A Brief History of Morse Code

or

Why CW Should Not be Called "Morse Code"

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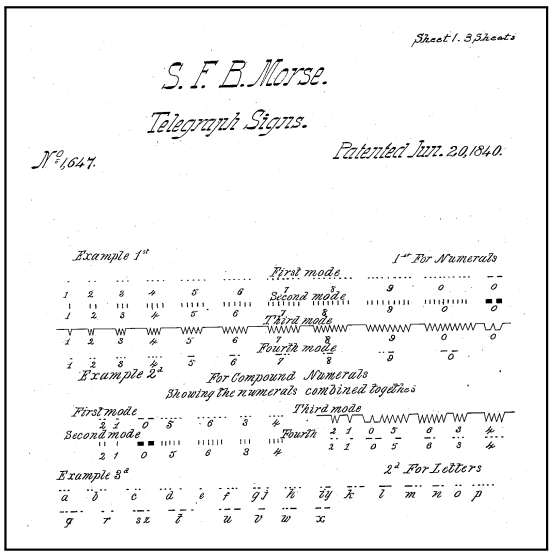
Font colors: *link to a slide*, *link to a file*, *link to a url*

Samuel Morse

Samuel F. B. Morse (April 27, 1791 – April 2, 1872), originally a very successful painter, co-invented the single-wire telegraph.[1] Morse submitted a patent application for his recording telegraph machine in 1838, (granted in 1840), that included an early "Morse code". He submitted a second patent for a telegraph system in 1848 (granted in 1849).

1840

Diagram from Patent #1647

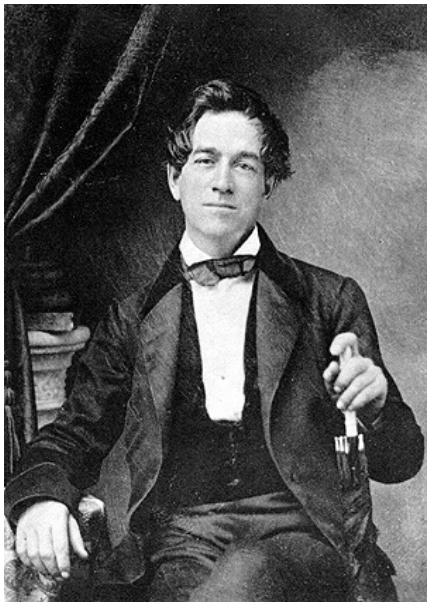


[1] Carl Friedrich Gauss and Wilhelm Weber invented a working electromagnetic two-wire telegraph in 1833. Gauss also discovered Kirchoff's Law before Kirchoff.

Alfred Vail

Alfred Lewis Vail, (Sept 25, 1807 – Jan 18, 1859), a talented machinist, saw Morse demonstrate an early version of his telegraph at the Univ. of the City of New York. Vail significantly improved the mechanisms and replaced Morse's "port-rule" with a key. Later, he replaced Morse's numeric codes and "verbonumeric dictionary" (code-book) with an alphanumeric system. One of Vail's most important ideas was to base the code on letter frequency; he counted letters in the type cases of a Morristown, NJ, newspaper.

"Vail resigned from Morse's employ [in 1848] and abandoned the telegraph industry citing his lack of recognition and contribution to the telegraph."



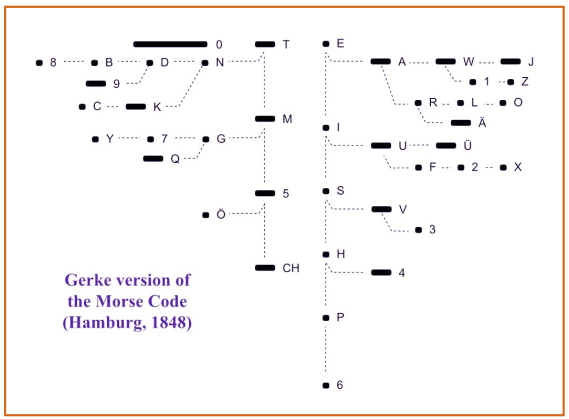
1853

Vail's transcription "What Hath God Wrought". May 11, 1844.
First telegraph transmission, Washington, DC, to Baltimore.

Frederick Gerke

Frederick Clemens Gerke, (Jan 22, 1801 – May 21, 1888). In 1838, Gerke joined Schmidt's private optical telegraph as a technician. After seeing Wm. Robinson's (unauthorized) Morse telegraph demonstration in June 1847, Gerke translated Vail's 1845 book on telegraphy into German and joined the Elektro-Magnetische Telegraph Companie. In 1848, he improved Vail's code by eliminating variable length spaces & dashes, also adding diacriticals; the ITU revised Gerke's code in 1865, defining the "International Morse Code".[2]

1840



[2] See pg. 48 in "Réglement de service international (télégraphique), édition de 1865".

The Timelines

Morse: 1832
Numbers with "verbonumeric dictionary"

→ 5

Vail: 1837
Alphanumerics based on letter frequency

→ 11

Gerke: 1848
Eliminated the variable spaces and dashes

→ 17

ITU: 1865
Redefine letters, separate *i* and *j*, pattern numbers

The Code

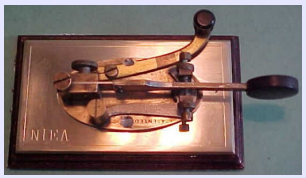
Vail (1844):

Correspondent

Lever Correspond't

→

Bunnell ($^{1881}_{1904}$):

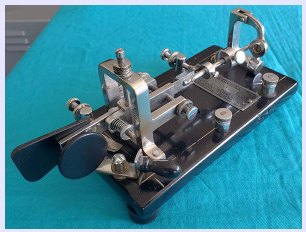


Triumph

Side-swiper

→

Martin (1905):



Vibroplex "Bug"

Produced for 120 years!

→

Today:

Electronic / Iambic

The Keys

The Standard: International Morse Code

Standard letters

A	·−	N	−·
B	−···	O	−−−
C	−·−·	P	·−−·
D	−··	Q	−−·−
E	·	R	·−·
F	··−·	S	···
G	−−·	T	−
H	····	U	··−
I	··	V	···−
J	·−−−	W	·−−
K	−·−	X	−··−
L	·−··	Y	−·−−
M	−−	Z	−−··

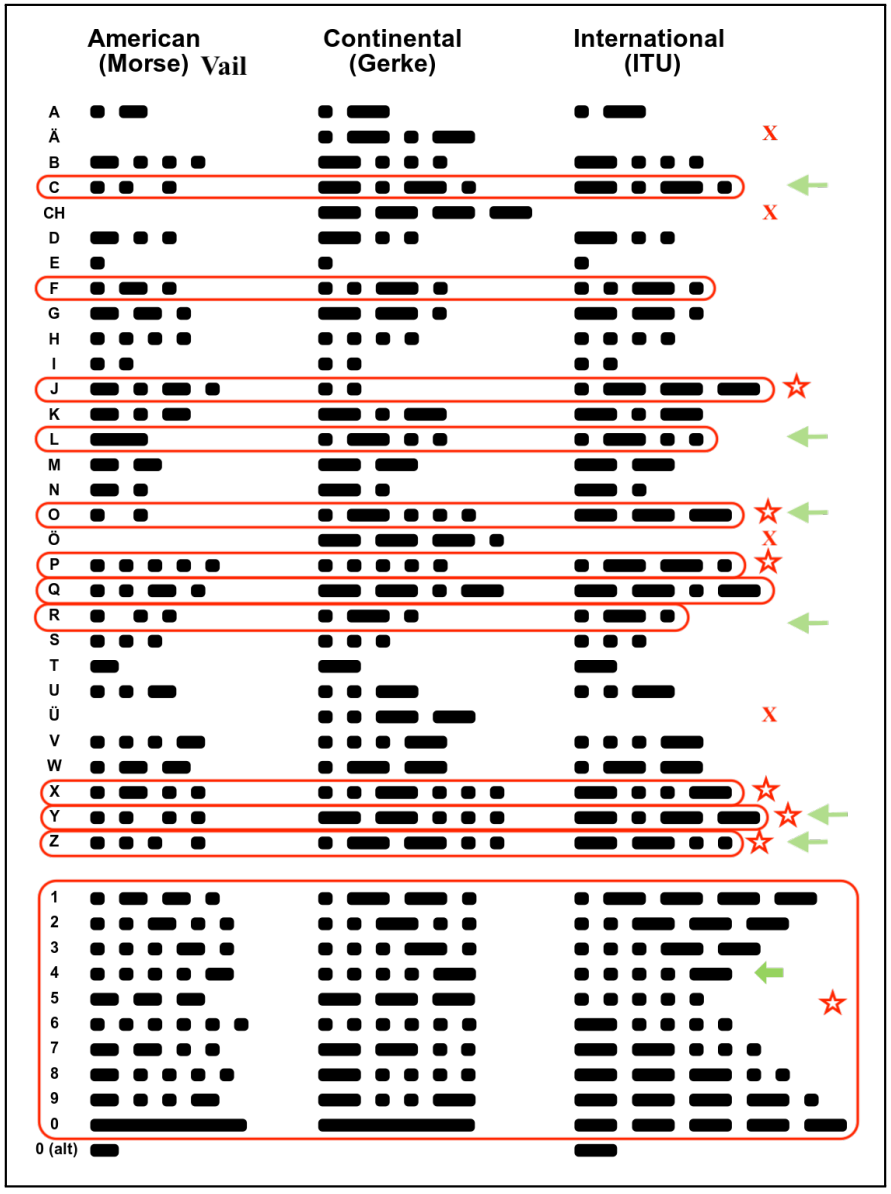
Numbers

1	·−−−−	6	−····
2	··−−−	7	−−···
3	···−−	8	−−−··
4	····−	9	−−−−·
5	·····	0	−−−−−

Punctuation

Comma	,	Left bracket	(
Question mark	?	Equals sign	=
Colon	:	Multiplication	x
Dash	-	Full stop (period)	.
Inverted comma	"	Semicolon	;
Slash	/	Apostrophe	'
Underscore	_	Right bracket	)
Addition sign	+	At sign	@

Chart of the Codes



Look at Vail's description in his book *The American Electro Magnetic Telegraph*.

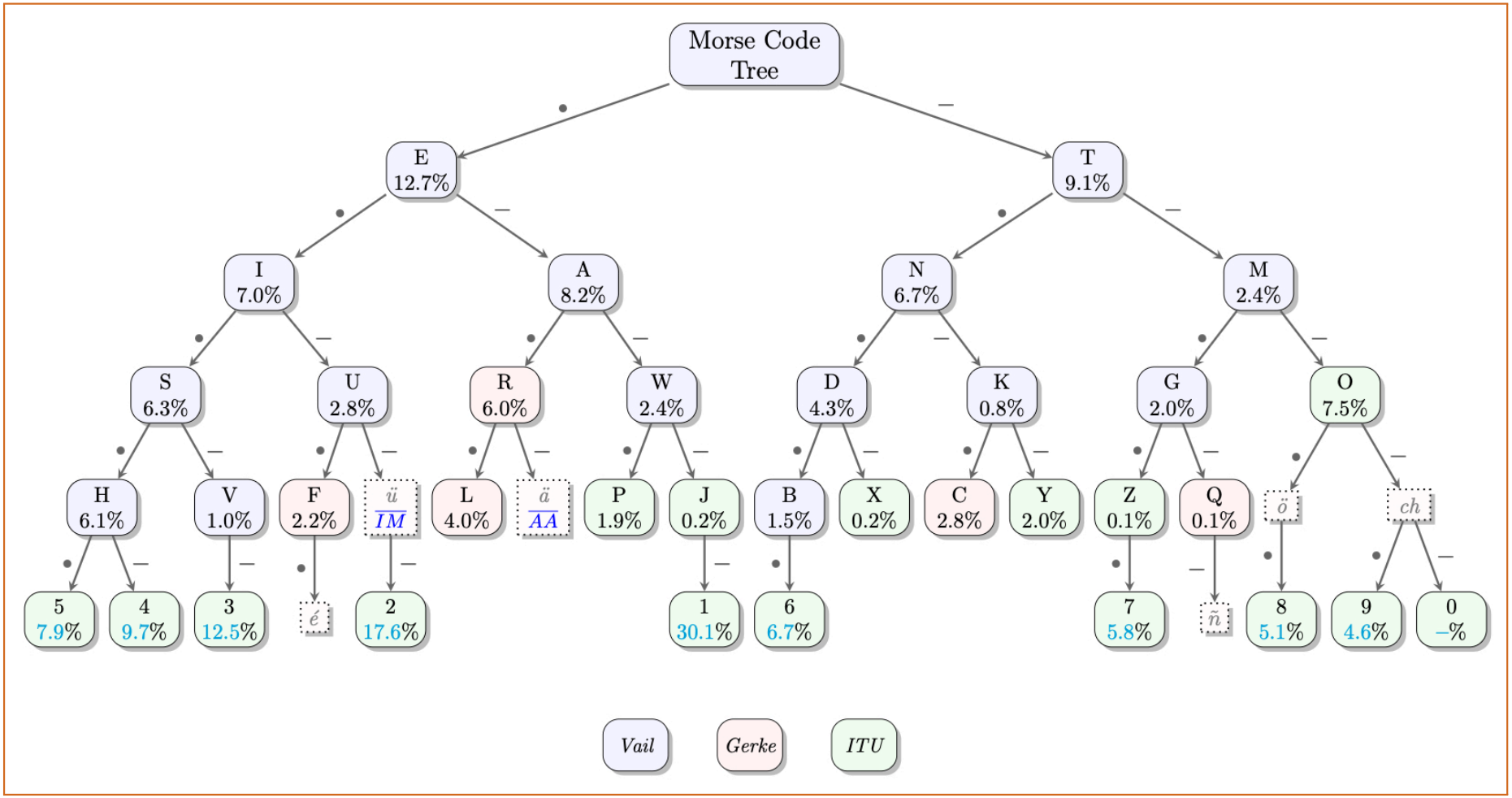
CW Letter Frequency

International Morse Code

Letter	Code	Frequency	1880s	"Weight"
A	• —	8.20%	8.12%	8
B	— • • •	1.50%	1.54%	12
C	— • — •	2.80%	3.01%	14
D	— — •	4.30%	3.96%	10
E	•	12.70%	12.78%	4
F	• • — •	2.20%	2.61%	12
G	— — •	2.00%	1.77%	12
H	• • • •	6.10%	5.94%	10
I	• •	7.00%	7.31%	6
J	• — — —	0.15%	0.15%	16
K	— • —	0.77%	0.47%	12
L	• — • •	4.00%	3.80%	12
M	— —	2.40%	2.42%	10
N	— •	6.70%	6.95%	8
O	— — —	7.50%	7.68%	14
P	• — — •	1.90%	1.95%	14
Q	— — • —	0.10%	0.12%	16
R	• — •	6.00%	6.15%	10
S	• • •	6.30%	6.43%	8
T	—	9.10%	9.50%	6
U	• • —	2.80%	2.70%	10
V	• • • —	0.98%	1.04%	12
W	• — —	2.40%	1.90%	12
X	— • • —	0.15%	0.21%	14
Y	— • — —	2.00%	1.70%	16
Z	— — • •	0.07%	0.05%	14

Morse Code by letter frequency in English text

The CW Tree



The Morse Code Tree: Left branch is •, right branch is —.

The numeric value with a letter is the letter's frequency in English text; with a number is the frequency given by Benford's 'Leading Digit Law' $f(n) = \log_{10}\left(1 + \frac{1}{n}\right)$

Development of the Electromagnetic Telegraph

1821 André Marie Ampère (F) described an electric telegraph using separate wires for each letter with an electromagnet to defect a needle.

1824 William Sturgeon (UK) invented a working electromagnet (able to lift 9 lb).

1831 Joseph Henry (US) popularized & improved Sturgeon's electromagnet and sent a signal over a mile of wire to ring a bell.

1832 Baron Pavel L Schilling (R) developed the first practical needle telegraph and the first electromagnetic telegraph; 5 (Latin) / 6 (Cyrillic) signal wires (binary) + Call + Ground.

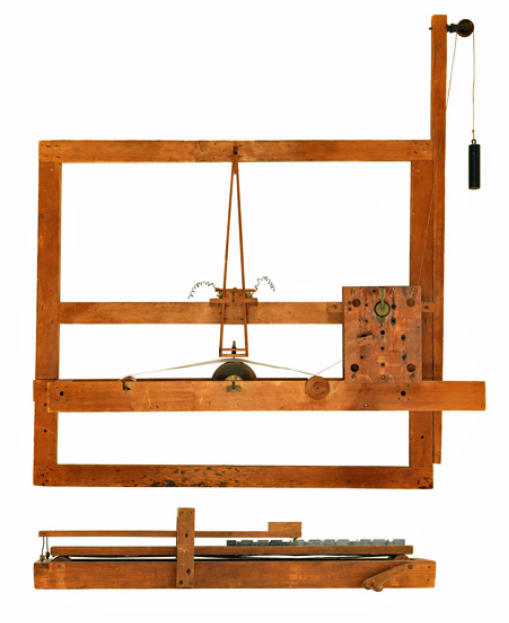
1833 J Carl F Gauss (G) and Wilhelm E Weber (G) created a working electromagnetic telegraph (2 wire, 5 bit binary code) used between their respective labs 3 km apart.

1837 Sir William F Cooke (UK) and Sir Charles Wheatstone (UK) patented (1837, UK) a telegraph system that used 6 wires and actuated 5 needle pointers attached to 5 galvanoscopes at the receiver.

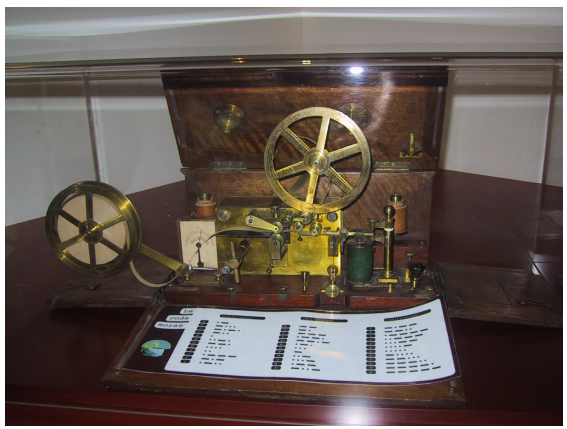
1837 Samuel F B Morse (US) patented (1837, US) a **one-wire** telegraph with a *port-rule* that used molded dots and dashes to make/break contacts, the receiver used a pencil to mark a paper tape; Alfred L Vail (US) replaced the *port-rule* with a key and Morse's verbo-numeric dictionary with the alphabet; operators soon didn't need the paper tape.

Early Telegraph Machines

Cooke & Wheatstone
Needle Telegraph

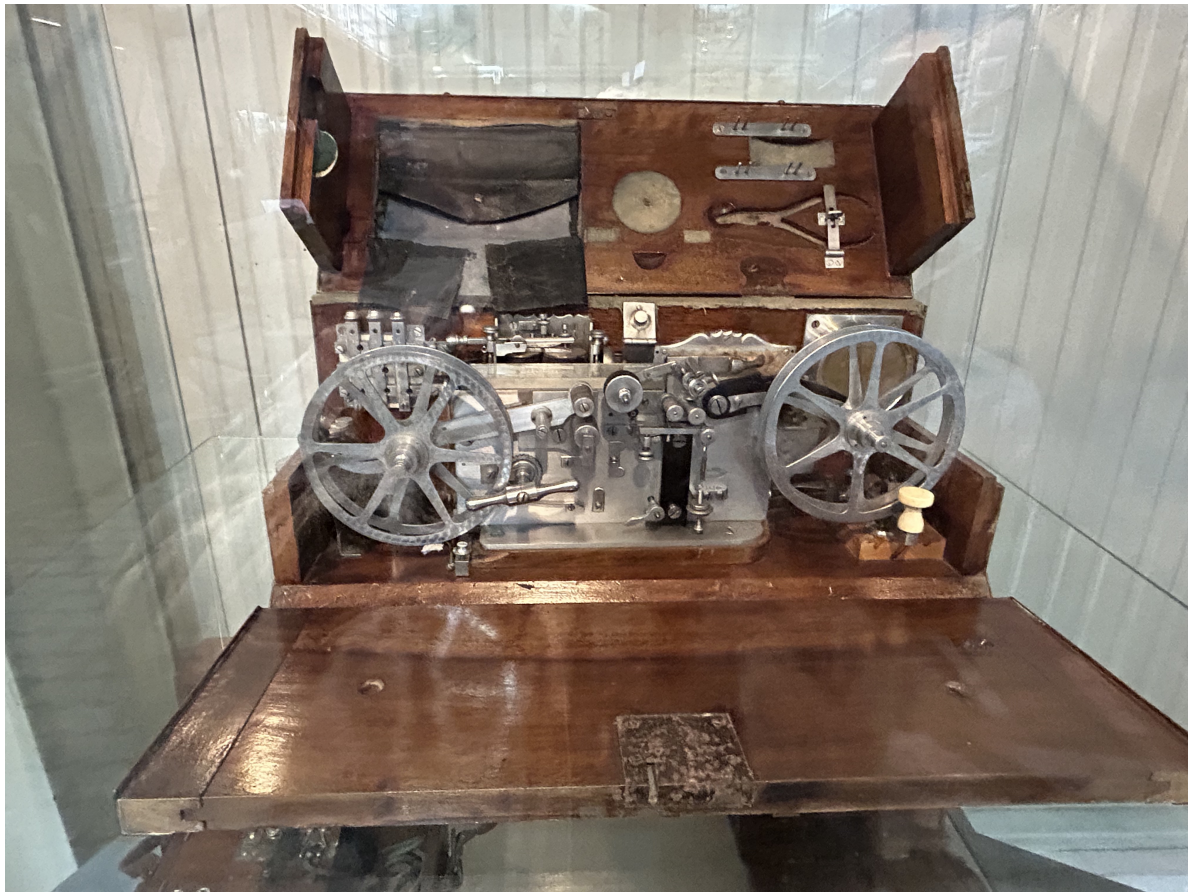


Morse's Original
Telegraph



Morse Telegraph
(1837)

Early Telegraph Machines

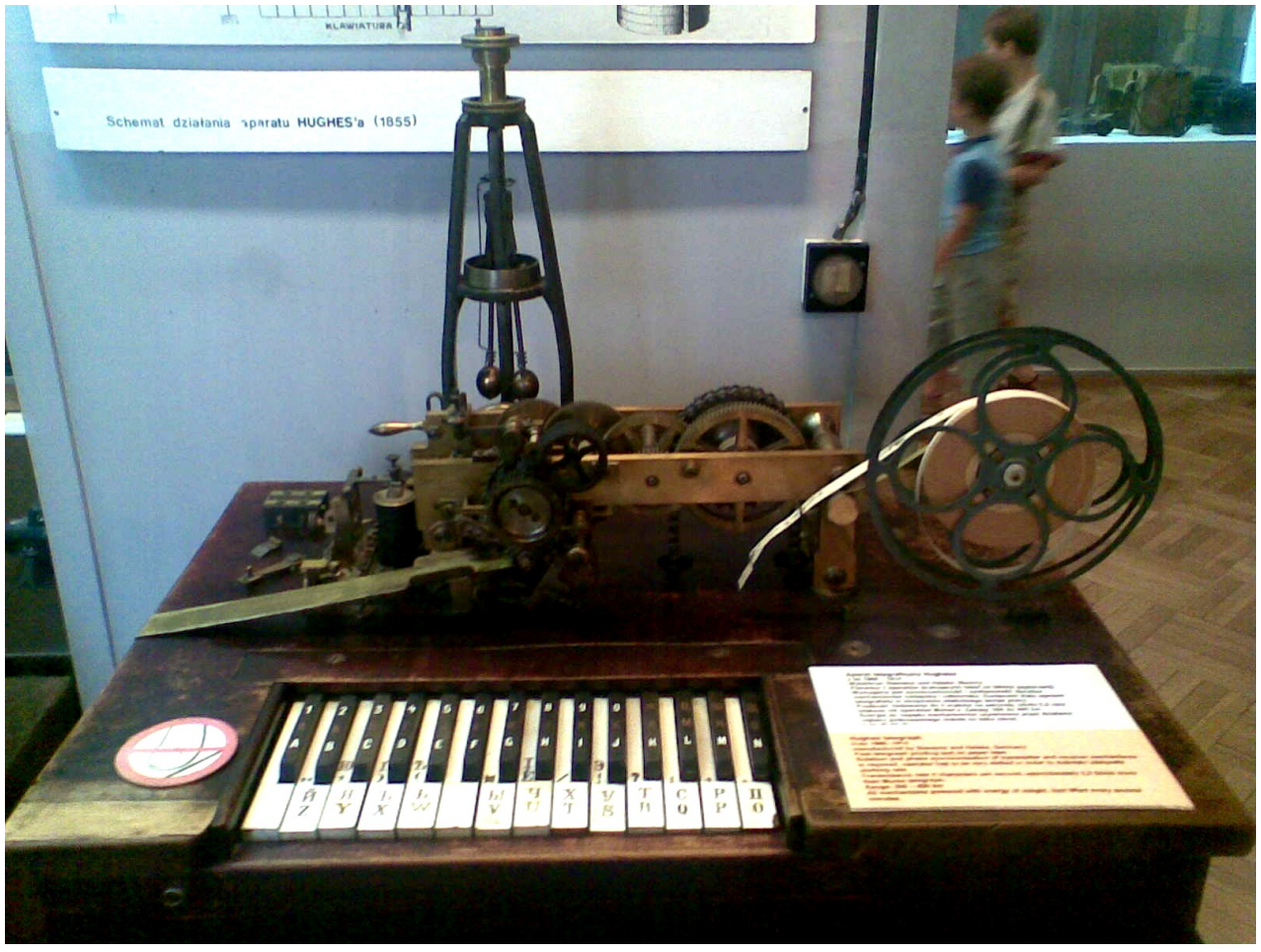


UNIDADE E/R TELEGRÁFICA DE MORSE MD-R-600

Materiais: Madeira, couro, ligas metálicas, têxtil e outros
Dimensões: 50,5 cm x 21 cm x 19,2 cm
Função: Receção e envio de mensagens morse
Origem: F. Rosati, Milão - Itália
Instituição: Regimento de Transmissões do Porto

C. 1910. At the Museu Militar do Porto (Porto Military Museum, Portugal)

Early Telegraph Machines



David E. Hughes "Printing Telegraph" of 1855.

Type letters on the keyboard, read text on the paper tape.

A Tiny Collection of Web Links

Web Links

- ARRL CW Resources
- ARRL Learning Morse Code
- CWops "CW Academy"
- Morse Code World: translator, training, and decoders
- LCWO.net — Learn Morse Code Online (in 34 different languages!)
- Apple's AppStore: Morse Code Reader and Decoder, HAM Radio CW Keyer
- Google Play: Morse Code App
- Vibroplex Code Practice Oscillator Kits at DX Engineering
- Code practice kits at Amazon.com
- The Navy and Coast Guard "Still Use Morse Code" (July, 2017); (YouTube)
- Wikipedia's "Telegraph code" page

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The Quiz

Question

1. Who invented “Morse Code”?
    a. Schilling
    b. Gauss & Weber
    c. Morse
    d. Vail
    e. Gerke
    f. The ITU
    g. *All of the above*