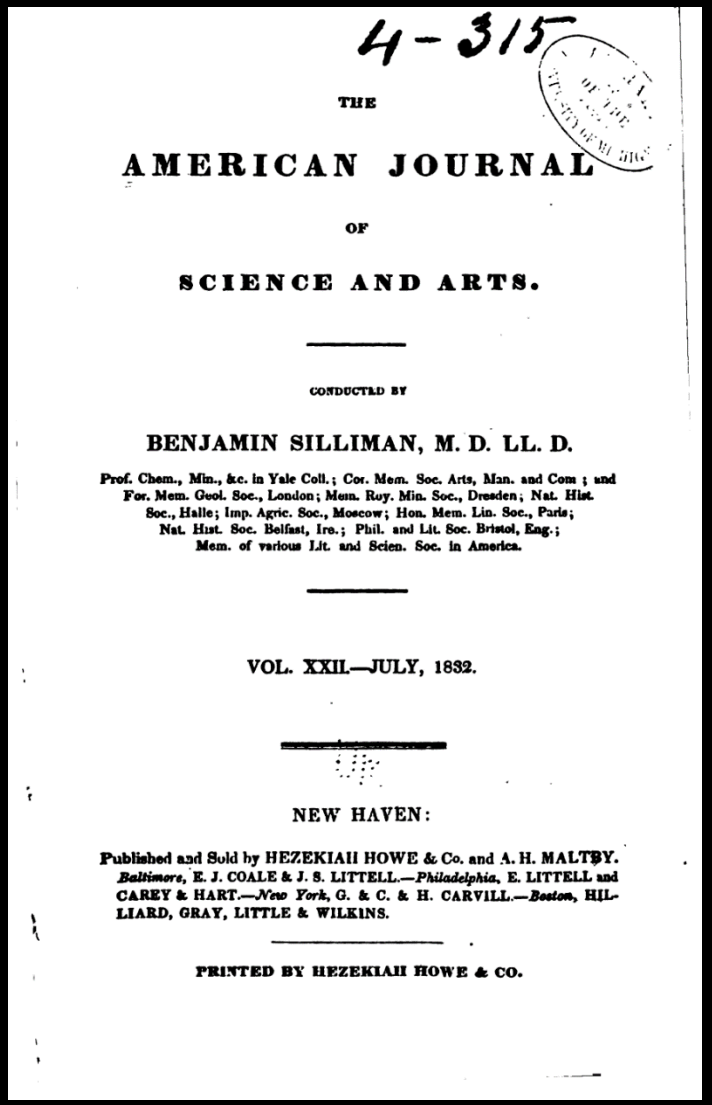

4-315

THE

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OF

SCIENCE AND ARTS.

CONDUCTED BY

BENJAMIN SILLIMAN, M. D. LL. D.

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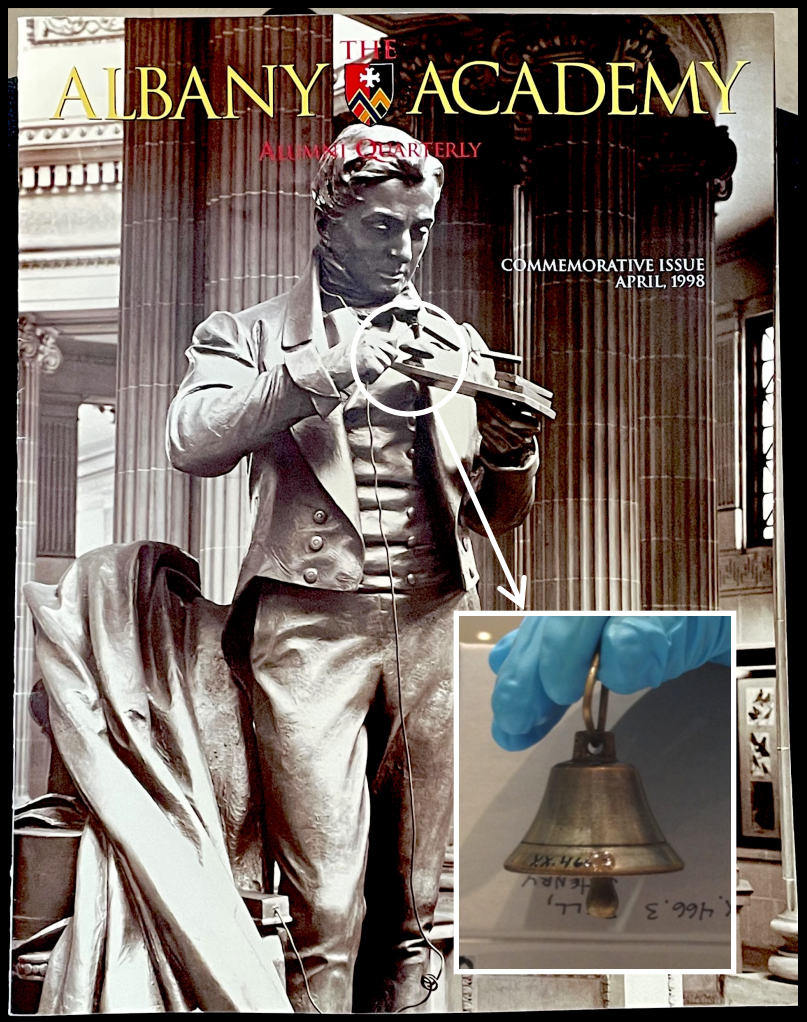
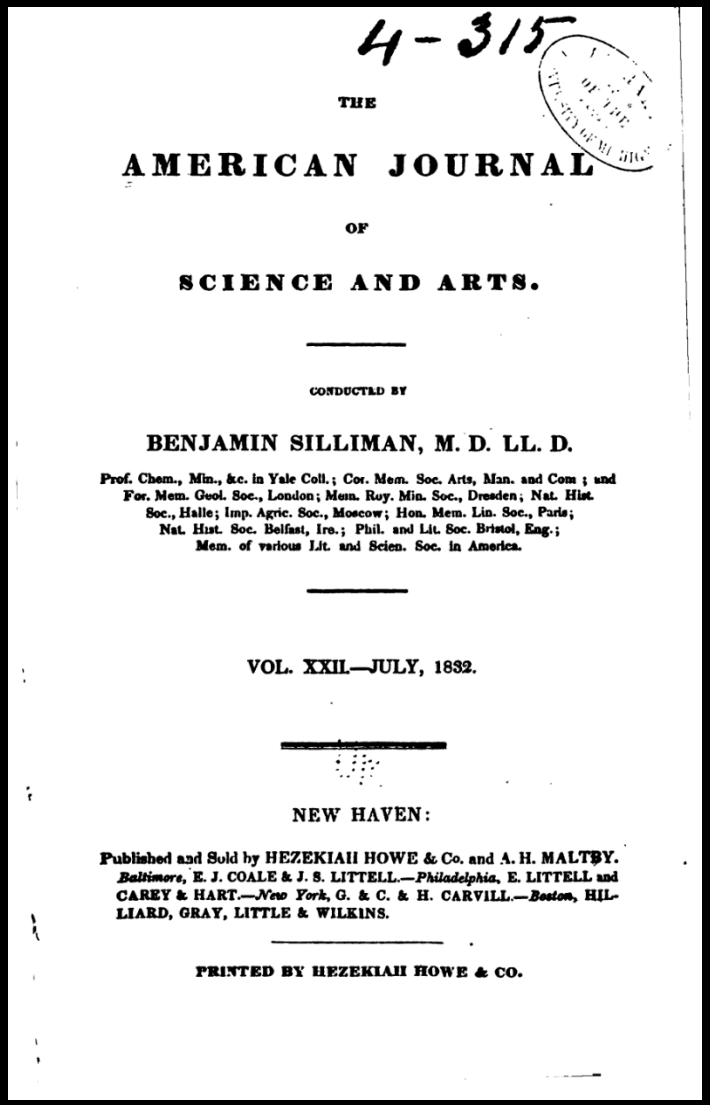
Silliman's Journal of Science



High School Teacher Joseph Henry holding sounding telegraph



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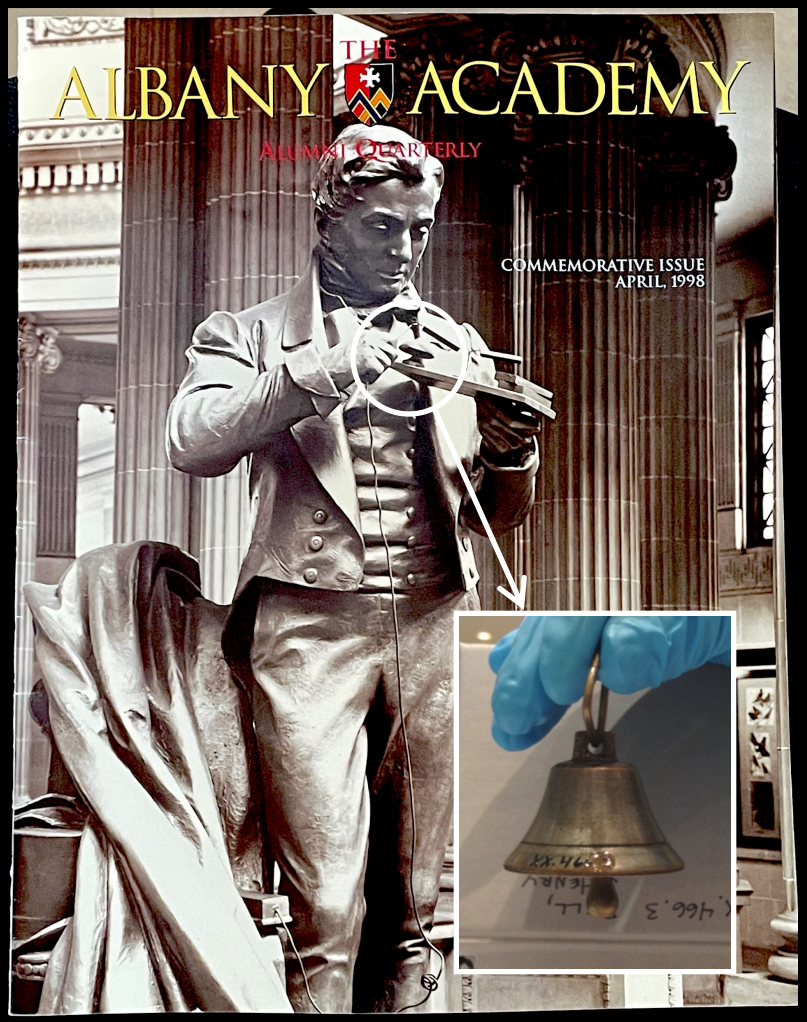
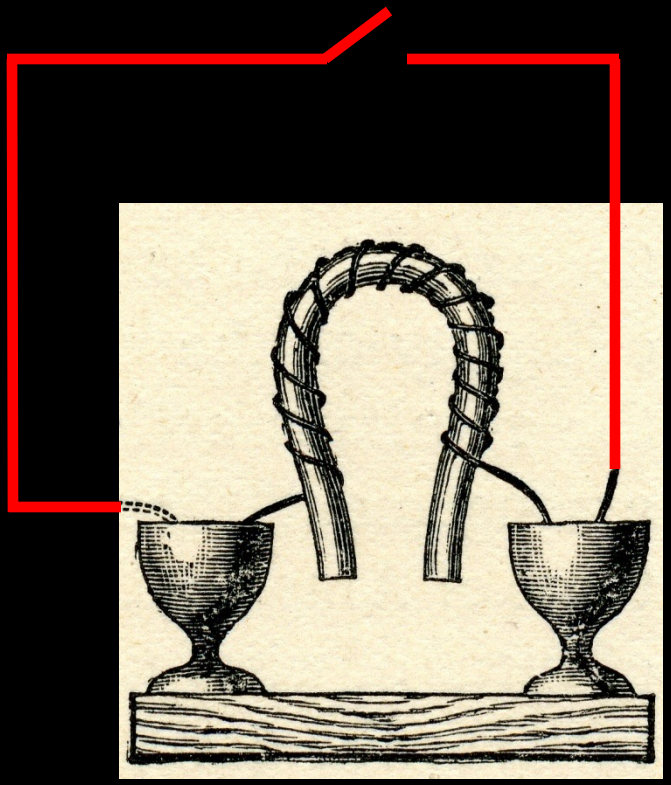


High School Teacher Joseph Henry holding sounding telegraph

Telegraph - Discovery

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



Electromagnet in circuit with two copper-zinc-acid batteries and on-off switch

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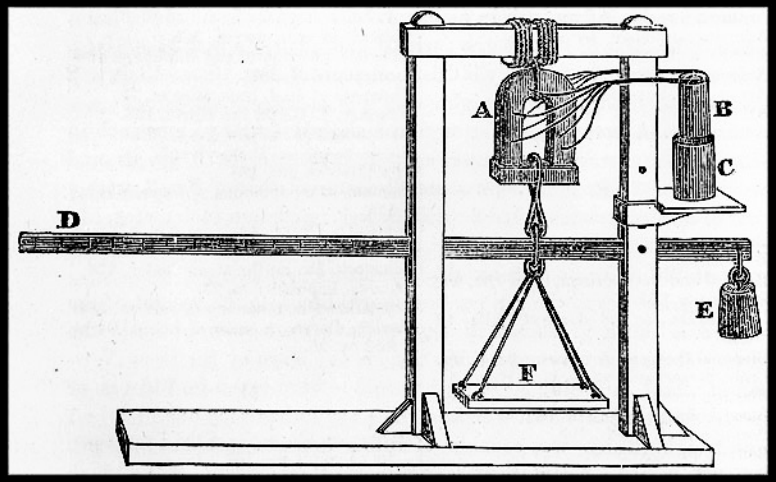
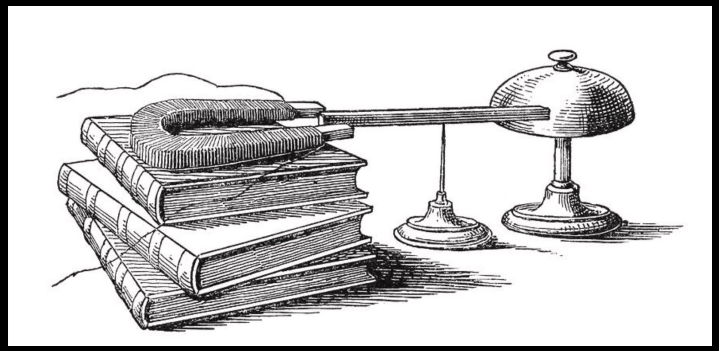


$$B = k I N$$

Magnetic Field



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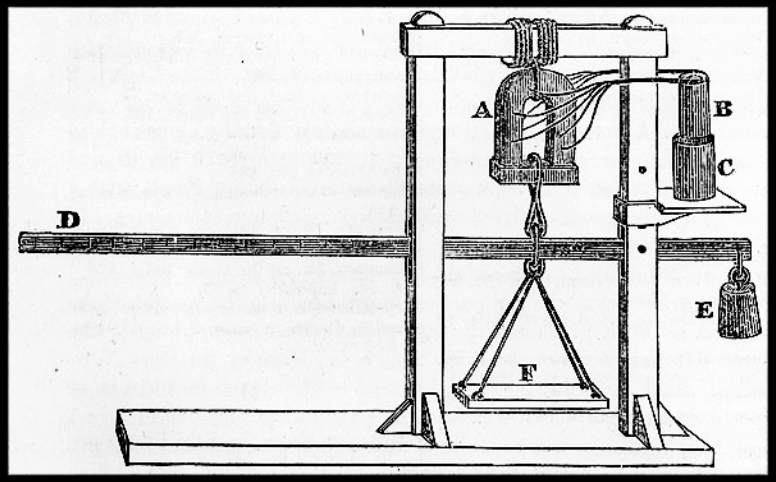

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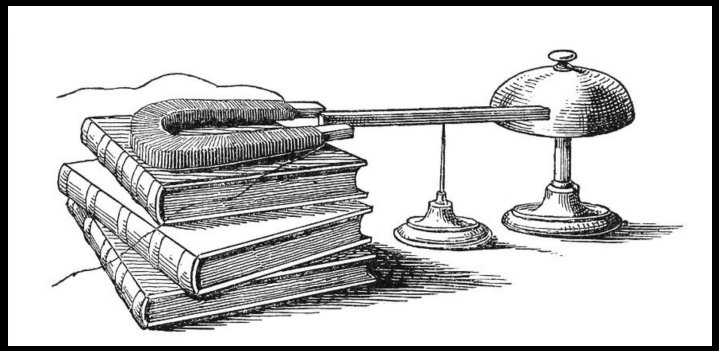
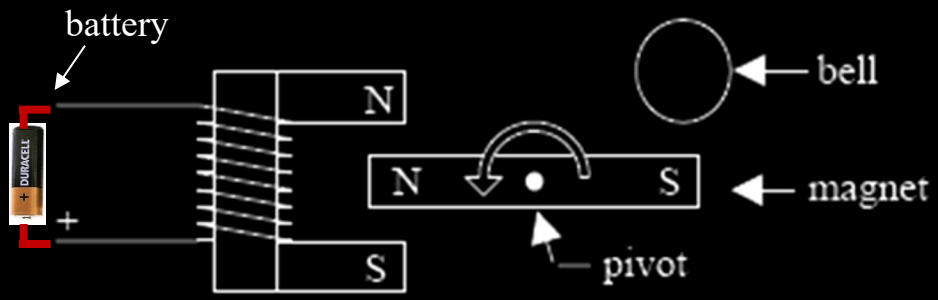


$$R = \frac{\rho L}{A}$$

Resistance

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

Ohm's Law



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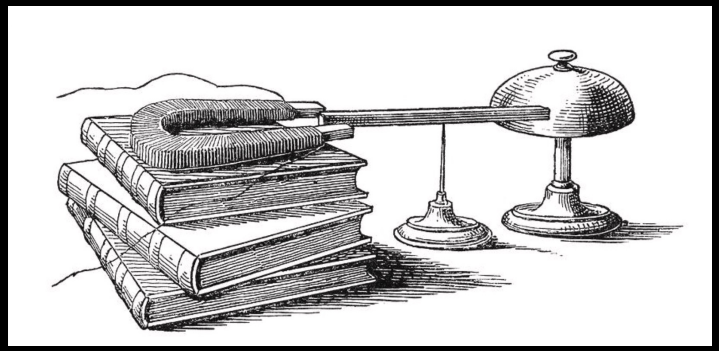

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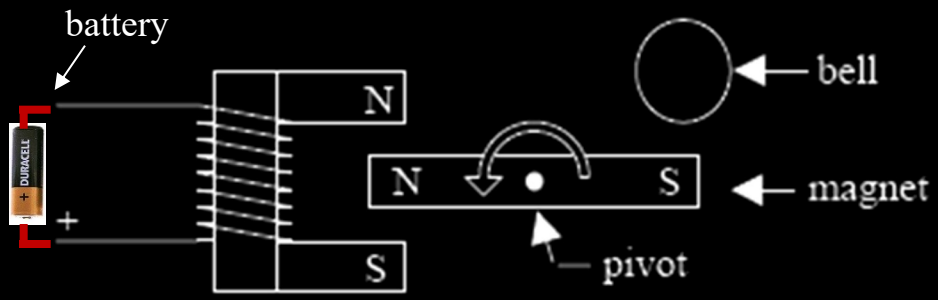

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Resistance

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Magnetic Field

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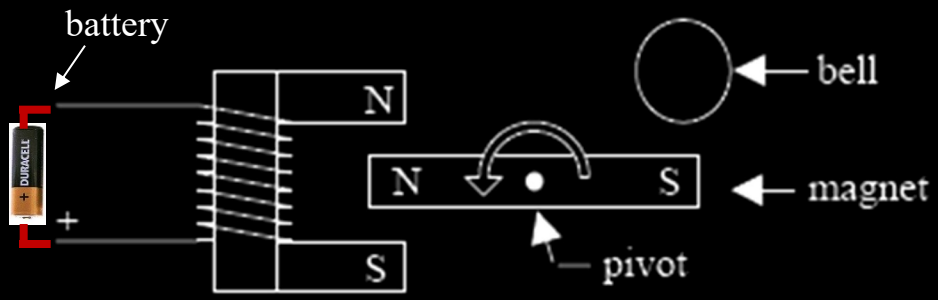
Ohm's Law

How does Henry's sounding telegraph work?

Poles in horseshoe electromagnet reverse when current is reversed



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Magnetic Field

The greater the current, the stronger the strike – high voltage overcomes high resistance of the long lines

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

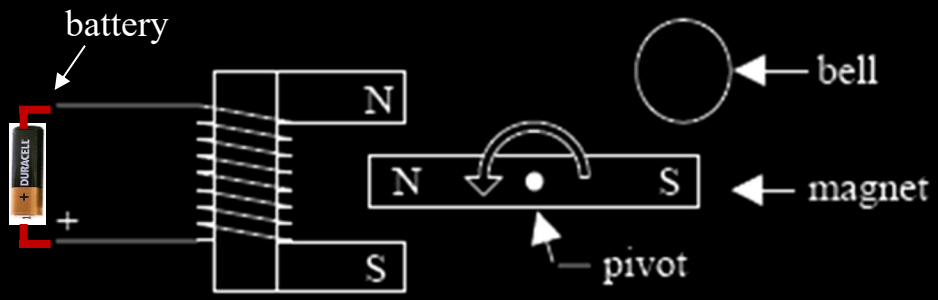
Resistance

The longer the path, the greater the resistance

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

Ohm's Law

The greater the voltage, the greater the current



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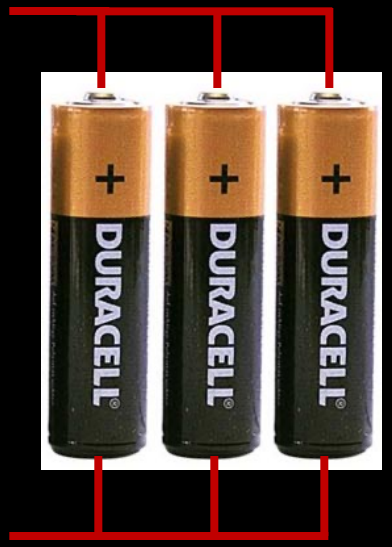
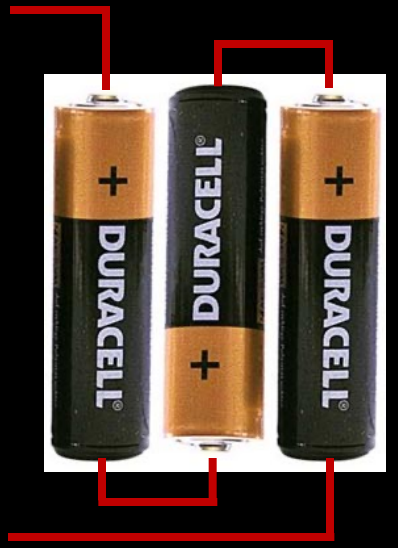
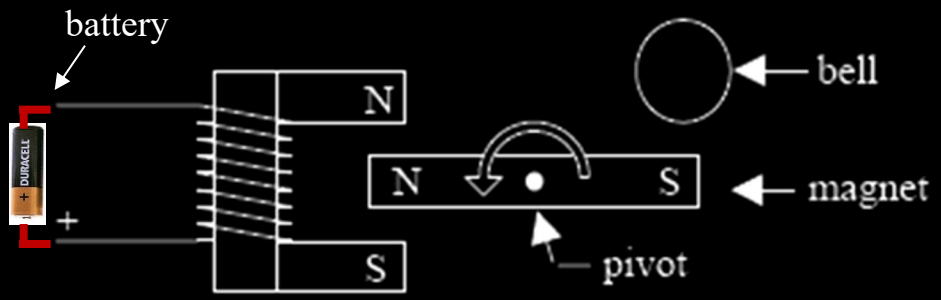
1 volt and
up to 1 amp



Parallel – more available current



Series – greater voltage



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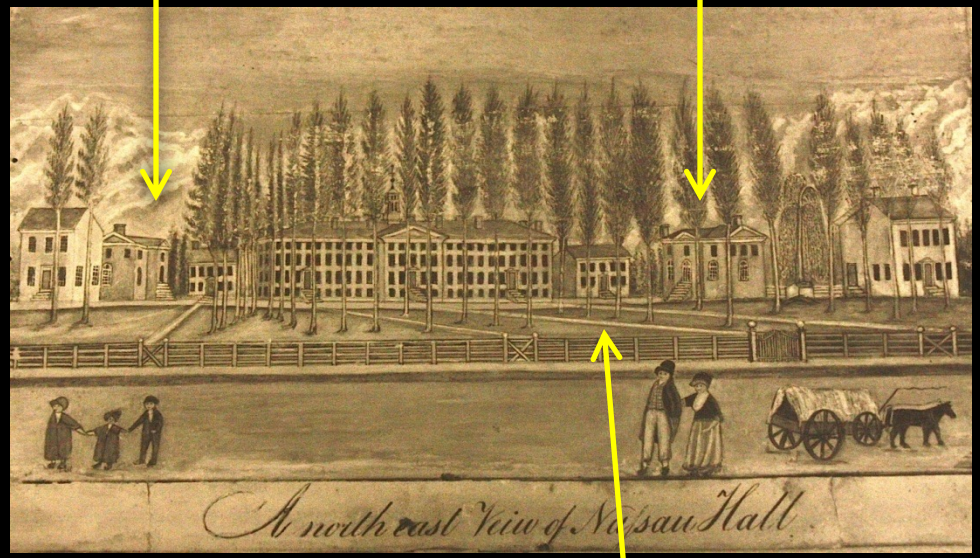
" The electro-magnetic telegraph was invented by me in Albany in 1830."

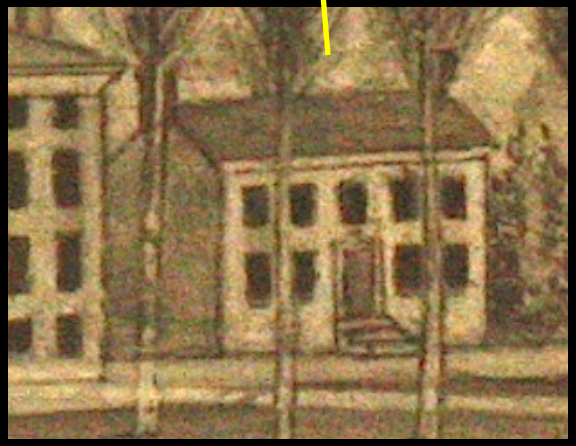
"I think that the first actual line of telegraph using the earth as a conductor was made in the beginning of 1836. A wire was extended across the front campus of the College grounds from the upper story of the Library building to the Philosophical Hall on the opposite side, the ends terminating in two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

- Joseph Henry

Philosophical Hall

Library





Joseph Henry's House in 1836

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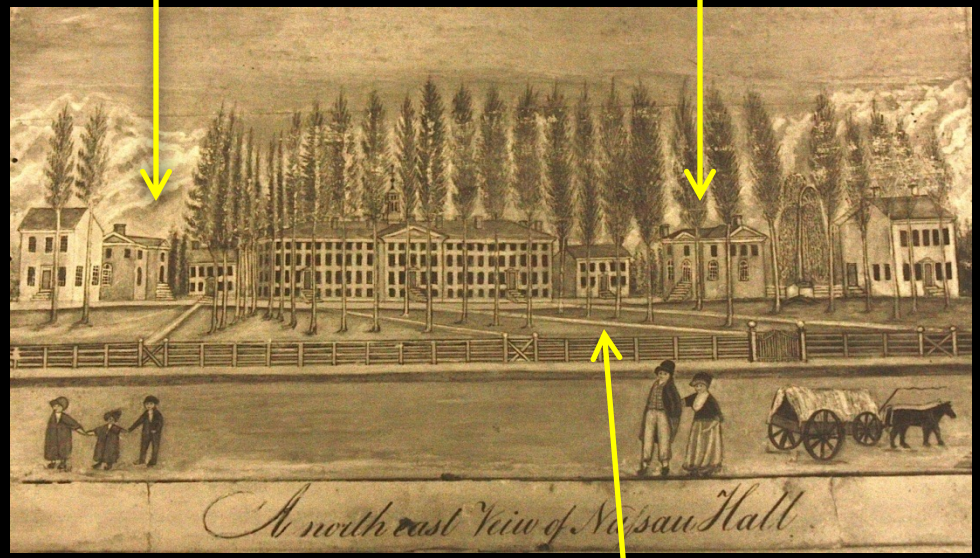

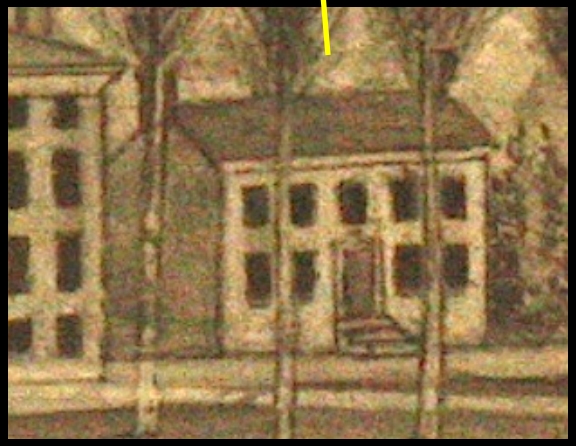

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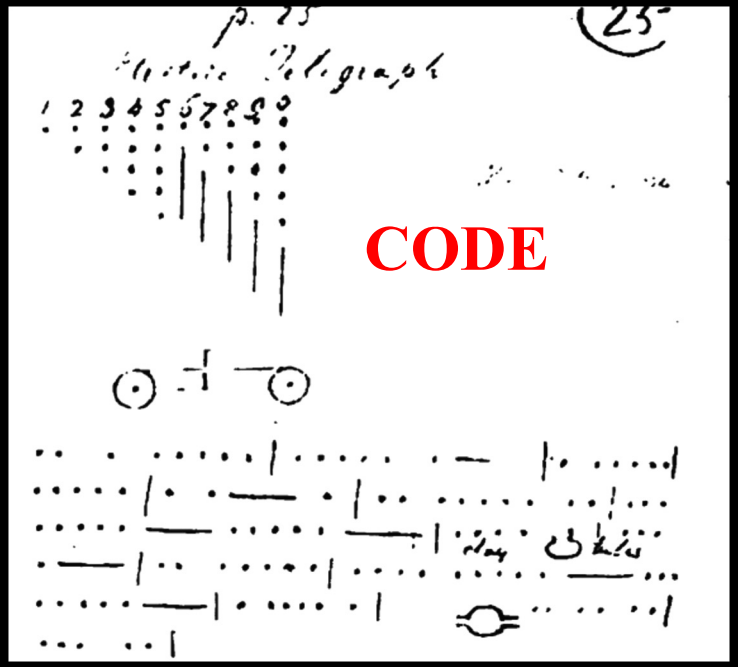
Telegraph - Design

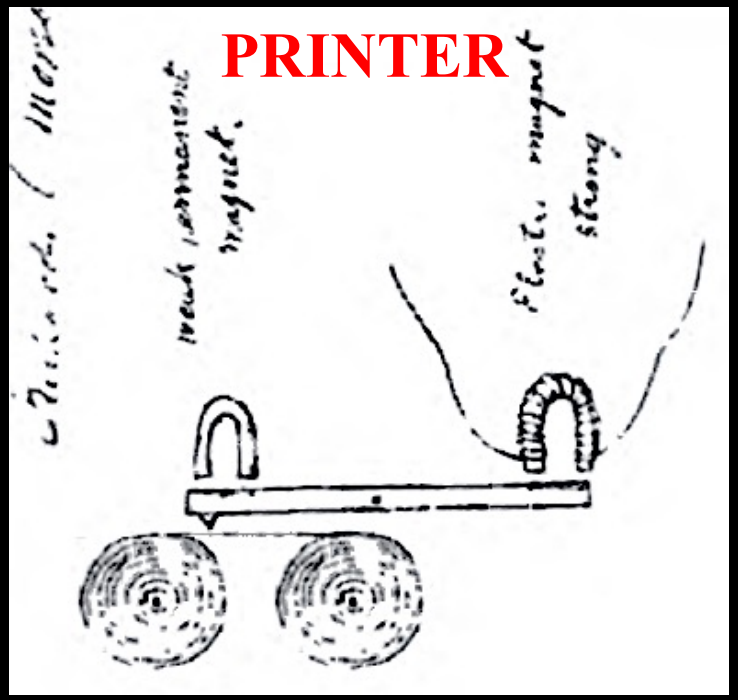
1832 – Morse's shipboard idea

1836 – Gale and Vail help out

1838 – Morse shows Van Buren

1842 – Henry helps Morse





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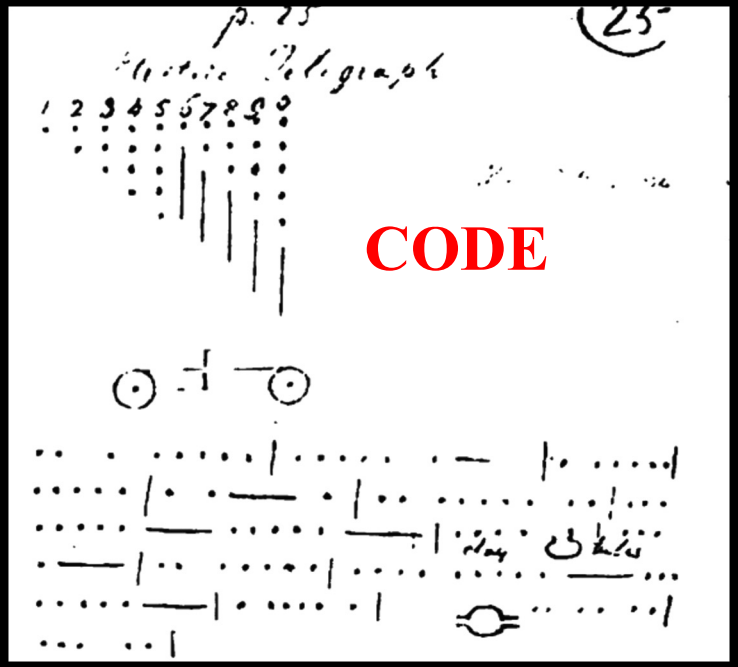
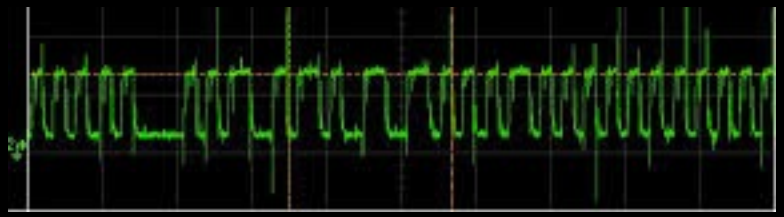


Digital signals in use today – WiFi, Ethernet



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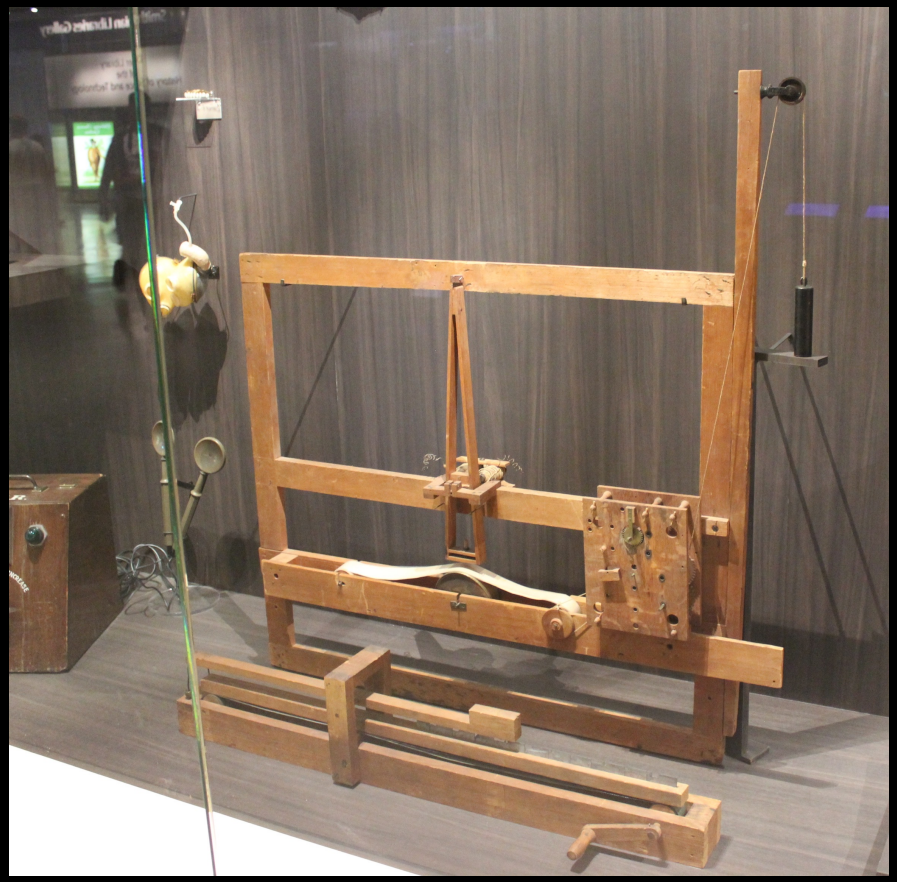

Morse's original telegraph on display at the Smithsonian

Telegraph - Design

- 1832 – Morse's shipboard idea
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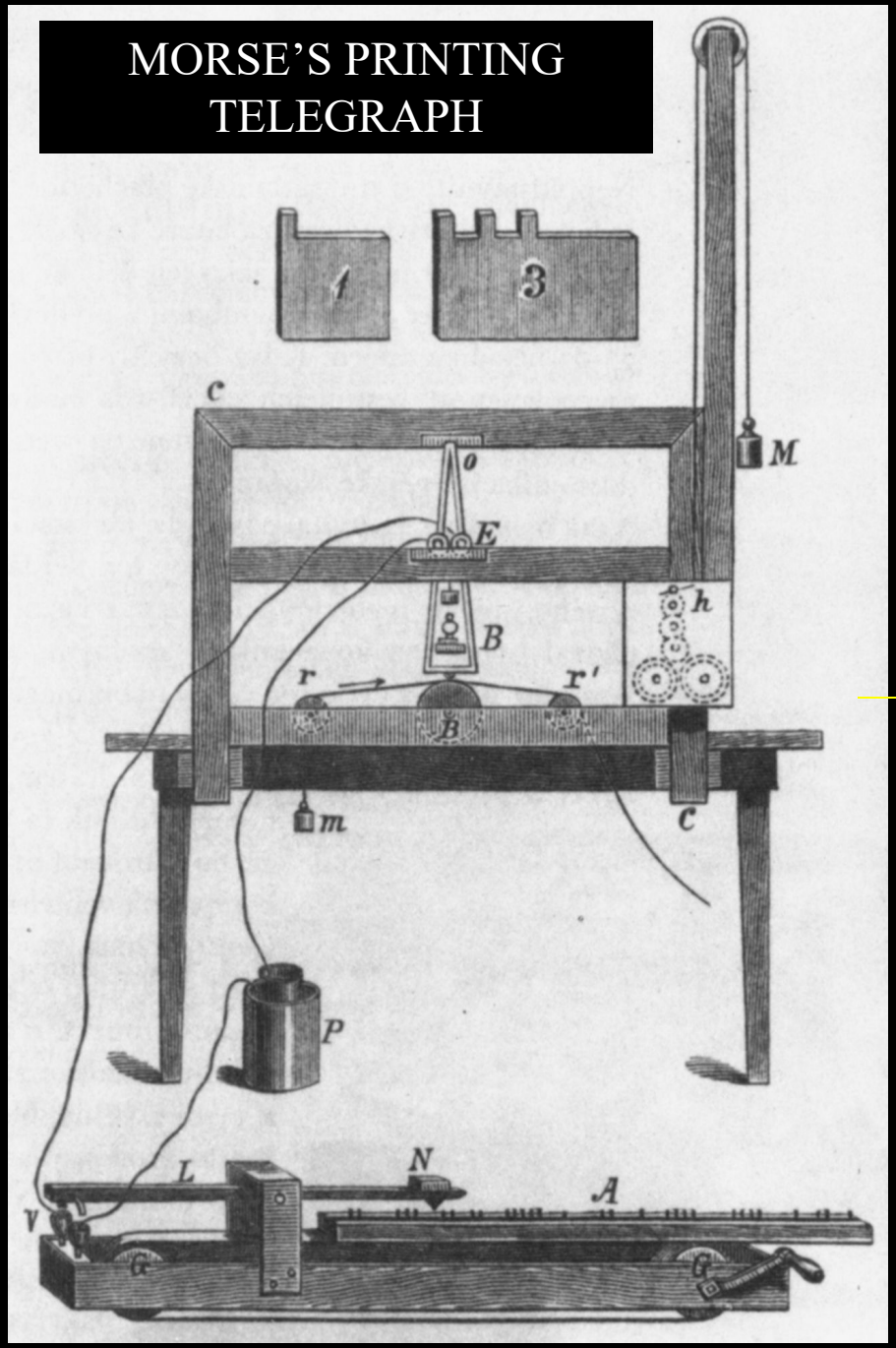
MORSE'S PRINTING TELEGRAPH



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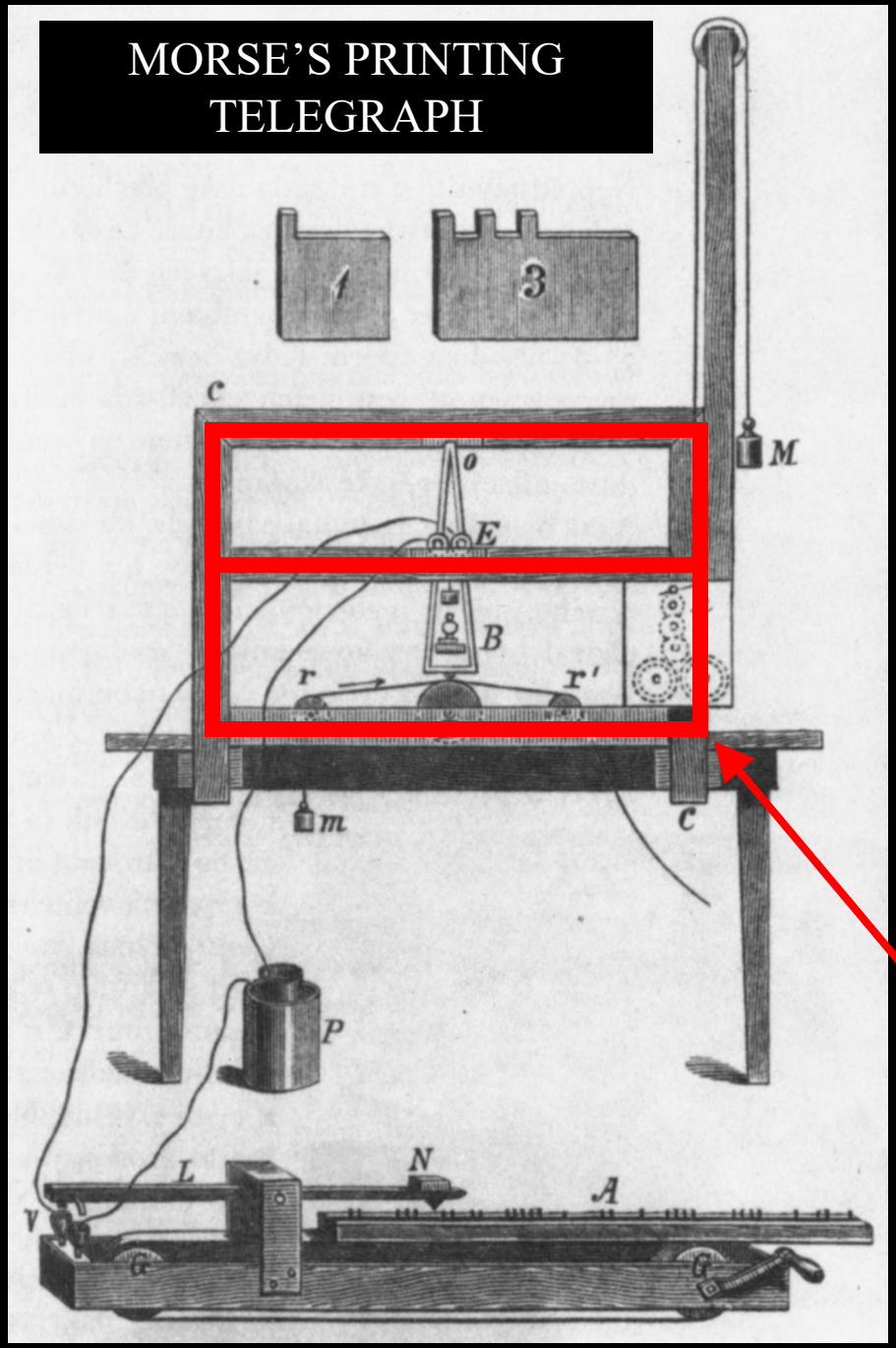
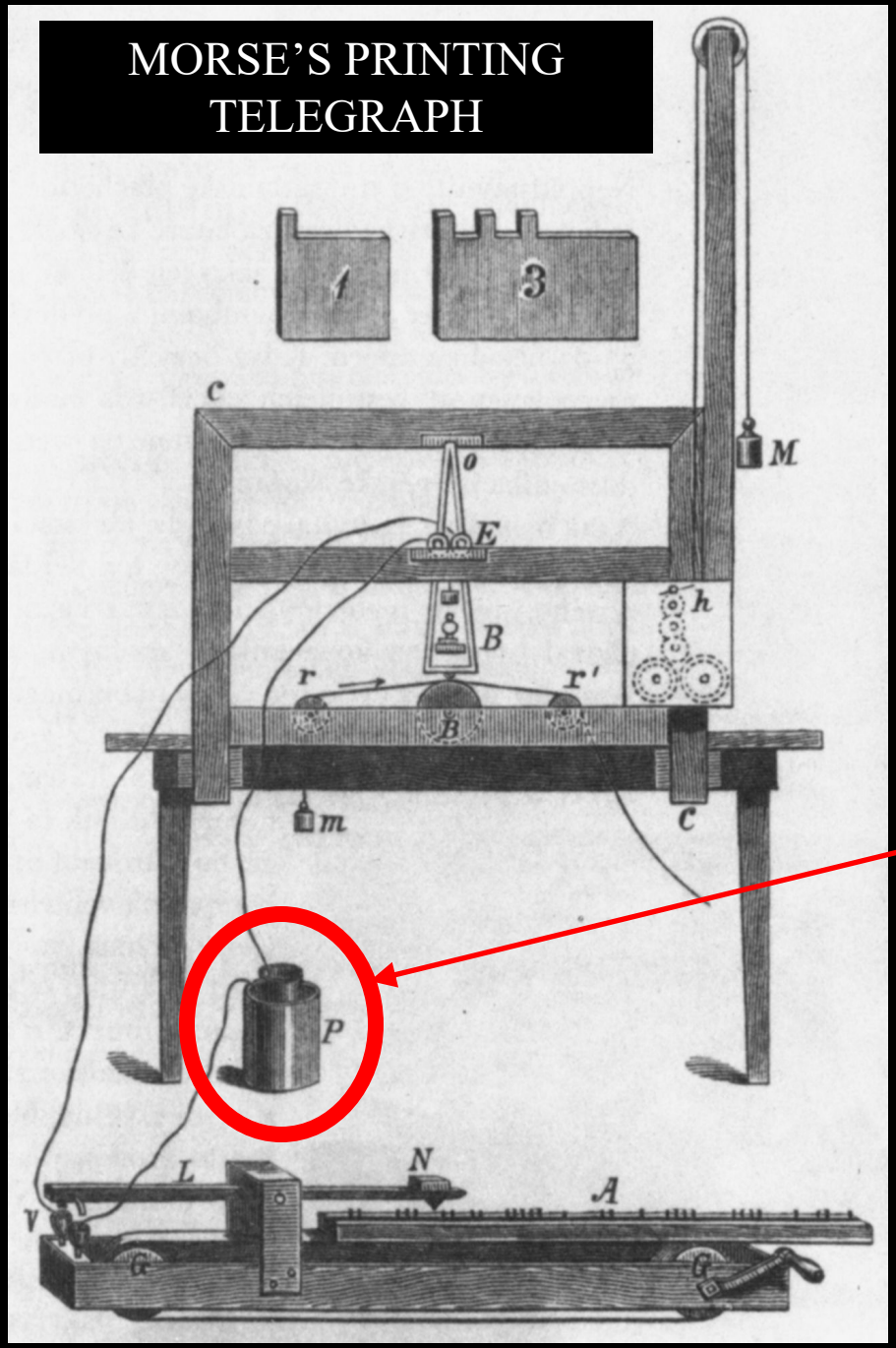


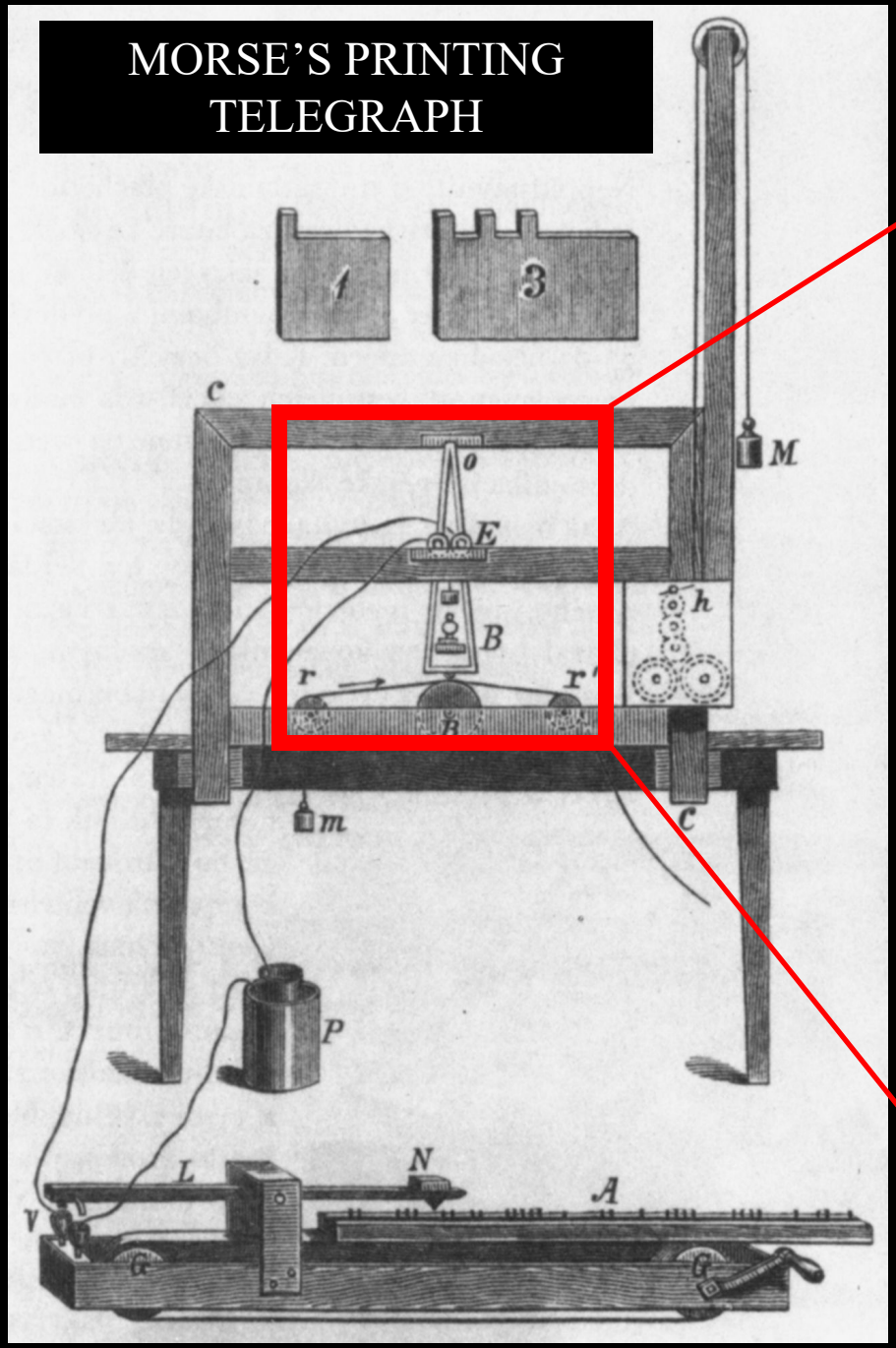
ARTIST'S CANVAS STRETCHER

MORSE'S PRINTING TELEGRAPH



Copper-Zinc Battery
(Galvanic Cell)

MORSE'S PRINTING TELEGRAPH



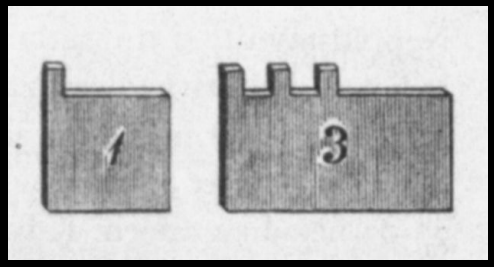
ELECTROMAGNET

PEN HOLDER FRAME DEFLECTED BY ELECTROMAGNET

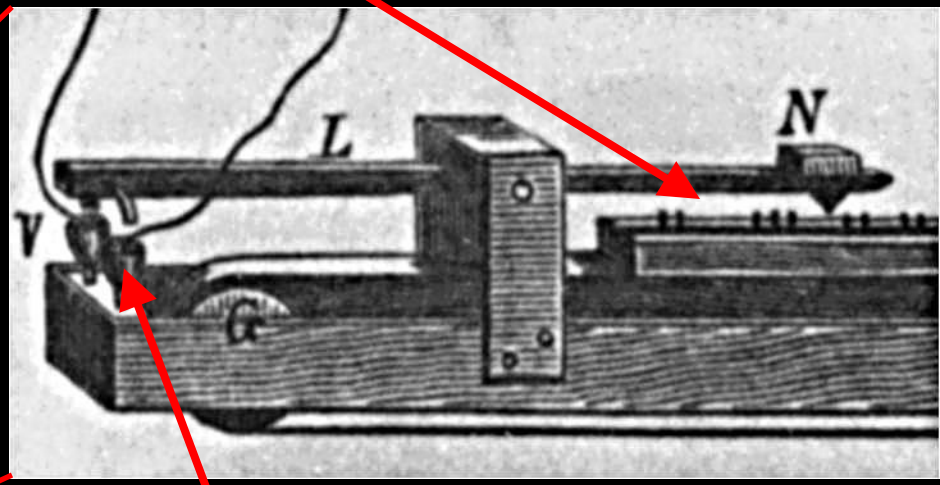
PEN

MOVING PAPER TAPE

MORSE'S PRINTING TELEGRAPH



MOVEABLE TYPE HOLDER



CONTACTS USING MERCURY

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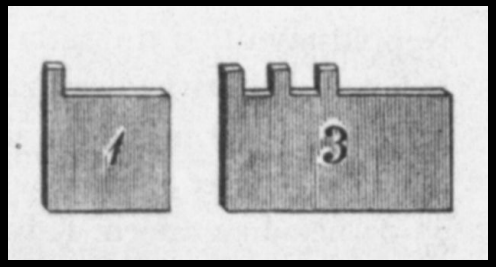

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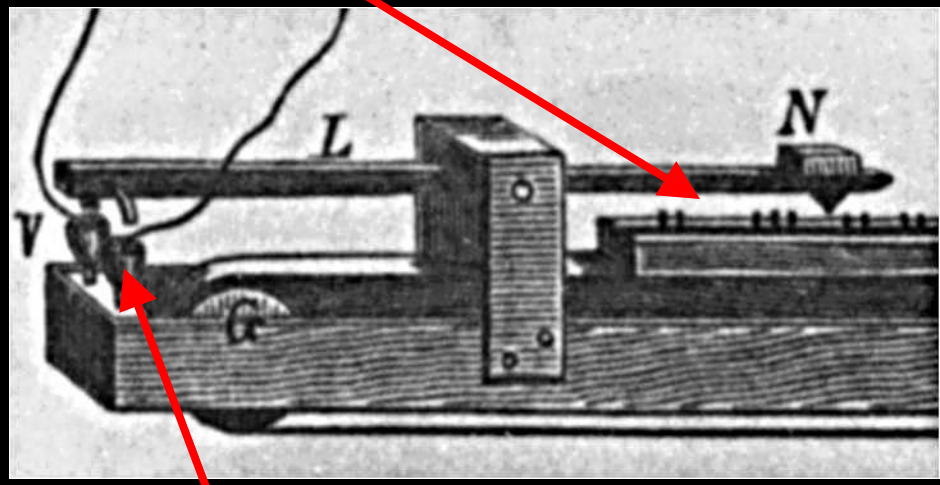

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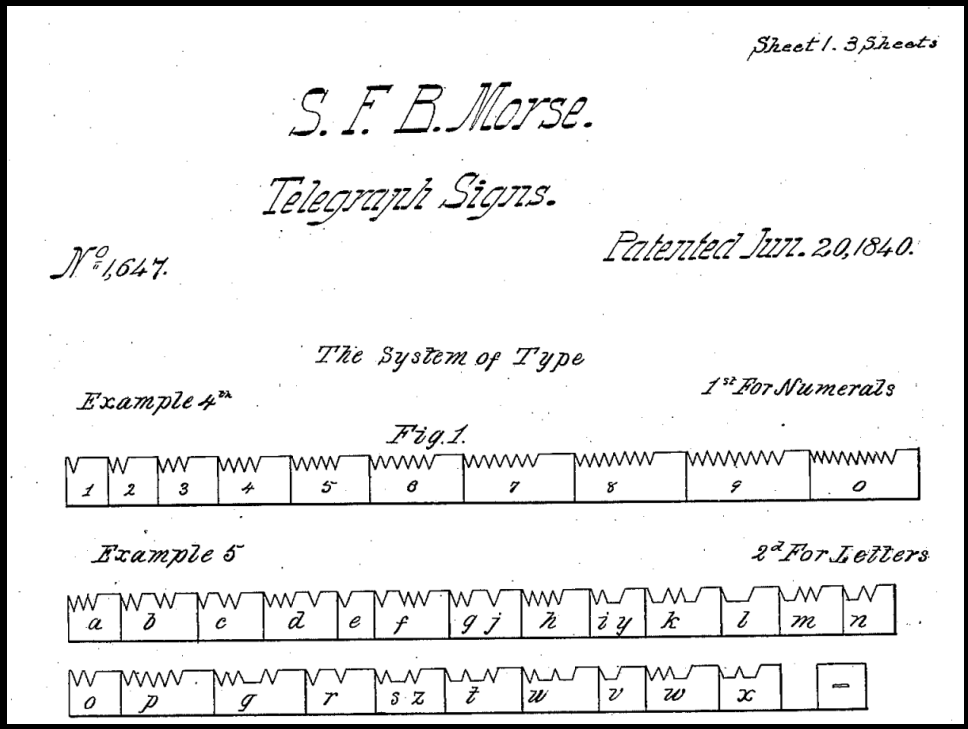

Sheet 1. 3 Sheets

S. F. B. Morse.

Telegraph Signs.

No. 1,647. Patented Jun. 20, 1840.

The System of Type

Example 4th — 1st For Numerals

Fig. 1.

1 2 3 4 5 6 7 8 9 0

Example 5 — 2d For Letters

a b c d e f g j h i y k l m n

o p q r s z t w v w x —

Morse patents a Binary Code

TELEGRAPH - Early

Congress - $30,000 to Morse

Morse - hires Vail & Cong. Smith

Smith - hires Ezra Cornell

38 miles connecting
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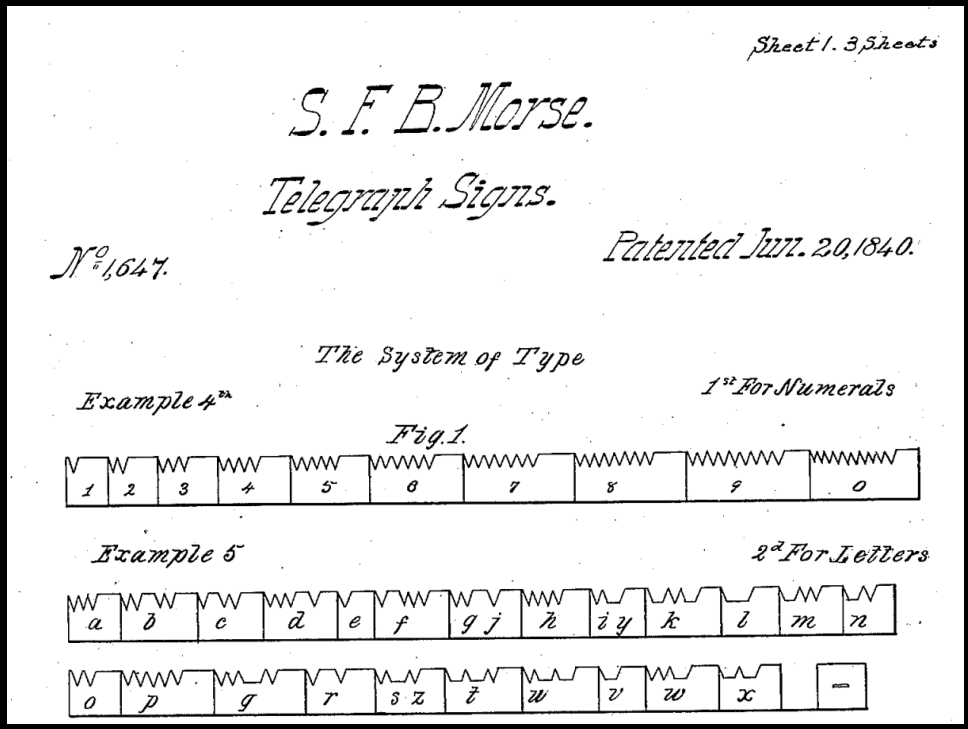

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Telegraph Wires along B&O RR Right-of-Way

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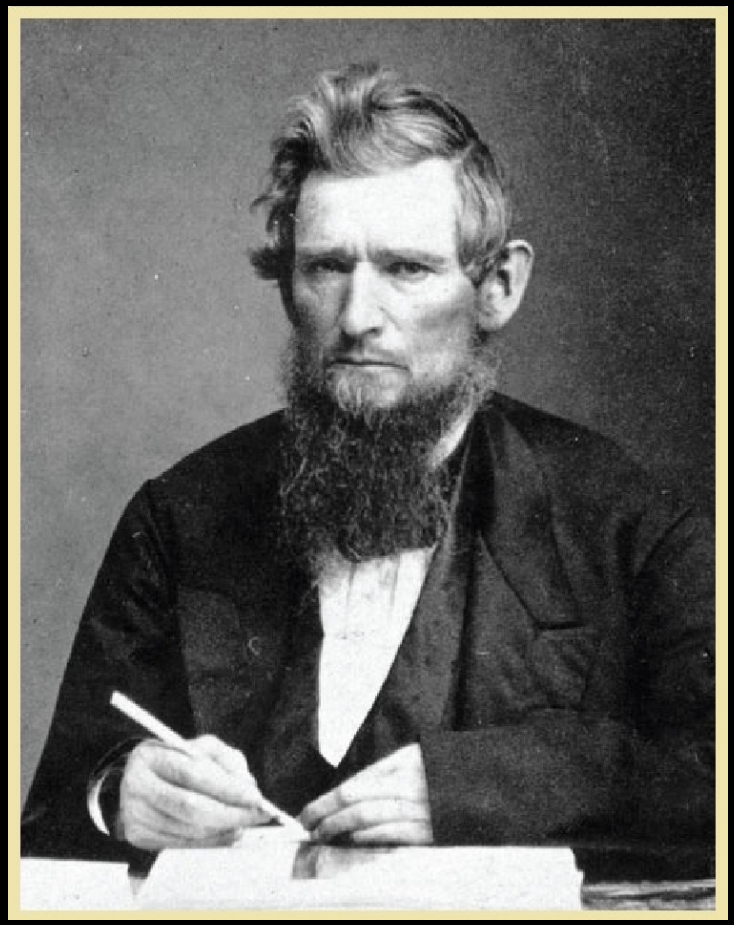

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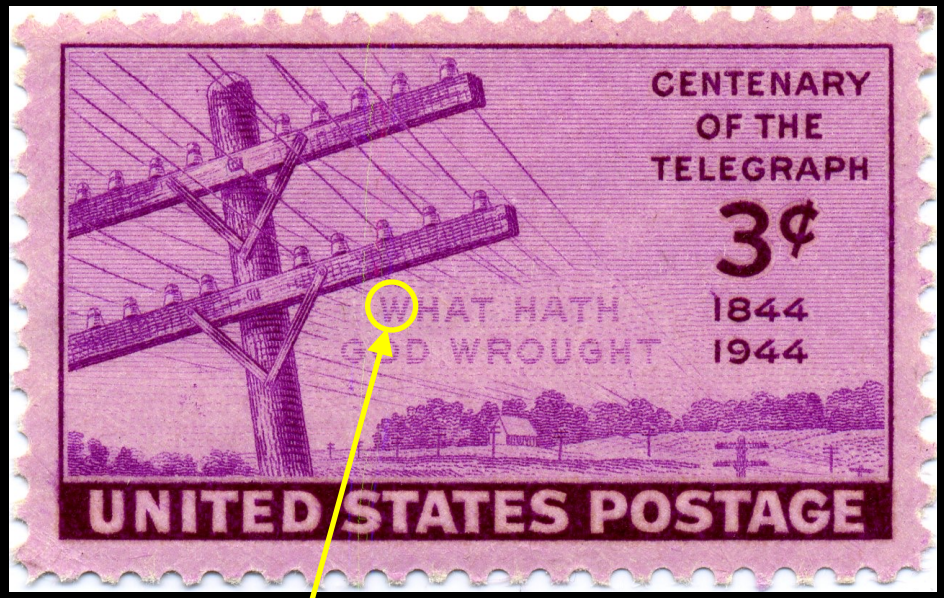

May 24, 1844 at 8:45am

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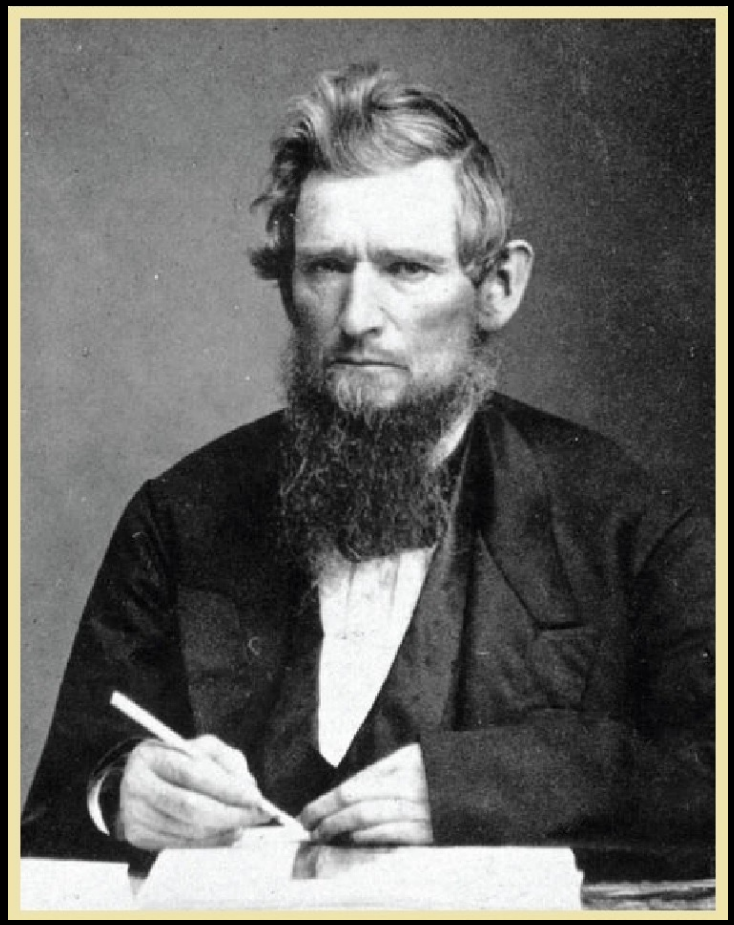
MORSE CODE – dots and dashes embossed on moving tape



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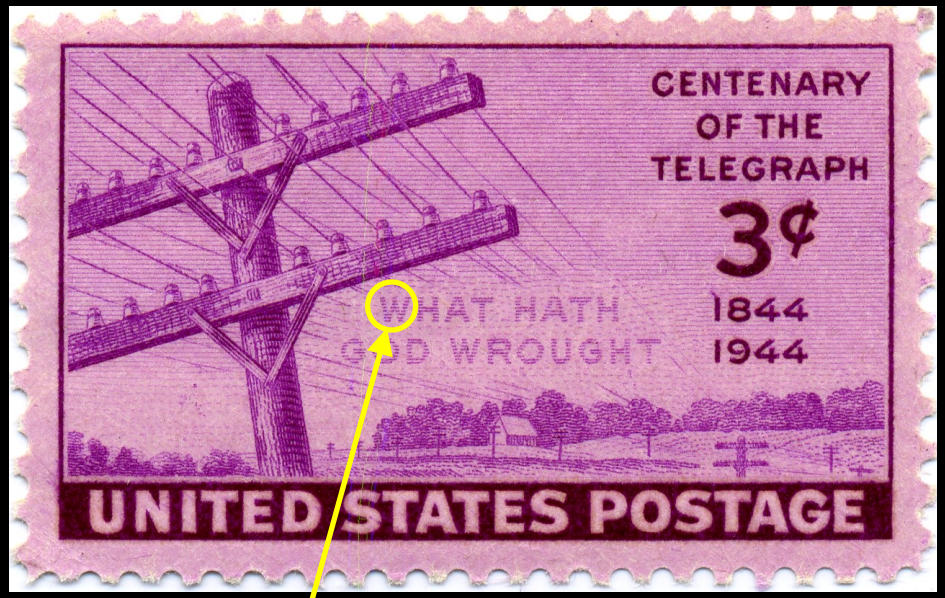

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Science and Engineering

Discovery

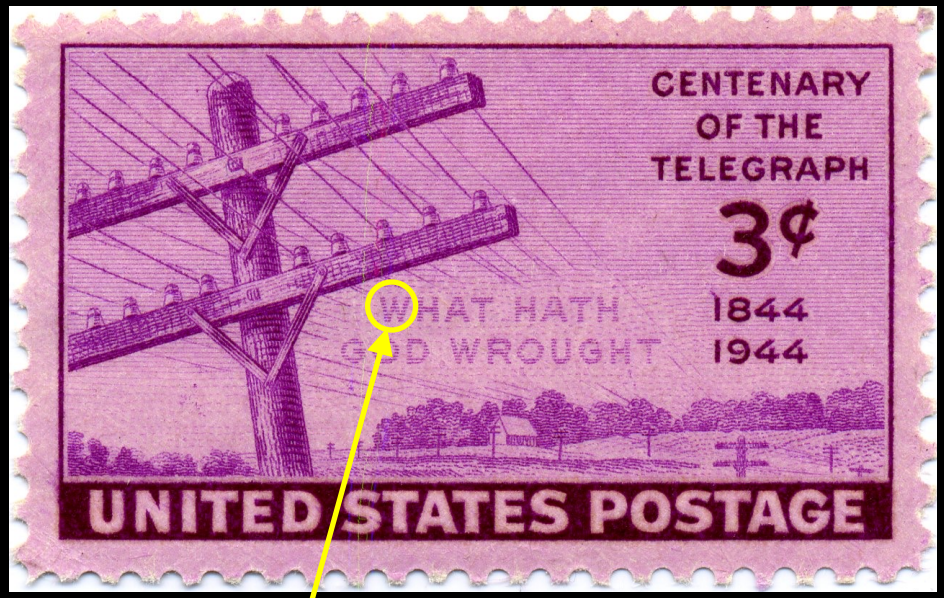
Scientist rings bell at a distance

Development

Gov't Grant, Private Company

Design

Artist gives telegraph language and plans wide-area network



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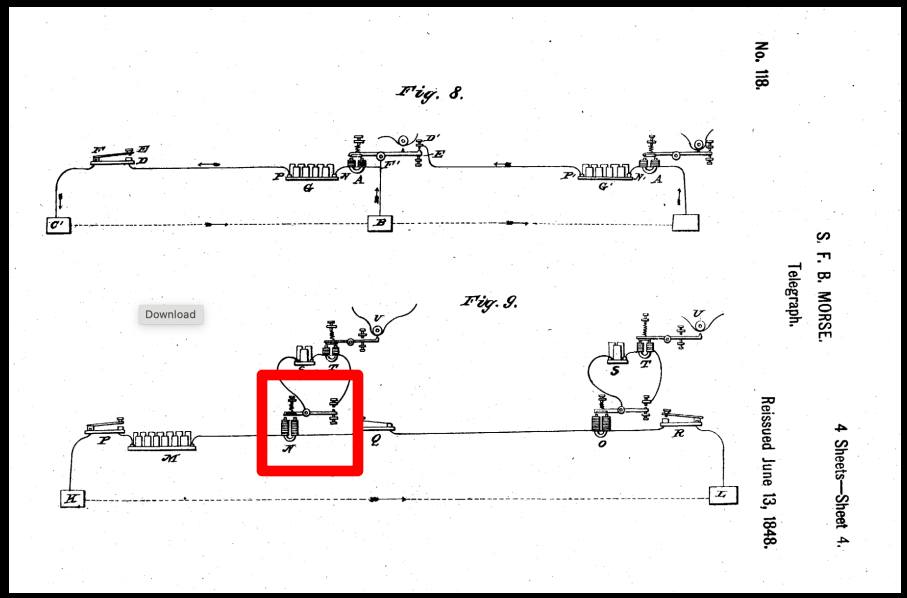
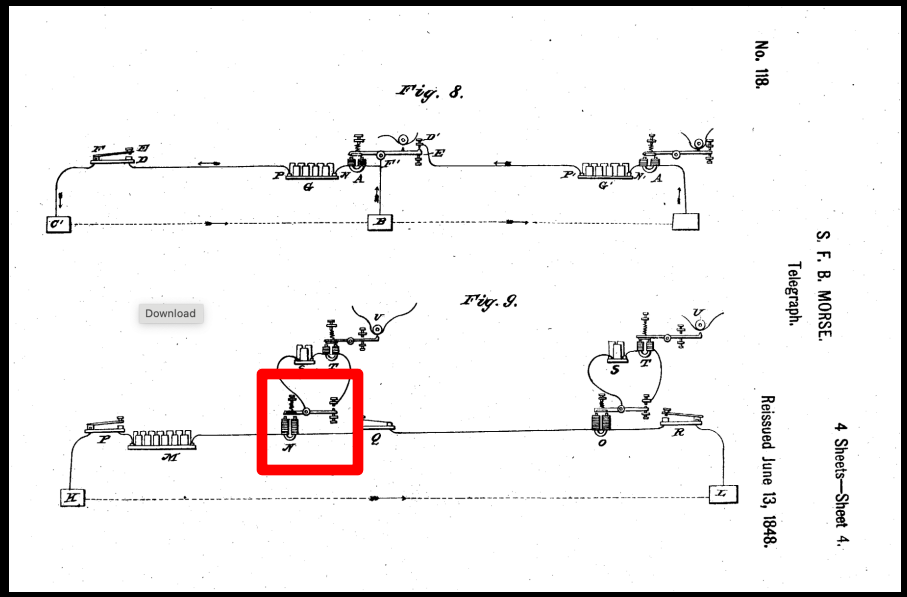


Morse Relay USRE118 in 1848

7th and E St, Washington, DC
Morse idea - replace Post Office



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Telegraph Lines in 1853

CONNECTING CITIES

TELEGRAPH - Later

1845 – independent companies; wire services; patent disputes

1856 – Western Union – Cornell becomes the major stockholder

1861 – Western Union completes Transcontinental Telegraph Line

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THE ELECTRO-MAGNETIC TELEGRAPH.

A DEFENCE

AGAINST THE INJURIOUS DEDUCTIONS DRAWN FROM THE

DEPOSITION OF PROF. JOSEPH HENRY

(In the Several Telegraph Suits),

WITH A CRITICAL REVIEW OF SAID DEPOSITION, AND AN EXAMINATION OF PROF. HENRY'S ALLEGED DISCOVERIES, BEARING UPON THE ELECTRO-MAGNETIC TELEGRAPH.

BY SAMUEL F. B. MORSE, LL.D.,

Professor in the New York City University, &c., &c., &c.

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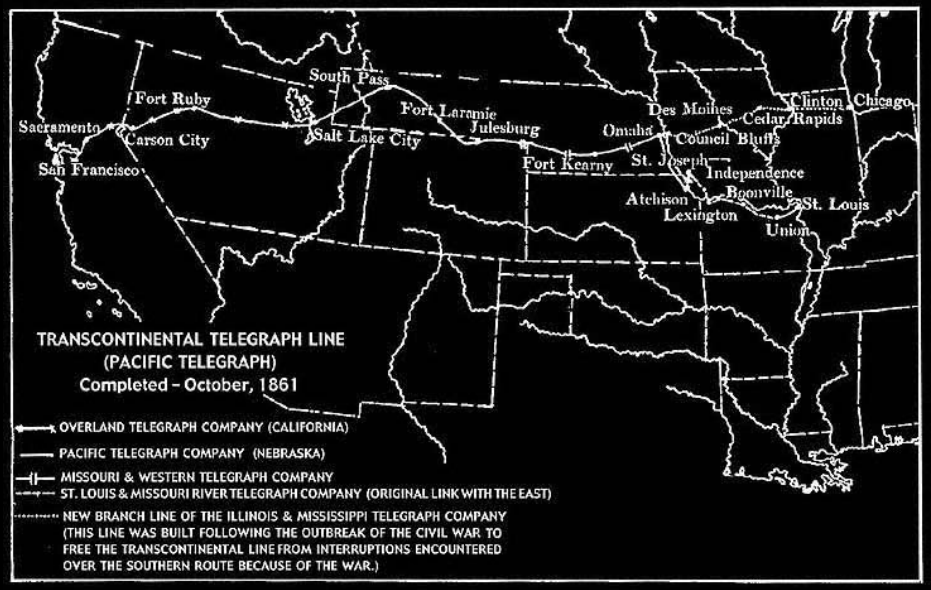

CONNECTING THE CONTINENT

Pacific Telegraph Act of 1860
(Pony Express ends service)

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US Capitol in 1861

Smithsonian Castle in 1862

Ben Franklin

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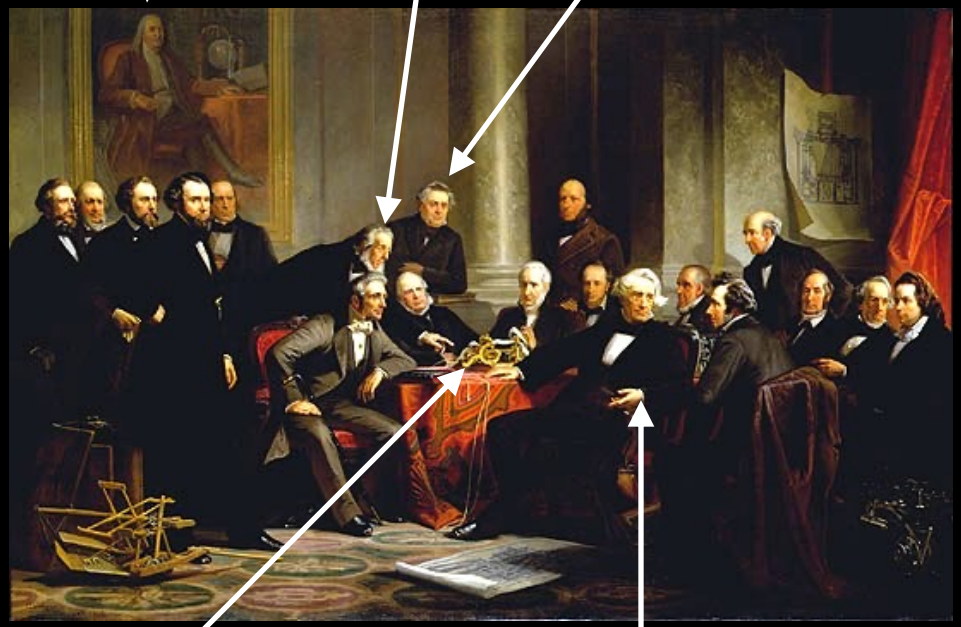
Peter Cooper



Telegraph Register

Samuel Morse

Christian Schussele's "Men of Progress"

US Capitol in 1861

Smithsonian Castle in 1862

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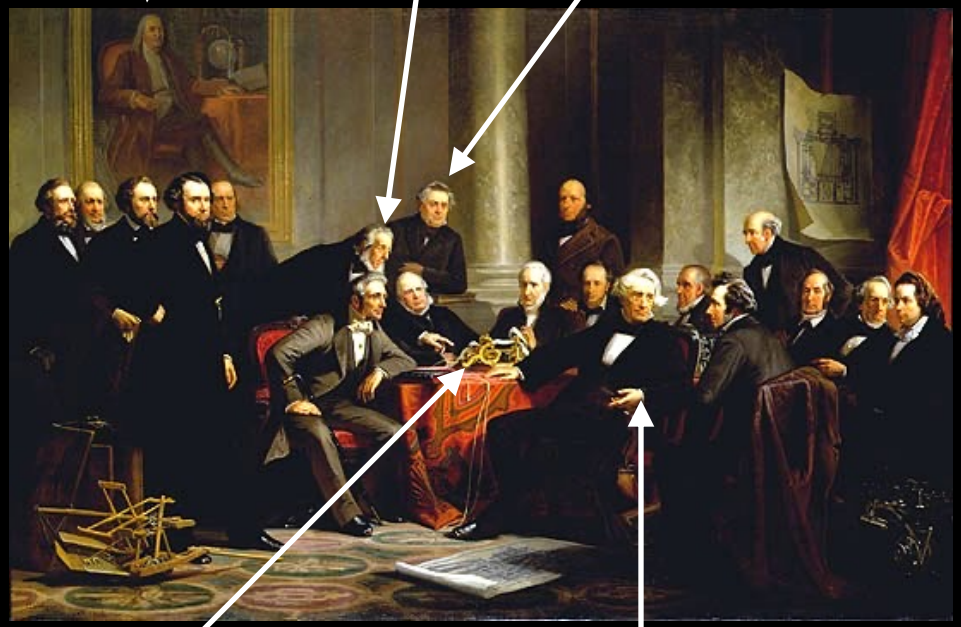

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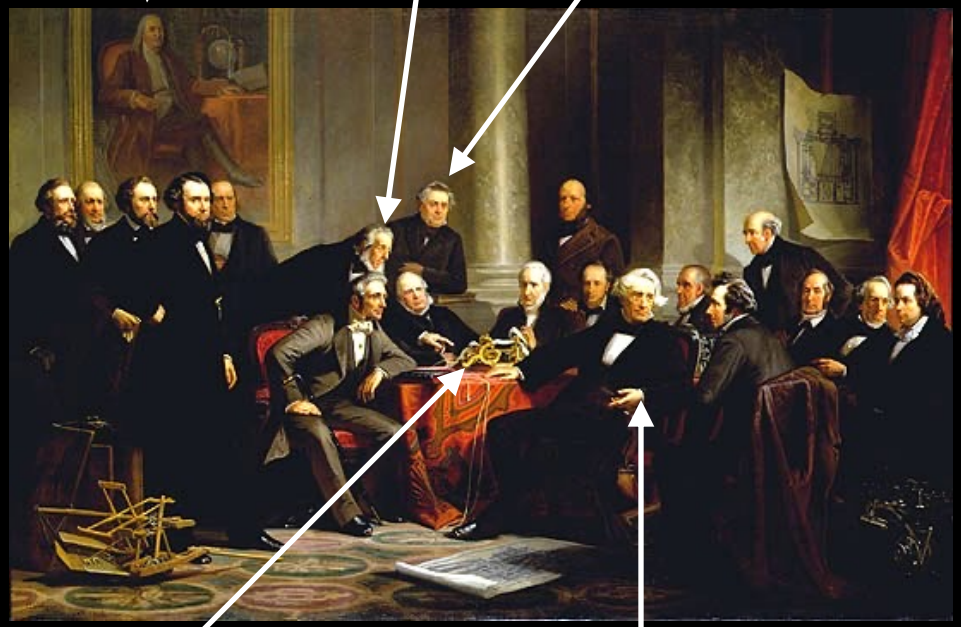

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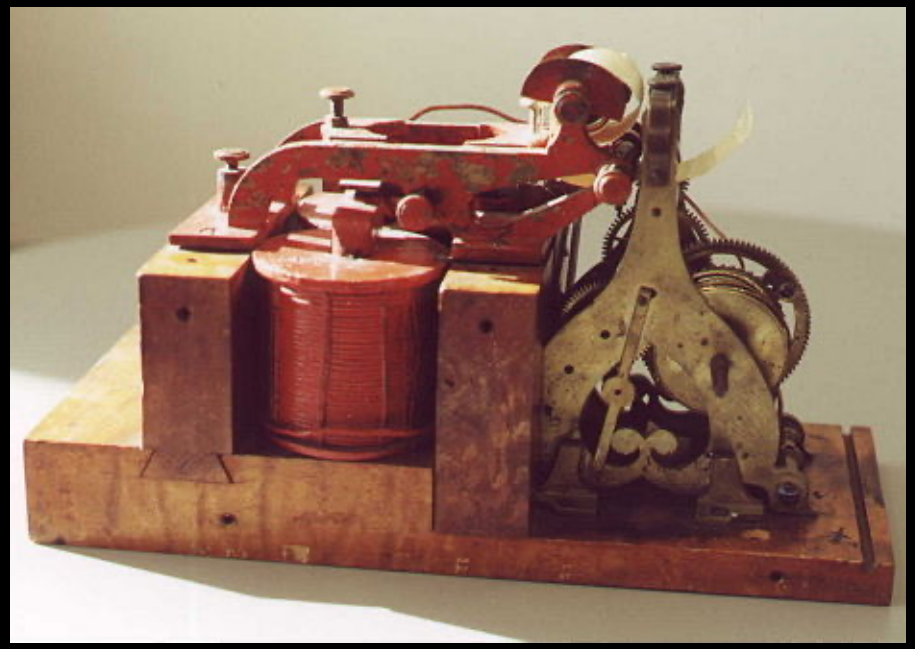
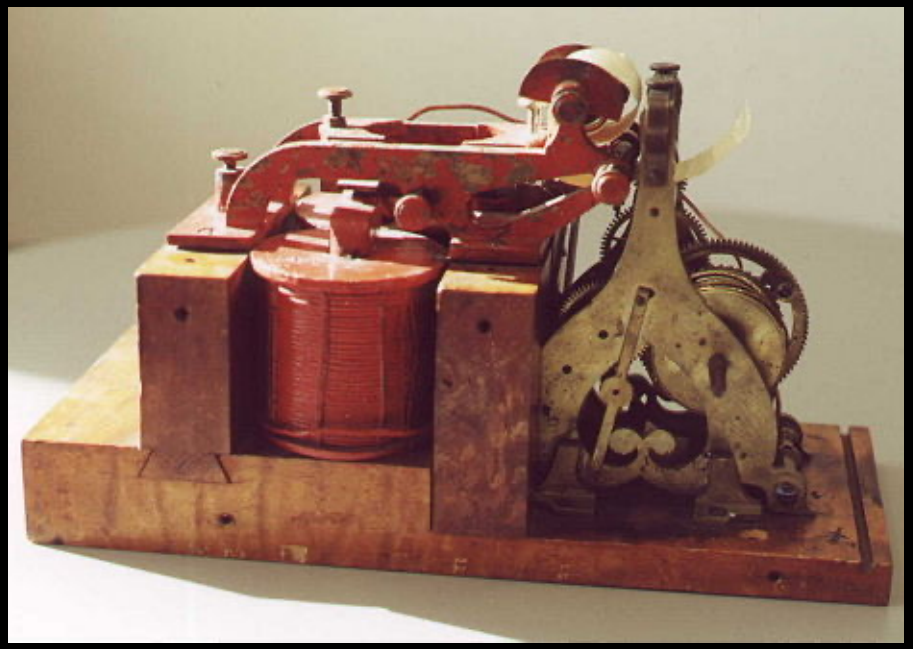


Vail telegraph register at Cornell

SIBLEY
COLLEGE at
CORNELL

Mathew Brady daguerreotype of his photography teacher, Samuel Morse



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Telegraphers

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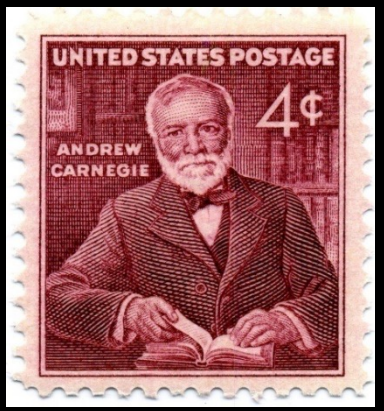

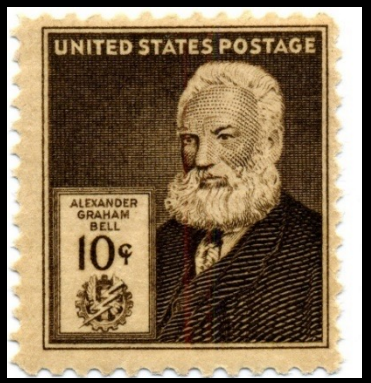

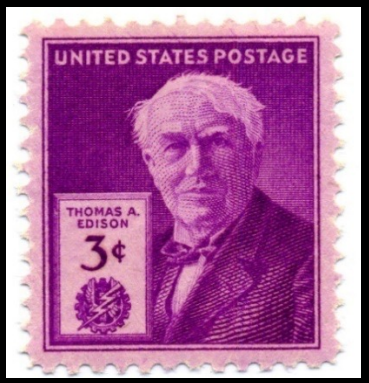

Telegraphers

Key Ideas

Scientific

- Strong Electromagnet
- Binary (dot-dash) Code

Social

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

Symbolic

- Artist as Innovator