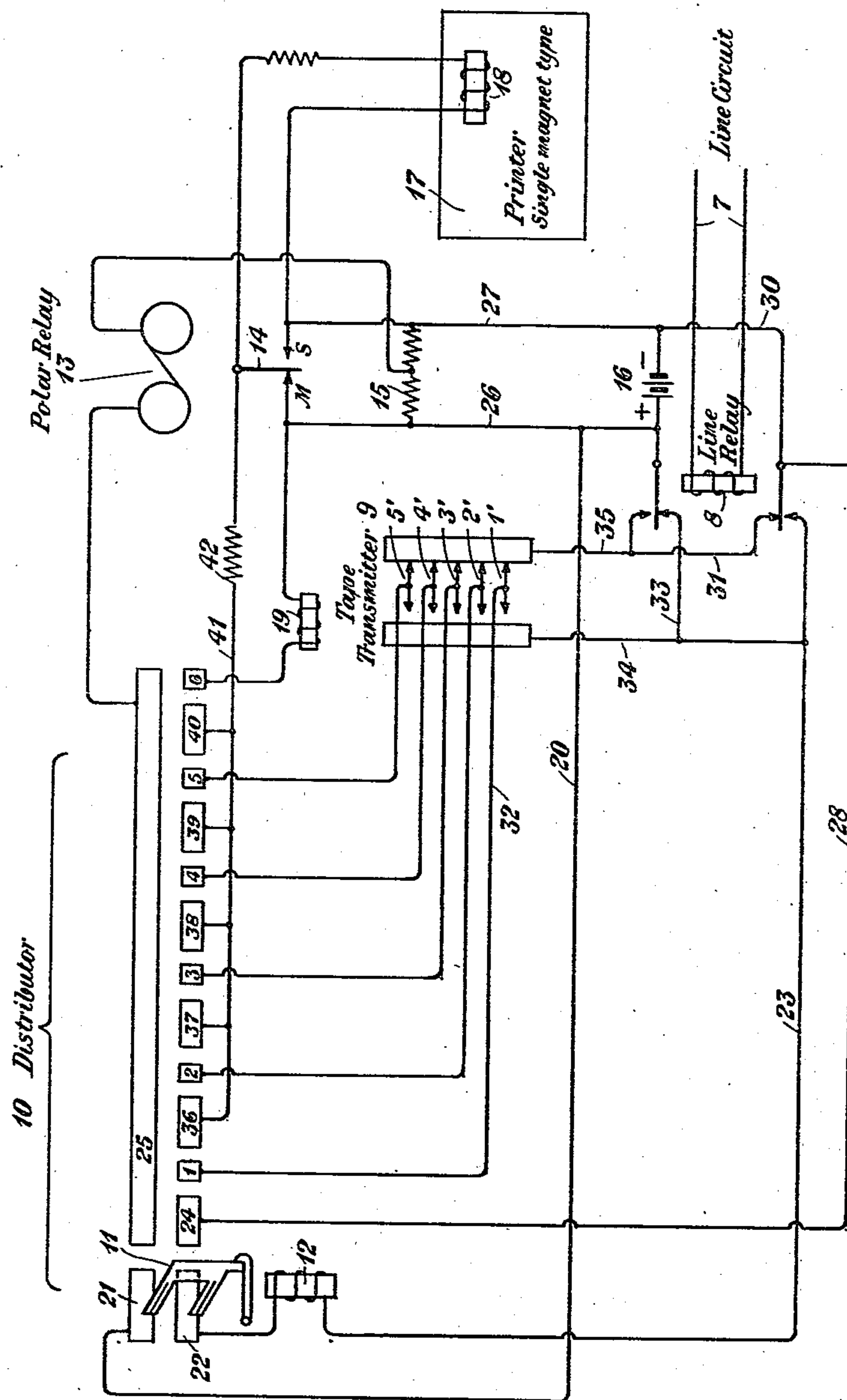


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G. S. VERNAM
TELEGRAPH CIPHER SYSTEM

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TELEGRAPH CIPHER SYSTEM.

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This invention relates to telegraph systems and more particularly to improvements in such systems wherein printing telegraph apparatus is utilized and in which the signals are transmitted in scrambled or unintelligible cipher formation for purposes of secrecy.

In a Patent #1,310,719, issued July 22, 1919 to G. S. Vernam, there is illustrated a well known secret telegraph signaling system. In this system the characters of the message which are made up of various combinations of the elements of a five unit code, are combined in effect with the code combinations of a key tape and the resultant code combinations make up an enciphered and unintelligible message which is transmitted to a distant station. At the receiving station the code combinations of the unintelligible message are combined in effect with the code combinations of a key tape identical to that at the sending station and the resultant code combinations will form the original message in intelligible formation or plain text. It has been one of the practices with the above referred to system to set up these plain text five unit code combinations at the receiving station on five selecting magnets and to thereby operate printing telegraph receiving mechanism well known in the art. However, it has been found in certain types of service that it would be undesirable to always utilize five magnet printing telegraph receivers and that conditions would arise wherein it would be more desirable to utilize a printing telegraph receiver of the type operated by only a single selective magnet. Accordingly, the primary object of this invention consists in providing at the receiving end of a secret telegraph system of the above type a translating device whereby the incoming five unit code combination may be deciphered and then utilized to operate a single magnet responsive device, such as a printing telegraph receiver of the single selective magnet type. This device is also suitable to be inserted at any point along a circuit for automatically enciphering or deciphering messages passing through and sending them on over the rest of the circuit. In such cases a repeating relay would be used instead of a printer.

The single selective magnet type of printer is well known in the art and for purposes of illustration a specific machine of this character may be found in the Morkrum teletype tape printer. Such apparatus is described in

an application filed in the U. S. Patent Office on December 23, 1919, Serial No. 346,948, in the names of Charles L. Krum and Howard L. Krum. Reference is made to this application for complete details of the arrangements. However, a general description of the receiving mechanism of the device is given herein. The received impulses which make up units of the five unit code combinations are caused to operate the single magnet of the teletype printer. The printer is controlled by this magnet which operates an armature moved in one direction by the magnet and in the opposite direction by an adjustable spring. The printer mechanism is carried by a suitable frame, the moving parts of which are operated from a motor through the medium of a start and stop clutch which is initiated in operation by the starting impulse or interval of each signal. A rotating selector actuator driven by the motor and thrown into operation by the clutch is adapted to position a set of selectors in different combinations in accordance with the movement of the armature of the controlling magnet, and which in turn is controlled by the combinations of impulses coming in. The shaft carrying the selector actuator is also provided with a transfer cam which at each rotation transfers the setting of the selectors or seekers and restores the first set for the next operation. The main shaft which carries the selector actuator also carries a combiner wheel, a notched ratchet wheel and a type wheel. The seekers cooperate with the combiner wheel to control a trip lever which in turn effects the engagement of a printing dog or arm with the notches of the ratchet wheel and the latter forces a print roller carrying a paper strip against the letter of the type wheel corresponding to the setting of the seekers, the latter and the print dog or arm being reset or restored to normal at the end of each revolution of the main shaft by suitable cams mounted thereon. The combination of incoming impulses at the receiving station thus controls through the medium of a single magnet, the operation of the printer mechanism to secure the impression of the characters represented by the signals upon a paper strip. It is understood that the arrangements of the invention may be utilized with other types of single magnet printers and that the above specific type has been described for purposes of illustration only. Furthermore, if a repeating relay were utilized

ized with the arrangements of the invention, the repeated impulses might be transmitted further along the circuit and utilized to operate any other type of printer mechanism.

5 The invention may be more fully understood from the following description together with the accompanying drawing in the figure of which is a circuit diagram embodying the principles of the invention.

10 In the drawing are shown the arrangements at a receiving station. At the sending station, there might be provided sending apparatus similar to that illustrated in the above mentioned patent to G. S. Vernam. In this sending

15 apparatus the characters of the original message would be composed of five unit code combinations. These code combinations would be combined in effect with the code combinations of a key tape to produce a set

20 of code combinations making up the enciphered or unintelligible message. This latter set of code combinations would then be transmitted to the receiving station. This obviously might be done either by a radio or wire system.

25 At the receiving station, these incoming code combinations would be received over a local line circuit illustrated as circuit 7 and the line relay 8 included therein would be actuated by these units of the code combinations.

30 Associated with the contacts of the line relay 8 is a battery 16 and the contacts of a tape transmitter 9. In the tape transmitter 9 would be inserted a key tape identical with the key tape used for enciphering purposes at the sending station. The contacts of

35 the key tape transmitter are connected to segments of a distributor 10. Other connections are made from the distributor to a polar relay 13 and further connections from the battery 16 and the contacts of the polar relay

40 13 are provided to the magnet 18 of a printer 17, which is of the heretofore mentioned single magnet type.

When a starting signal, which consists of

45 an open pulse, is received over line circuit 7, the line relay 8 will release and close the following circuit, from positive pole of battery 16, conductor 20, segment 21, brush 11, segment 22, winding of start magnet 12, conductor 23, contact of relay 8, to the negative pole

50 of battery 16. This will operate the start magnet 12 which will release the brush 11 of the distributor and allow it to commence its travels across the distributor segments.

55 When the brush 11 touches segment 24, the following circuit is closed, segment 24, brush 11, segment 25, windings of polar relay 13, midpoint of resistance 15, conductor 26, battery 16, conductor 28, to segment 24. The polarity of the current flow in this circuit is such

60 that the armature 14 of the polar relay 13 will be moved to its spacing contact "S". This will short circuit and release magnet 18 of the printer 17 and thus give the printer a

65 start signal.

As has been pointed out the key tape will have caused to be set up on the contacts of the tape transmitter 9 the key code combination corresponding to the cipher code combination being received. Accordingly, as the brush 11 passes over segment 1 the signal on the line at that instant will combine in effect with the selection 1' of the tape transmitter contacts to operate the polar relay 13 in the following manner:

(1) If the line signal is marking (relay 8 operated) and the tape transmitter contact 1' is against the right-hand or marking bus-bar, the polar relay armature will be moved to its spacing contact. This is due to the fact that under such conditions the circuit closed through the polar relay will be as follows: negative pole of battery 16, conductor 30, contact of relay 8, conductor 31, right-hand bus-bar, contact 1', conductor 32, segment 1, brush 11, segment 25, windings of polar relay 13, midpoint of resistance 15, conductor 26, to positive pole of battery 16.

(2) If the line signal is spacing (relay 8 released) and the tape transmitter contact 1' is against the left-hand or spacing bus-bar, the polar relay armature will be moved to its spacing contact. This is due to the fact that under such conditions the circuit closed through the polar relay windings is as follows: negative pole of battery 16, conductor 30, contact of relay 8, conductor 34, left-hand bus-bar, contact 1', conductor 32, segment 1, brush 11, segment 25, windings of relay 13, midpoint of resistance 15, conductor 26, to positive pole of battery 16.

(3) If the line signal is marking and the key tape selection is spacing, the polar relay armature will move to its marking contact. This is due to the fact that under such conditions the circuit closed through the polar relay windings is as follows: positive pole of battery 16, contact of relay 8, conductors 33 and 34, left-hand bus-bar, contact 1', conductor 32, segment 1, brush 11, segment 25, windings of polar relay 13, midpoint of resistance 15, conductor 27, to negative pole of battery 16.

(4) If the line signal is spacing and the key selection marking, the polar relay armature will move to the marking side. This is due to the fact that under such conditions the circuit closed through the polar relay windings is as follows: positive pole of battery 16, contact of relay 8, conductor 35, right-hand bus-bar, contact 1', conductor 32, segment 1, brush 11, segment 25, windings of polar relay 13, midpoint of resistance 15, conductor 27, to negative pole of battery 16.

It will be noted that when the armature of polar relay 13 is on its spacing contact, the winding of magnet 18 is short circuited and magnet 18 is released. When the armature of relay 13 is on its marking contact, a circuit is completed from battery 16 over con-

ductors 26 and 27 and over the marking contact and armature of relay 13 through the winding of magnet 18, thereby operating magnet 18.

5 When the brush 11 moves on over segments 2, 3, 4 and 5, the key tape selection on the transmitter will combine with the incoming signal in the same manner as already described with respect to segment 1 and contact 1' of the transmitter.

10 After each of the segments 1, 2, 3, 4 and 5 are provided the segments 36, 37, 38, 39 and 40. These segments are connected through a common conductor 41 and a high resistance 42 to the armature of the polar relay 13. Accordingly, when the brush passes over these segments 36, 37, 38, 39 and 40, a locking circuit is provided for the polar relay to hold it operated while the brush is passing between the operating segments 1, 2, 3, 4 and 5.

20 When the brush passes over segment 6, the following circuit will be closed: from positive pole of battery 16, conductor 26, winding of stepping magnet 19, segment 6, brush 11, segment 25, winding of polar relay 13, midpoint of resistance 15, conductor 27, to negative pole of battery 16. This will cause the polar relay armature to move to its marking contact and hence close the operating circuit for the magnet 18 so that a "stop" impulse may be sent into the printer. The stepping magnet 19 will also be operated to step the key tape of the transmitter ahead one step.

35 While the arrangement has been disclosed in certain specific forms which are deemed desirable, it is understood that it is capable of embodiment in many other forms without departing from the spirit of the invention as defined by the appended claims.

40 What is claimed is:

1. The method of deciphering and receiving a secret message, which consists in combining the electrical effect of the received impulses with the effect of the electrical condi-

tions representing a deciphering character to produce electrical impulses representing the message character, and causing said message character impulses to individually and sequentially operate a single responsive device.

2. In a secret signaling system in which the electrical impulses transmitted as the secret message are produced by combining the effect of electrical conditions representing the original message character with the effect of electrical conditions representing a ciphering character, a receiving set comprising means for combining the electrical effect of the received impulses with the effect of electrical conditions representing a deciphering character to produce electrical impulses representing the original message character, a relay, and timing mechanism for applying said last mentioned electrical impulses sequentially to said relay.

3. In a secret signaling system in which the electrical impulses transmitted as the secret message are produced by combining the effect of electrical conditions representing the original message character with the effect of electrical conditions representing a ciphering character, a receiving set comprising a receiving relay responding to the electrical impulses comprising the secret message, a key tape transmitter having its contacts set to represent the ciphering character utilized to produce the secret message, circuits controlled by said receiving relay and said transmitter contacts to reproduce a set of electrical conditions representing the original message character, a polar relay, a distributor to sequentially apply said last mentioned set of electrical conditions to said polar relay, and a single magnet printer controlled by the contacts of said polar relay.

In testimony whereof, I have signed my name, to this specification this 27th day of October, 1925.

GILBERT S. VERNAM.