A LITTLE MORE ABOUT AND AROUND THE MORSE CODE

Featuring Samuel Finley Breese MORSE (left)**, Alfred VAIL** (middle) **and… Friedrich Clemens GERKE** (right)

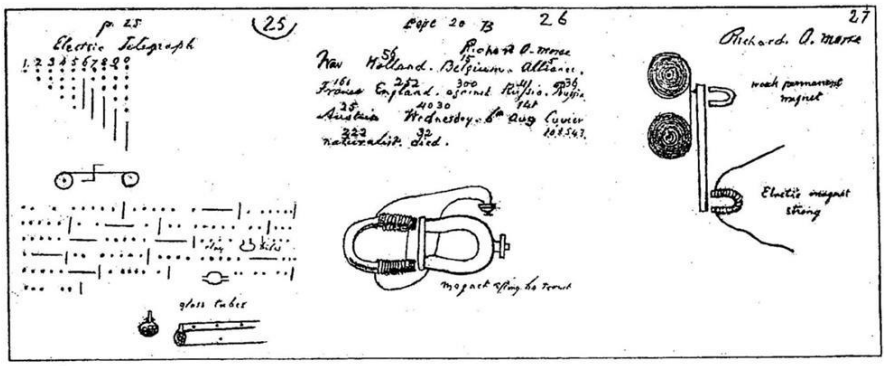


1. Shall we say the Morse code, or should we call it the Vail code? And where does Gerke comes in? (see point 2).

A controversy exists over the role of each in the invention of the code. Vail and Morse certainly collaborated in the invention of the Morse telegraph and almost certainly in the final form of the code. But it is clear that the basic ideas came from Morse, years before Vail became, in 1837, his assistant. So, perhaps we should say that Morse was the inspirer, and Vail the man who brought out their final version. Here are some observations in this regard.

> During his voyage home to New York in 1832 on the *Sully*, Samuel Morse first conceived the idea of the electromagnetic telegraph during his conversations with another passenger, **Dr Charles T. Jackson** of Boston, a twenty-eight-year-old physician with a Harvard M.D. Below you see the reproduction of some drawings in Morse's notebook, in which he has noted down during this voyage some of his first ideas about a telegraph machine.

He originally devised a cipher code (digits 0…9), similar to that used in existing semaphore line telegraphs, by which words were assigned three- or four-digit numbers and entered into a codebook. The sending operator converted words to these number groups and the receiving operator converted them back to words using this codebook. Morse spent several months compiling this code dictionary.



Reproduction from Morse's notebook, showing his original code
Source: Morse, 'Samuel Morse: letters and papers', 1914

But he later abandoned this scheme and, certainly, with the help of his associate Alfred Vail (or maybe only by Vail?) devised the alphabet, which could be used to spell out messages a letter at a time in dots and dashes.

- I would like to add here that Morse's idea was about a copy of the electro-magnetic signalling apparatus -using a Sturgeon magnet- that, in 1832, **Professor Joseph Henry** (1797-1878) had actually constructed and operated. Was Morse aware of this?...

> The patent (in 1840) of his first telegraph model of 1837 gives the same evidence:


S. F. B. Morse.
Telegraph Signs.
Sheet 1. 3 Sheets
N° 1647.
Patented Jun. 20, 1840.
Example 1st
1st For Numerals
First mode
Second mode
Third mode
Fourth mode
Example 2d
For Compound Numerals
Showing the numerals combined together
First mode
Second mode
Third mode
Fourth
Example 3d
2d For Letters
The System of Type
Example 4th
1st For Numerals
Fig 1.
Fig 2.
Example 5
2d For Letters
Example 6.
Type for circular Port Rule
Fig 1
Fig 2.
Fig 3.
Inventor
Witnesses

> It is said by Morse supporters that Vail, in public and private writings, never claimed the code for himself. According to one researcher, in a February 1838 letter to his father, **Judge Stephen Vail**, Alfred wrote, "Professor Morse has invented a new plan of an alphabet, and has thrown aside the Dictionaries." In an 1845 book Vail wrote describing Morse's telegraph, he also attributed the code to Morse.

> In those early days, Alfred Vail was assisted by a very young skilful mechanic, **William Baxter** (1824-1904; in 1868 the inventor of the 'portable Baxter steam engine'). They worked 'night and day' closely together.
Writing of this period, Baxter said that the code was worked out by Vail (ref. 2-> below).

*For more on this topic I can refer you to:
1-> The website of Neal Mc Ewen: http://www.telegraph-office.com/pages/vail.html
2-> An article from F.L. Pope, 1888 'THE American Inventors of the Telegraph – With special reference to the services of Alfred Vail' > https://babel.hathitrust.org/cgi/pt?id=uiug.30112059675808&view=1up&seq=938

- At the very end, Pope writes at the end of his article: *"If justice be done, the name of Alfred Vail will forever stand associated with that of Samuel F.B. Morse in the history and introduction into public use of the electro-magnetic telegraph"*

3-> A book of 36 pages by Vail's son J. Cummings Vail, published in 1914: 'Early History of the Electric--Magnetic Telegraph From Letters and Journals of Alfred Vail'
4-> My article 'ABOUT Samuel MORSE VERSUS Alfred VAIL

Reference 2 and 3 argue very much in favour of Vail.

2. A bit about Alfred Vail (1807-1859).

Alfred Vail played a very important role in the development of the Morse telegraph. Since he is unknown to many, I take this opportunity to put him here somewhat in the spotlight.

He was born in Morristown, New Jersey, where his father, **Stephen Vail**, was an entrepreneur and industrialist who built the Speedwell Ironworks into one of the most innovative iron works of its time. His brother George was a noted politician.

After completing his early schooling, he worked for his father and became a skilled mechanic. But he returned to school and enrolled in the University of the City of New York to study theology in 1832, graduating in 1836.

Visiting his alma mater on September 2, 1837, he happened to witness one of Samuel F. B. Morse's early telegraph experiments in the mineralogical cabinet and lecture room of **Professor Leonard D. Gale**. (This professor became later on heavily involved in the development of Morse's telegraph). He became fascinated by the technology and negotiated an arrangement with Morse to develop the technology at Speedwell Ironworks That was a great stroke of fortune for Morse. Indeed, Vail brought with him his mechanical expertise, a practical inventiveness, and his father's financial resources. Negotiations resulted in an agreement between Samuel Morse and Alfred Vail, on September 23, 1837. Vail agreed to construct a full set of telegraph equipment at his father's shop and finance the American and foreign patent-application process, in return for a 25% interest in Morse's rights to the telegraph. Alfred split his share with his brother George, and when Morse took on **Francis O. J. Smith**, a congressman from Maine (then chairman of the House Committee of Commerce), as a partner, he reduced the Vails' share to one-eighth. Morse himself retained patent rights to everything Vail developed.

During 1838, Vail helped make many improvements to Morse's original design, including a simple sending key and a much more compact size. He also worked out the final form of the Morse code, and invented a printing telegraph in 1837. By 1838 the partners were demonstrating their perfected telegraph; the superb mechanics of the system were largely Vail's contribution. I would like to add here that Alfred Vail was assisted by a young skilful mechanic, William Baxter (the later inventor of the 'portable Baxter steam engine).

The first successful completion of a transmission with this system was at the Speedwell Iron Works on January 6, 1838, across two miles (3 km) of wiring. The message read "A patient waiter is no loser." Over the next few months Morse and Vail demonstrated the telegraph to Philadelphia's Franklin Institute, members of Congress, and President Martin Van Buren and his cabinet. Demonstrations such as these were crucial to Morse's obtaining a Congressional appropriation of $30,000 to build his first line in 1844 from Washington to Baltimore. Vail remained with Morse for the next four years, publishing 'The American Electro Magnetic Telegraph in 1845'. He retired to Morristown in 1848, intending to manufacture telegraphic equipment, but his plans were never realized. Since Vail shared a one-eighth interest in Morse's telegraph patents with his brother George, Vail realized far less financial gain from his work on the telegraph than Morse and others. He died in poverty in January 18, 1859.

Because the terms of Vail's partnership agreement specified that all patents would be in Morse's name, it is difficult to tell precisely which telegraphic innovations were Vail's invention, and to what extent.

- See more on this in my article "ABOUT SAMUEL MORSE VERSUS ALFRED VAIL"

3. The American and the International Morse code and… Gerke.

In order to increase the efficiency of encoding, Morse code was designed so that the length of each symbol is approximately inverse to the frequency of occurrence in text of the English language character that it represents. For instance, the most common letter in English, the letter ‘E’, has the shortest code: a single dot.

* In its original implementation, the Morse code specification included the following, rather complicated, symbols and agreements:

1. short mark or dot
2. longer mark or dash
3. a longer internal gap used in C, O, R, Y, Z and &
4. long dash in the letter L
5. even longer dash in the numeral 0

* Then, as I think he is not well known outside Germany, I have to mention Friedrich GERKE (source: Wikipedia). In the years before Gerke joined the optical and later the electrical telegraph, he worked as a musician in pubs and establishments for sailors on the ‘famous’ Reeperbahn in Hamburg. He also started a career in writing and journalism and published many articles about social life and criticized poor governance. Gerke wrote several books about life in general, nature, and healthcare. After some years he terminated his musical profession because he earned enough money from his writings.

From 1838 on he joined the optical telegraph of Johann Ludwig Schmidt, who established a private telegraph line between Hamburg and Cuxhaven. Gerke's first job was to fix any technical problems. This optical telegraph line served as a ship reporting system between Cuxhaven at the Elbe estuary and the some 120 km further upstream located port of Hamburg. In 1842, the year of the 'Great Hamburg Fire', he requested help from neighbouring fire brigades using the optical telegraph.
By request of Hamburg Senator Carl Möhring, the Americans William and Charles Robinson demonstrated their electrical Morse telegraph in Germany. Recognizing the great advantages of the new technology, Gerke defected a regular telegraph service on **15 July 1848 between Hamburg and Cuxhaven, which for the first time in Europe used Morse code on landlines.**

Friedrich Gerke perceived the disadvantages of the American Morse code and, in 1849, changed nearly half of it. In his system there are three symbols: the short ‘dot’, the longer ‘dash’ and the ‘space’. Without the spaces, Morse would become illegible, as it defines the boundaries between the components of each letter, between letters, and between words, all in different ways (length of the relevant spaces). ’His code was adopted as a standard for transmission over cables by the Austro-German Telegraph Union (which included many central European states) at a conference in 1851

And in 1865 the Gerke code was adopted, be it somewhat modified, by a convention of the International Telegraph Union in Paris [*See my article. The ‘INTERNATIONAL TELEGRAPH UNION.’*] It was first known as ‘Continental Morse’, although as its use spread it also became known as ‘**International Morse’**. At this point the original Morse code started to be called **American Morse (**also **called Railroad Morse)**, to differentiate between the two main standards.

The Friedrich Clemens Gerke Tower is a 230-metre-tall telecommunication tower in Cuxhaven in Germany. It was completed in 1991 and is not accessible for tourists. In spite of its size, it is only used as receiving point for cable TV, as a radio relay station and as a mobile phone transmitter, but not for broadcasting.

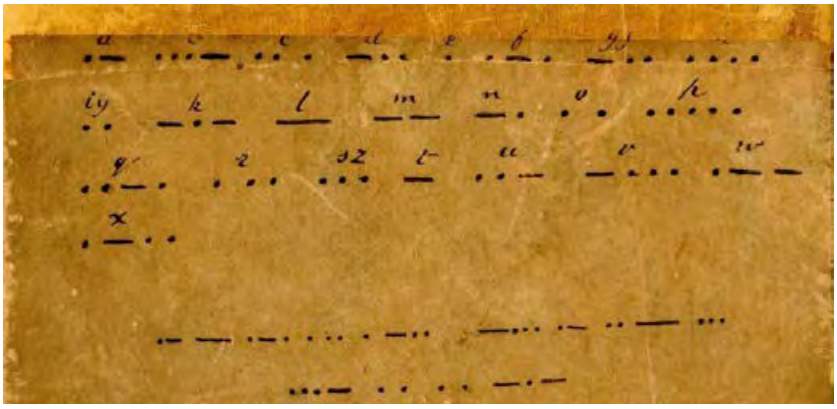
- Comparison of American and International Morse

Letter	International Code	American Morse	Letter	International Code	American Morse	Digit	International Code	American Morse
A	·−	·−	N	−·	−·	0	−−−−−	−−−−−
B	−···	−···	O	−−−	− −	1	·−−−−	·−−−·
C	−·−·	·· ·	P	·−−·	·····	2	··−−−	··−··
D	−··	−··	Q	−−·−	····	3	···−−	···−·
E	·	·	R	·−·	· ··	4	····−	····−
F	··−·	·−·	S	···	···	5	·····	···
G	−−·	−−·	T	−	−	6	−····	·····
H	····	····	U	··−	··−	7	−−···	−−··
I	··	··	V	···−	···−	8	−−−··	−−···
J	·−−−	·−−·	W	·−−	·−−	9	−−−−·	−····
K	−·−	−·−	X	−··−	·−··			
L	·−··	−−	Y	−·−−	·· ··			
M	−−	··	Z	−−··	··· ·			

As you can see, only the yellow highlighted characters have the same coding in both codes (but in reality, the length of the dash is still shorter in American Morse).

- Common punctuation (see also here below in 3. Miscellaneous)

Symbol	International Code	American Morse	Symbol	International Code	American Morse
Period [.]	·−·−·−	·····	Apostrophe [']	·−−−−·	···· ···· (QX)
Comma [,]	−−··−−	·−·−	Slash [/]	−··−·	··· − (UT)
Question mark [?]	··−−··	····	Hyphen [-]	−····−	···· ···· (HX)
Exclamation mark [!]	−·−·−−	−−·−	Parenthesis (open) [(]	−·−−·	····· −· (PN)
Ampersand [&]	·−···	·····	Parenthesis (close) [)]	−·−−·−	····· ·· ·· (PII)
Paragraph break	·−·−·	····	Quotation mark (open) ["]	·−··−·	···· −· (QN)
Semicolon [;]	−·−·−·	··· ·· (SI)	Quotation mark (close) ["]	·−··−·	···· ···· (QJ)
Colon [:]	−−−···	··· · · (KEE)			



ALFRED VAIL'S BOOK (Smithsonian Institution)

4. Miscellaneous

- Length of Morse code characters

In order that the Morse code characters are easy to read, it is necessary to ensure that they are the correct length. Too long or too short, and the Morse code messages can be very difficult to read as the rhythm of the different characters is destroyed. Part of the International Morse code "standard" is an agreed definition of the various lengths of dots, dashes and spaces.
-A dash is equal to three dots
-The space between elements which form the same letter is equal to one dot.
-The space between two letters is equal to three dots
-The space between two words is equal to seven dots

- Two of the special signs.

-Percentage and per-thousand signs:
To indicate the % or per thousand, the figure), the fraction bar and the figures 0 or 00 shall be successively transmitted (i.e., 0/0 or 0/00).
A whole number, a fractional number or a fraction followed by the % or per thousand sign shall be transmitted by joining up the whole number, the fraction number or fraction to the % or per thousand sign by a single hyphen.
For 3%, send 3-0/0 and not 30/0
For 4 1/2 percent, send 4-1/2-0/0 and not 41/20/0
-On 24 May 2004, the 160th anniversary of the first public Morse telegraph transmission, the Radiocommunication Bureau of the International Telecommunication Union (ITU-R) formally added the @ character to the official Morse character set, using the sequence: •▬▬▬•▬▬• (mnemonic: AC: the abbreviation of the French 'a commercial'.

- See **A LOT** more about special codes and other excellent information via: https://en.wikipedia.org/wiki/Morse_code

5. More miscellaneous.

1/ **Morse's second death**
On 31 January 1999 Morse was buried a second time. On that day, Morse signalling was officially stopped on what was then the big bastion: radio telegraphy on the Merchant Marine (between ships and with the coastal stations).
Of course, there are still many radio operators (called 'HAMs') who continue to communicate in Morse (using the Continuous Wave or CW mode), as well as some boy-scouts. And in America and Australia, landline some telegraphy enthusiasts are still contacting each other using old instruments (mostly sounders). This 'dial-up telegraphy' is done by coupling their instruments with 300 bits per second modems (yes 'bits', not kbits nor Mbits...) to the public telephone network!

2/ **Morse versus SMS…**
Have a look at this nice competition with Jay Leno as the jury (it's a rather old movie; I think from 2006).
https://www.dailymotion.com/video/x1wltc

3/ **Can I send Morse with my smartphone?**
Yes, you can use Morse on any phone, smart or otherwise. Call the number you want and when they answer say didididit dit didahdidit didahdidit dahdahdah ..
Seriously: go for example to www.iditdahtext.com

4/ **How can I learn Morsecode?**
My friend Google will give you a lot of possibilities, including Apps for your smartphone.

By the way, I myself learned the Morse code as a young member of the boy-scouts. I was very proud when, at the age of 10, the master fixed the corresponding skill badge on the shirt of my uniform. The requirement was: meeting the standards for translating code at 5 words per minute (wpm).
For serious guidance, I refer you to American Radio Relay League (ARRL) at
http://www.arrl.org/learning-morse-code where there are further links and information about different ways of learning Morse, for example the Koch method versus the Farnsworth method.

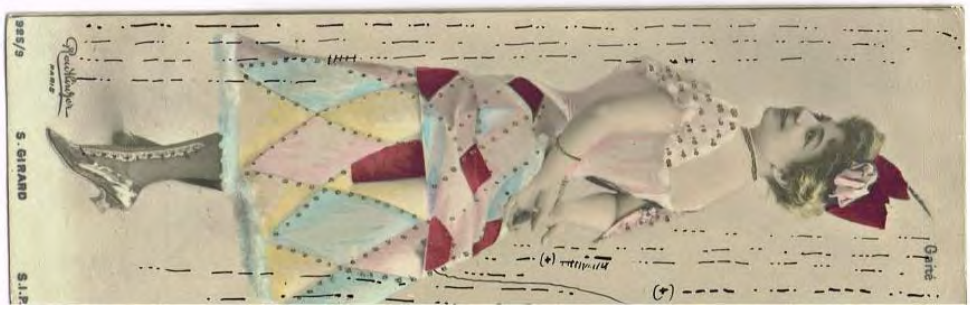
5/ **How to convert text into Morse and vice versa?**
A simple search on Google gives you many possibilities.
Here are two of them:
https://www.geocachingtoolbox.com/index.php?lang=en&page=morse
http://morsecode.world/m/eJxjYhIR8XEN9XZVCHJ1dA7xdA1WBAAj-AQ0

6/ **Records**
International contests in code copying are still occasionally held. In July 1939 at a contest in Asheville, North Carolina in the United States Ted R. McElroy set a still-standing record for Morse copying, 75.2 wpm, 'Paris' being the typical word (5 letters and 50 dots durations). Hams participate in contacts all the time, where the objective is to make as many as possible 'QSOs' (code for 'communications') within a given time frame.

7/ **Who coined the term 'bug'**
There are two meanings to the word 'bug' in the early history of the telegraph.
On 3 March 1878 Thomas Edison joked in a letter to Western Union President William Orton: "You were partly correct, I did find a 'bug' in my apparatus, but it was not in the telephone proper. It was of the genus 'callbellum.' The insect appears to find conditions for its existence in all call apparatus of telephones."
The second meaning evolved from a technical problem to become a nickname given to semi-automatic Morse keys. Read the story in John Casale's website: http://www.telegraph-history.org/bug/index.html
So it was not the famous Grace Hopper who was the first to use this word to indicate a problem. Her story started on 9 September 1947, when the Harvard's Mark II Aiken Relay computer was malfunctioning. After rooting through the massive machine to find the cause of the problem she found the bug. It was an actual insect, a moth... It was caught between the contacts of a switch ...

8/**Morse over IP**
https://8ch9azbsfifz.github.io/moip/index.html#gettingstarted
https://github.com/8cH9azbsFifZ/moip

9/ **Carrier pigeon versus morsecode**
A historical re-enact. Mind you, this is in Dutch (not the images of course).
https://www.youtube.com/watch?v=aGiSylFDblc



6. SOS, the ‘tune’ for saving lives, but not souls (so not S.O.S.)

It is now indeed well over 100 years ago that the distress signal SOS was officially put into use as an alarm signal for ships in distress. In the period prior to radio telegraphy (before, say 1900), it was not easy to send out emergency signals. This could only be done with visual and auditory signals such as light, flags, horns, heliographs (reflecting the sunlight), ... and therefore only the distance to other ships or to the shore could be covered by such means.

Marconi and other pioneers in the field of wireless transmission changed this from around 1900. In that pioneering period messages were restricted to Morse telegraphy as voice transmission had not yet been invented.

CQD

The main application of wireless telegraphy at that time was certainly to be found in the maritime world, and the possibility of sending out an emergency call was the most important element. But during the first years of the 20th century this distress signal was not SOS but CQD. The Morse code CQ (‘Calling all stations’) was already a generally agreed call signal in Great Britain at that time, which asked the attention of all the stations that were listening at the relevant frequency. It preceded the transmission of the time signal or an important announcement. It was the Marconi Wireless Telegraph Company that added the 'D' to make it the CQD emergency signal. It is now often said that CQD is the abbreviation of 'Come Quick, Danger' but it is not. It was a good mnemonic tool to remember it. But in fact, it meant: (CQ) = attention! + (D) = danger. However, they probably chose the D because it is the abbreviation of both Distress and Danger. It is interesting to note that CQ is still used in amateur radio to call all stations listening on the air – both in Morse and in voice transmissions (American hams often refer to it as ‘seek you’.)

SOS

At the international conference on wireless telegraphy in Berlin in 1906, it was decided to define an unambiguous emergency signal that would be internationally acceptable and had to be such that it would not cause confusion. They were well aware that this was not the case with the CQD signal. My friend Greg Ulsamer drew my attention to the fact that the SOS signal had already been in use in Germany before, with an ordinance of the 'Keizerliche Marine' of 30 March 1904.

In that period the Italians used e.g., SSSDDD and the Germans preferred SOE. Eventually they opted for SOS. It was agreed that this signal would be very clearly distinguishable from all other Morse signals in a message. We now call it S-O-S but beware, no 3 letters are sent, all signals come directly after each other! It could just as well have been called IJS, or SMB, or VTB, as they give the same sequence of dots and dashes. This sequence has a typical ‘melody’ and it clearly distinguishes itself from everything else in a Morse message.

And so, as from 1 July 1908 SOS became the well-known distress signal. Creative spirits connected the expression 'Save Our Souls' to it. But also other variants came to the fore such as 'Sinking Of Ship', 'Send Out Succour', 'Save Our Ship'.When the Titanic sank in 1912, the Radio-Officer (RO), in those times called the’ marconist’, alternately sent out the signals SOS and CQD.

It is not possible to calculate how many lives were saved by the use of SOS. In fact, we have to say: saved by the invention of wireless telegraphy, but the SOS signal has certainly contributed a lot to the efficiency.

Conclusion:

This special SOS sequence should not be considered as the three separate letters S O S. It must be transmitted as a fluent whole. The official distress signal SOS is as such a well identifiable code consisting of 9 immediately consecutive signs: 3 dots, 3 dashes and 3 dots. This special sequence sounds good in the ear in the first place and so it is immediately recognizable.

As we have alluded above, the use of the SOS distress call became a thing of the past on 1 February 1999 when Morse communications with ships at sea were officially discontinued. There are now many other possibilities to call for emergency assistance and which use, of course, voice transmission.
For example:
- The Global Maritime Distress and Safety System that works with Inmarsat satellites.
-VHF radio signals: via channel 16 and the call 'mayday, mayday, mayday' (from the French “m’aidez” = “help me” in English and in Dutch) followed by data such as identity, position, situation...
-Digital Selective Calling: a system that automatically sends out emergency data at the touch of a button.
-Satellite telephony: e.g., to the emergency number 999.
-Beacons which, when in contact with seawater, automatically transmit the position.
And any further systems subject to future technological innovations.

> *See possibly the website of the International Convention for the Safety of Life at Sea (SOLAS):* *https://en.wikipedia.org/wiki/SOLAS_Convention*

SOS and Morse are therefore 'out of fashion' but not completely gone yet. A number of hams still use it and in certain circumstances the SOS signal can certainly still come in handy to call for help.

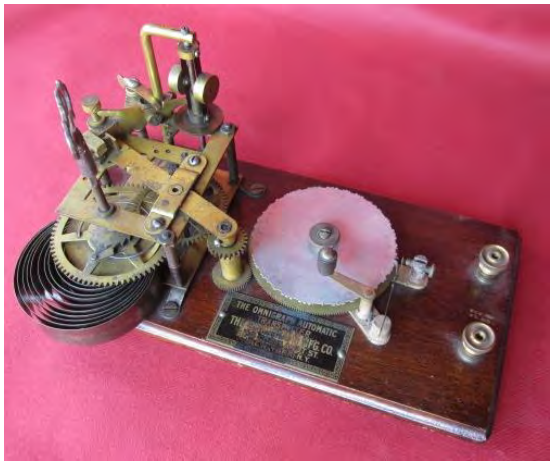
Back in 2008 I read in the newspaper that the elite troops and pilots in the Belgian Air Force still have a mirror in their survival kit that should allow them to send out the SOS signal by reflecting the sun's rays (like a heliograph).

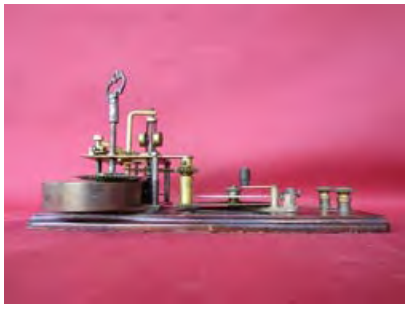
PS: Interested in SOS? Then you must also read Neal Mc Ewen’s article about it, which his part of his great website: http://www.telegraph-office.com

Young soldiers learning Morse code, using landline registers. Left: in Nancy (FR); right: in Vilvoorde (B)
[date unknown]

7. Some instruction tools and and testers of Morse code knowledge.

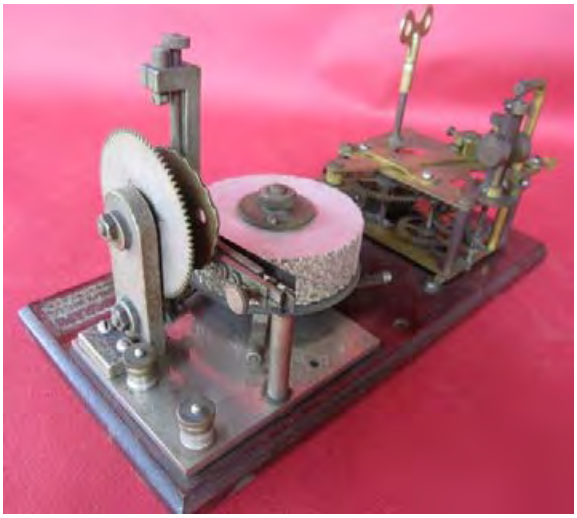
This can be a collection domain in itself. I am showing here a couple of them that once were part of my collection. First of all two models of the company Omnigraph. These are wind-up 'automatic' transmitters.





In essence this is a mechanically driven disk with Morse code protrusions. These are probed by a sensor which closes the contact when ‘reading’ the long or short Morse code signals. It thus simulates the Morse key. It can then be connected to a Morse recorder, but also to a light or a buzzer.

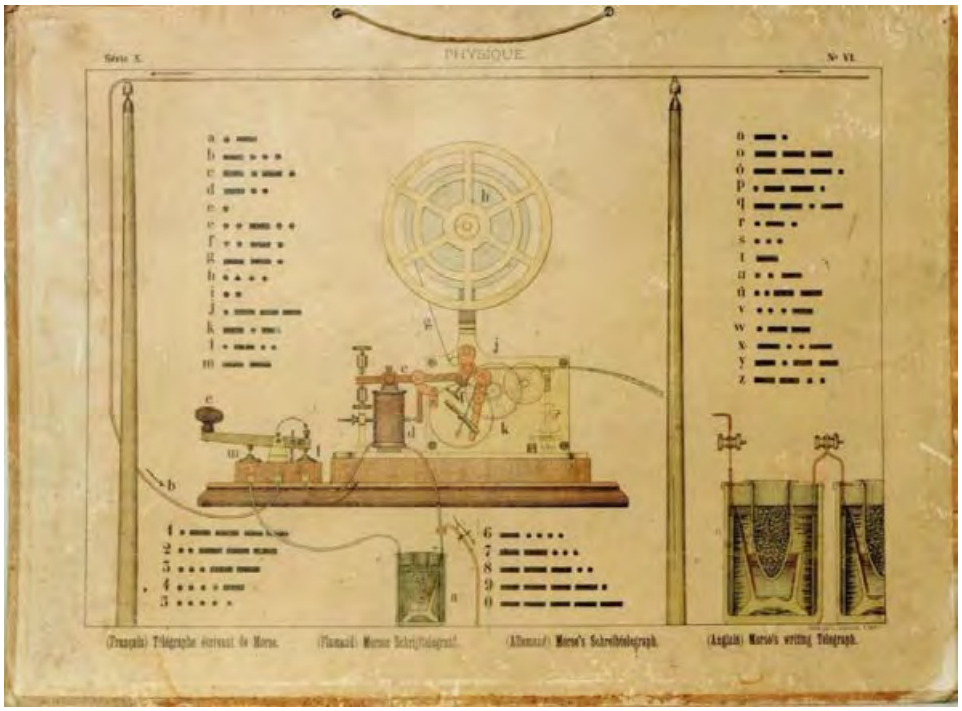
This second model (below) probes successively each of the 15 (!) disks. Before commencing, each disk can have every fifth part turned on or off, resulting in different combinations of text which students cannot anticipate or learn by heart beforehand.



The little board below (left) is set with the Morse code signs in metal strips. By sliding over it with the metal sensor (as part of a circuit with a battery and receiver) one can now effortlessly forward Morse signs. On the right is a box that contains metal strips with all the characters of the alphabet in Morse code. One has to slide them, one after the other, over the 'scanner' (the little box at the right-hand side). Cumbersome…

Bottom left you see a 78 rpm record to learn Morse code. They came in sets of 10, each record with an increased level of difficulty. The name is well chosen: “The tireless Professor”.

The image at right shows an ‘automatic’ transmitter that drives a pre-prepared paper tape containing the message in Morse code. It has the typical motor and speed regulator of a gramophone.



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THANK YOU TO

My good friend and passionate Morse key collector, **Kees van der Spek**. Kees was a CW (Morse code) radio operator in the Signal Corps of the Dutch Army during 1973-75. He has been living in Australia since 1977 and provided me with excellent input and reviewed my text.