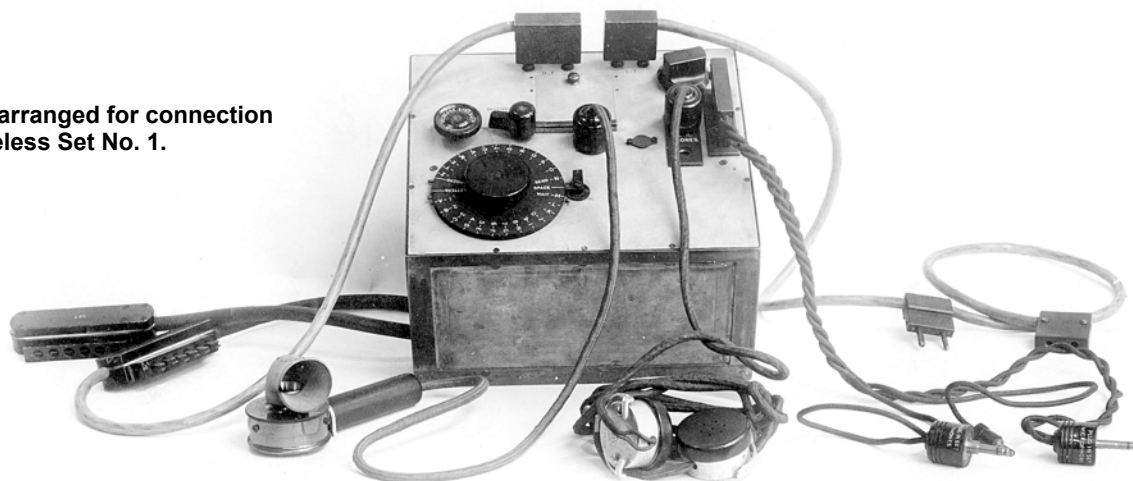


Experimental Dial System

Date of issue: September 2023.

After publishing over 340 Wireless for the Warrior Volume 2 'Supplements', the amount of source material gradually dried up. Not directly related material, but within the scope of the WFTW website and interest, will be published in a new range entitled the 'Various Series'.

Dial Set arranged for connection to a Wireless Set No. 1.



Dial System Country of origin: England

Summary

The Dial System, developed by the Signals Experimental Establishment*, was an experimental wireless communication system based on audio frequencies. It was designed to serve as a substitute for Morse code and emerged in 1932 as an attachment to Wireless Set No. 1. The system built upon experiments conducted by the Cambridge University O.T.C. around 1927-28. This article describes the technical development history of the system, utilizing all available documentation on the topic retrieved from the archives of the Royal Signals Museum in Blandford Forum.

Cambridge University O.T.C.

In a report submitted to the Royal Engineers Board in 1928, the Cambridge University Officer Training Corps described their experiments with a system where each letter was represented by an audio tone at a specific frequency. This system was known as the Dial System.

Attempts were made to develop the Dial System using the 'high frequency method,'

where the frequency from a CW Sender, type A Mk.III, was varied based on the setting of a lettered dial. The tuning circuit in the CW receiver on the receiving side was equipped with a similar dial, allowing for the tracking of frequency variations in the transmitter, letter by letter. However, this 'high frequency' dialling method was eventually abandoned due to its instability and tracking errors.

Development by S.E.E.

Nevertheless, the general idea was recognized not only for eliminating the use of Morse code but also for automatically encrypting and decrypting a message. In 1930, the Signals Experimental Establishment took over the development of the 'Dial Set' using the 'low frequency' method, which was developed as an attachment to Wireless Set No. 1.

Due to its low priority classification (level 4) for the development of a working prototype, progress was not reported until 1932, as indicated in a secret S.E.E. Report No. 564.

Audio oscillator

The 'low frequency' method made use of an audio-frequency oscillator, which amplitude modulated the transmitter of a No. 1 Set. The frequency of this oscillator, ranging from 512 to 1536 Hz, could be continuously varied over the audio frequency band by operating a knob with a dial marked with numbers and letters.

Equal changes in frequency took place between consecutive letters.

An identical audio frequency oscillator would be coupled to the output of a distant receiver, and the frequency generated at each setting of the lettered dial on this oscillator would correspond, letter for letter, with the frequency generated by the oscillator at the transmitter. The operator at the receiver would hear two tones in the headphones: the tone from the transmitter and the tone from their local dial oscillator.

DATA SUMMARY

Organisation: British Army

Developer/maker: Signals Experimental Establishment.

Year of Introduction: 1932.

Purpose: Substitute for Morse signalling.

Power supply: 6V LT and 200V HT.

Size (cm): height 11, length 21, width 21 (an estimate).

Acknowledgements:

- With many thanks to the director, curator and librarian of the Royal Signals Museum, Blandford Forum, Dorset.

References:

- Report on the research work carried out by the Cambridge University OTC, R.E. Board, 1928.
- Dial Set, inclusion in S.E.E. Inventions Book, 25 Jan. 1930.
- Signals Experimental Establishment report No. 564, Report on the development of the Dial System (Secret), Dec. 1932.
- Wireless for the Warrior, Compendium 1, pp 171-172, Louis Meulstee, Sept. 2009, isbn/ean: 978-90-808277-2-1

To send a message, the dial oscillator at the transmitter would be set to the letter to be transmitted. The receiver was tuned to receive the tone from the transmitter and the dial oscillator at the receiver would be adjusted until the two tones in the headphones were exactly matched in frequency.

The dial at the receiver would then indicate the letter transmitted. When the dial at the transmitter was set to the next letter of the message, the change would be indicated at the receiver by a change of frequency of one of the two tones heard in the headphones. The dial at the receiver would then be re-adjusted until the tones were again equal.

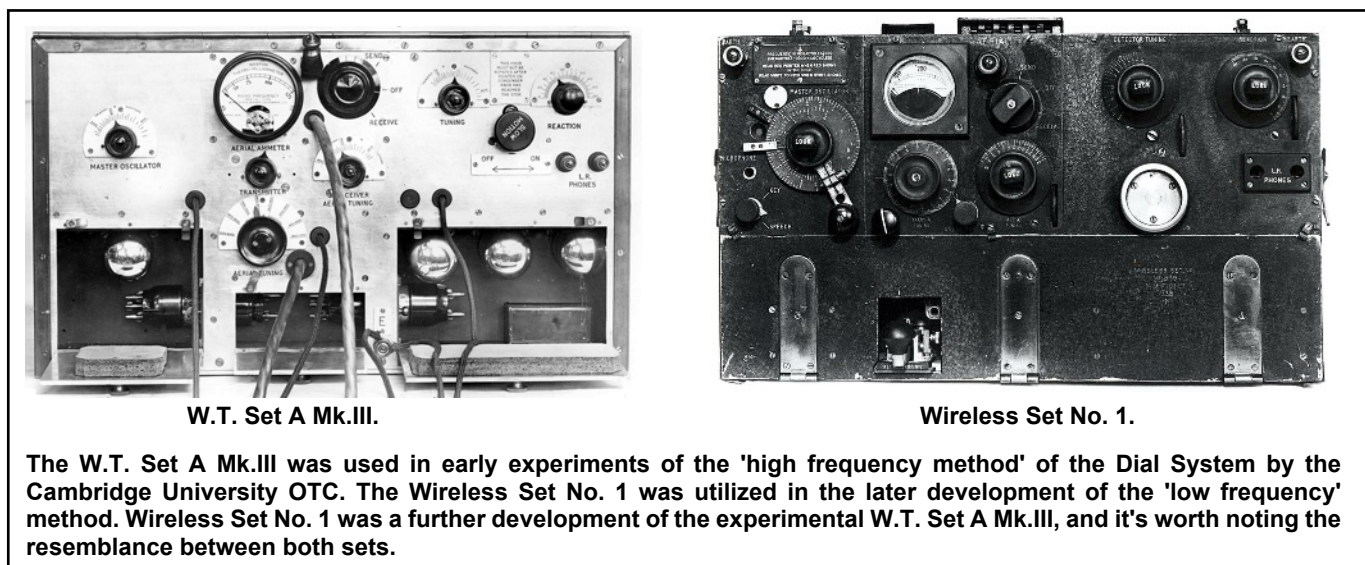
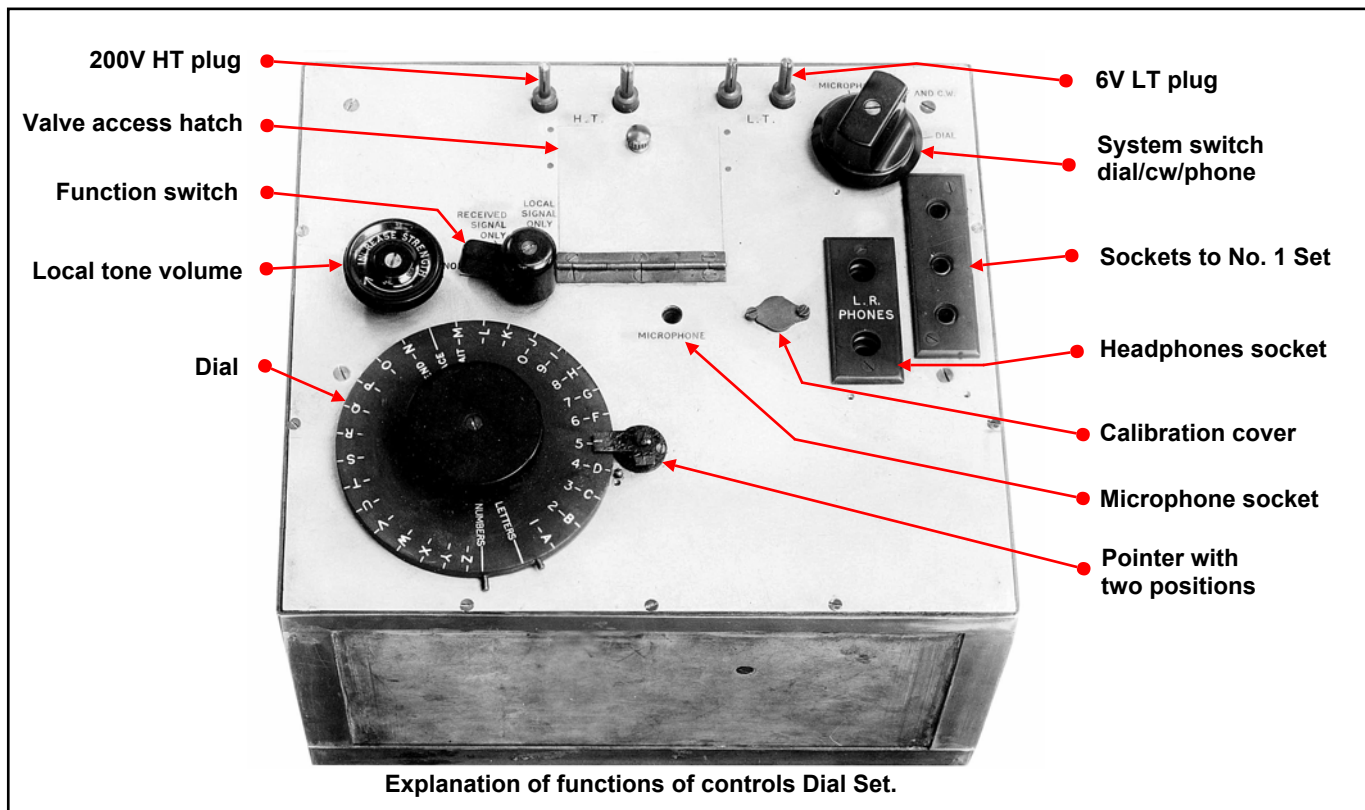
This process would be repeated letter by letter, throughout the message.

Slow speed

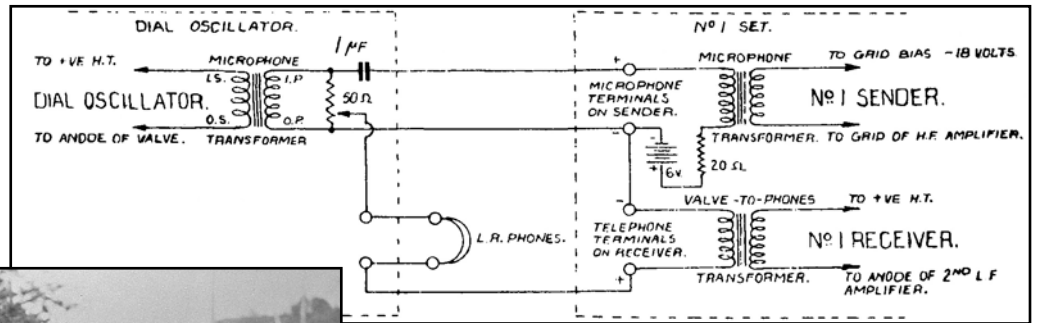
It was possible to send and receive messages accurately at a speed of about 12 symbols per minute, depending on the skill of the receiving operator. Because this method of signalling was a combination of an oral method and a visual method, for the greatest speed of working, two operators were principally required, as in other methods of visual signalling. One operator would manipulate the dial, read the letters, and call them out, so that the second operator would write down the messages as received. It was found that

even in the presence of excessive interference, messages could be accurately received when the signal was weak, and the equipment was beyond the range for intelligent reception of speech. Despite promising test results, the system exhibited notable drawbacks in practical application. Its accuracy was questionable, and its operational speed proved to be particularly sluggish. Consequently, development ceased, and the Dial System faded into oblivion.

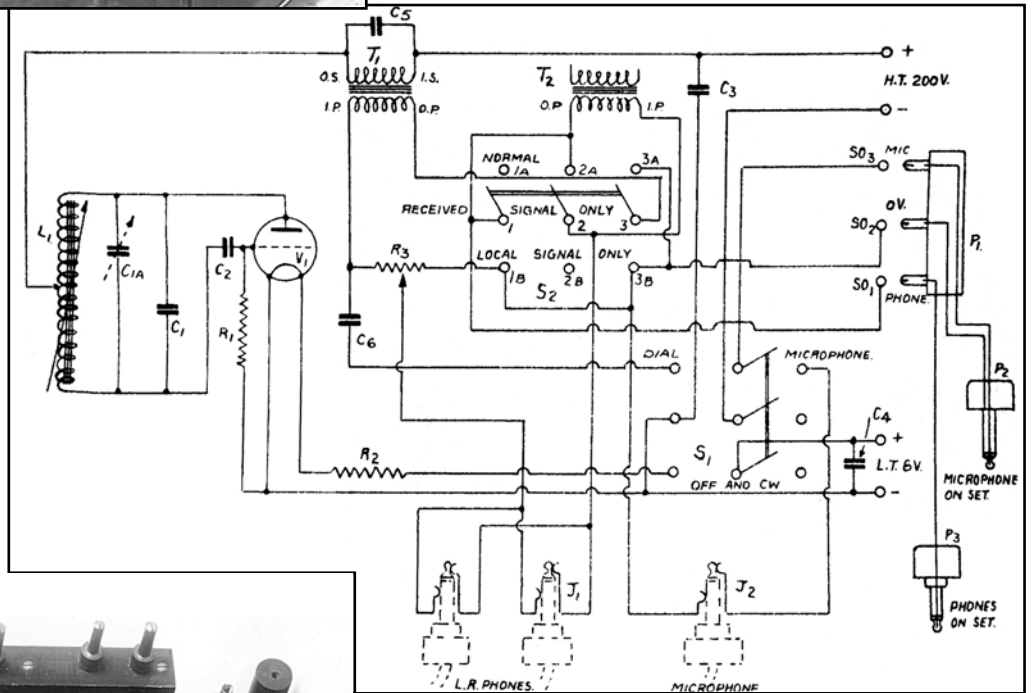
**S.E.E., in 1941 renamed Signals Research and Development Establishment.*



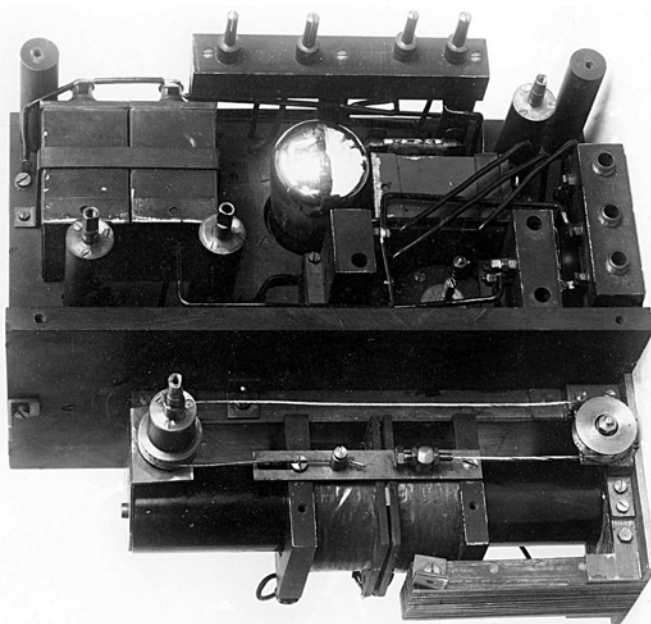
Functional circuit diagram of the audio connections of the Dial System connected to Wireless Set No. 1 in 'normal' position.



Range trials of the Dial System were conducted in 1932. One of the stations was carried in a Morris Eight light car. This photo shows a standard No. 1 Set installation in this vehicle without the Dial System attachment.



The circuit diagram of the Dial Set, along with the connection cable assembly to Wireless Set No. 1, is shown above. The valve used in this setup was a type PM1HF. One section of T2 was dedicated solely to the 'Received Signal Only' function, which compensated for the audio level delivered to the headphones



An internal view of the Dial Set was taken from above with the front plate detached, revealing the audio frequency oscillator drive mechanism (located at the bottom) and other components. The movement of the coil former, which slid on an ebonite tube at the open end of the laminated iron core, was controlled by a threaded pulley connected to a Bowden wire