

The Morkrum Printing Telegraph

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(Document Notes)

The Morkrum Printing Telegraph is a direct acting keyboard system; that is, the operation of the keyboard at the sending end actuates the printing mechanism at the receiving end directly, without any intermediate operations.

Upon the simplicity of the line currents used, depends the ability of a printer to operate successfully under the varying conditions of weather and line interference, met with in actual work; to meet these requirements, the reliability of the Morse polar duplex has been taken advantage of, and the system almost exactly duplicated in the Morkrum Printer.

The current is of single strength, with the battery always connected to the line, and the signals are transmitted by reversals of polarity. This system gives the advantages of the Morse polar duplex, in its ability to work successfully over long lines, and also makes it possible to repeat through direct point repeaters.

The transmitted signal is divided into six time intervals. The negative pole of the battery is normally connected to the line between signals, and it is accordingly essential that a signal be started by connecting the positive pole to the line.

Figure I shows a signal in which current of positive polarity is sent to the line during all of the six time intervals. The first interval is designated as (O) in the diagram, and is known as the starting interval. The selective signaling is accomplished by combinations of reversals of polarity of the current sent to the line during the five succeeding time intervals. This allows thirty-two selections to be made over the line, and by using a shift of the type wheel, fifty-three letters, figures and characters are printed.

This system of selective signaling is illustrated by Figure II, which shows the signals sent over the line for the word "The." The letter "T" is formed by reversing the polarity of the current sent to the line during the third and fifth intervals. In letter "H" the current is reversed during the second, third, fourth and fifth intervals, while in letter "E" the reversal takes place during the second and fifth intervals.

As in this system there is never to exceed three and an average of only two signalling currents sent to the line, for each letter, it is not necessary to transmit the signals at a high rate of speed, in order to obtain the necessary speed on the transmitting keyboard.

Figure III shows the theory of the action of the receiver in selecting the different signals. The receiving mechanism is arranged to connect the selective locks to the line relay for only a short portion of the duration of each time interval of the transmitting signal.

The system is not synchronous in the ordinary sense of the word, but is roughly isochronous; that is, the receiving mechanism is adjusted to run approximately the same speed as the transmitting mechanism, and a governing rheostat is provided to regulate the speed of the receiving mechanism, so that the relation of the received intervals to the transmitted intervals can be correctly adjusted. This is for the purpose of compensating for any difference in the voltages of the local power at the two ends.

This arrangement allows of considerable distortion of the signals before the selection is interfered with, as it is only necessary that the interval of the receiving mechanism lies somewhere within the limits of the corresponding transmitted signal.

The mechanism is divided into a number of elements, the functions of which and their relations to each other are best explained by reference to Figure IV, in which "T" is a transmitter bank of relays, "R" is a receiver bank, and "A" an auxiliary bank.

The combinations corresponding to the different signals are set up in five pole changers, in the keyboard, one for each of the five selective intervals. The function of the transmitter bank is to connect these pole changers successively to the main line pole changer.

As shown by Figure IV, the keyboard and transmitter bank control the action of the home recorder relay and the pole changer.

The operation of the home recorder is accomplished selectively in exactly the same manner as that of the printing mechanism at the far end.

On the relays the contacts correspond to the "marking" and "spacing" contacts of a Wheatstone relay, and are so designated.

The marking contact point of the home recorder relay operates a receiver bank, which acts as a distributor and successively connects the selective lock relays in an auxiliary bank to the spacing contact of the home recorder relay. The spacing intervals of the signal operate the corresponding selective locks, while the marking intervals leave them unoperated. The lock relays in the auxiliary bank control the mechanism of the printer, the actual selection of the letter being accomplished in the printer.

The first four intervals control a mechanical selecting device, which interposes the proper stop pin in the path of the typewheel arm, and the fifth interval governs the direction of rotation of the typewheel, and completes the operation of printing the letter.

In a duplex set the contact points of the main line pole changer are connected to the two poles of the main line battery, while the tongue is connected through a ground switch to the split of the main line relay.

After leaving the main line relay, one side passes through a differential galvanometer to the main line, while the other side passes through the galvanometer to the artificial line.

The contact points of the main line relay control the action of the receiver bank, auxiliary bank and receiving printer, in the same manner as in the home recorder, previously described.

A three point switch is arranged so that the marking contact of the main line relay may be connected to a Morse sounder, if desired.

The receiver and home recorder are identical and interchangeable; these, and also the transmitter bank and keyboard are provided with slip connections so that any one of them may be instantly removed and another element substituted.

Reliability and Workmanship

Realizing that if identical results were to be obtained, identical machines must be built, the Company has equipped a factory with the finest machinery, and has built tools, dies and special machinery to insure accuracy and interchangeability of parts, to the careful design and accurate construction of which much of the success of the printer is due.

After preliminary line trials, operators were put on the machines, and tested for months before being put into actual service, and a high degree of reliability was thus developed.

Capacity

A duplex set installed for the Postal Telegraph Cable Company between New York and Boston has now been in daily service for nearly a year, and the machines are showing a capacity for handling heavy traffic, having handled over one thousand messages in a nine- hour day. One postal operator made a record of sending 74 messages in an hour and 66 messages the following hour. Nearly a good a record was made by an operator of the C. B. & Q. Ry. on a set installed between Chicago and Galesburg, who sent 71 and 65 messages in two hours.

Printers Installed and Rented

The Printers are placed on a rental basis, the Company sending out instructors to install, and instruct operators and attendants. More definite information as to terms and contracts will be given upon application.

Document Notes

This document was formatted (and edited to clarify the title block) by [Gil Smith](#), July 2001. The figures are missing. The original file, [krum&krum--morkrum-printing-telegraph.txt](#), courtesy of Jim Haynes, had this note at the top:

"Jim:

I thought that you might be interested in seeing this manuscript that I found at the Chicago Historical Society while researching my thesis. I think it may have been written by Howard and Charles Krum since their names were penciled on the front, but I can't verify one way or the other.

Tom Schumacher"