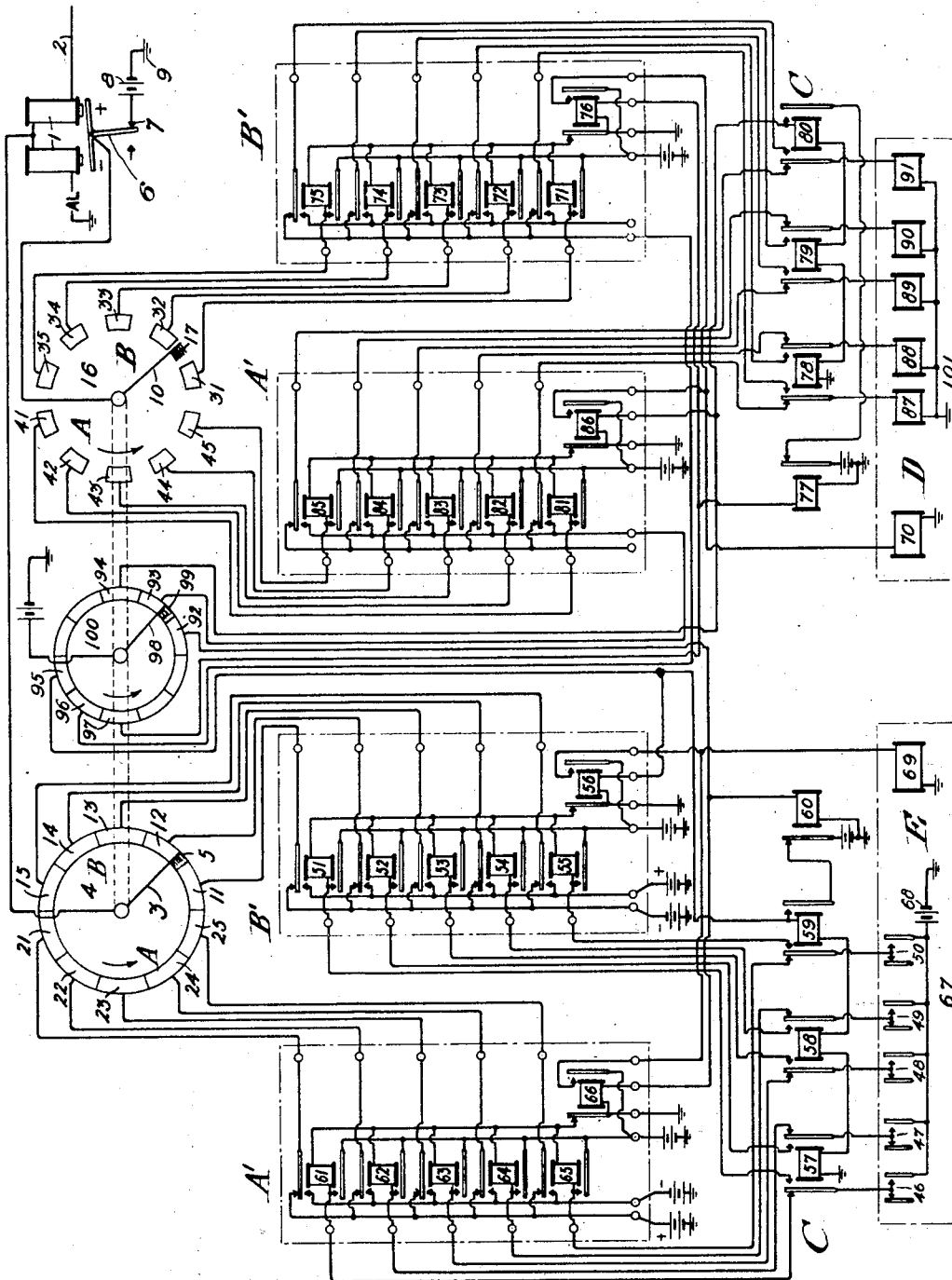


P. M. RAINEY.
TELEGRAPH SYSTEM.
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1,399,997.

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Inventor:
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UNITED STATES PATENT OFFICE.

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TELEGRAPH SYSTEM.

1,399,997.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, PAUL M. RAINEY, a citizen of the United States, residing at Glen Ridge, in the county of Essex, State of New Jersey, have invented certain new and useful Improvements in Telegraph Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to telegraph systems and more particularly to one in which a signal overlapping means is provided.

Its object is to provide an improved overlapping device for the storage of signals, so that the maximum of traffic may be transmitted over a telegraph line.

The invention comprises a distributing device having receiving and transmitting rings, each of which is divided into a plurality of sets of conducting segments. Each set is associated with a separate set of signal storing devices, so that the brushes of the distributors wipe over the sets of segments associated with the various sets of signal storing devices in succession. The system further comprises a transmitter and receiver which may be of any well-known type. Between the receiver and transmitter and their respective sets of signal storing devices are located electromagnetic switching means connected on one side to the receiver and the transmitter respectively, and on the other side adapted to be connected to their respective sets of signal storing devices in succession. A local distributor is provided, which is connected to a source of local current and has a plurality of segments connected to the switching mechanism and to the sets of signal storing devices in such a manner that in its rotation, which is properly timed with respect to the transmitting and receiving distributors, it is adapted to perform the functions of energizing the switching means and connecting one of the sets of signal storing devices in the receiving and transmitting circuit, to the receiving and transmitting distributors, and simultaneously connect another of said sets of signal storing devices to the receiver and transmitter. Provision is also made that even when no signals are sent there will be current reversals on the line to insure synchronism of the sending and receiving distributors. To this end one set of signal storage relays is arranged when the transmitter is at rest to send to line current impulses of posi-

tive polarity, while the other set of signal storage relays is arranged when the transmitter is at rest to send to line current impulses of negative polarity. In the receiving circuit, in one set of storage relays, the local distributor sends a pulse through the armatures of those which have been actuated and in the other set through the armatures of those which have not been actuated for the purposes and in the manner to be hereinafter set forth. For example, assume that each of the distributors has sets of segments A and B connected respectively to sets of signal storing devices A' and B', and there is provided switching means C in the receiving circuit and a similar switching means in the transmitting circuit, and that there is a receiver D, a transmitter E and a local distributor 100. During the time that the distributor brushes are sweeping over their respective sets of segments A, each connected to their respective set of storing devices A', the set A' in the transmitting circuit is giving up its stored impulses to the line through the distributor 4, and the set A' in the receiving circuit is being energized through its distributor 16 to store the received impulses. At the same time the set of signal storing devices B' in the transmitting circuit is connected through its switching means C to the transmitter E and is storing the next set of impulses to be sent out on the line, while the set of signal storing devices B' in the receiving circuit is connected through its switching means C to the receiver D and giving up a previously received set of impulses to be translated into a printed message in any well-known manner. When the brushes of the receiving and transmitting distributors move to the sets of segments B, the local distributor is timed to energize the switching means C and shift the connection between the various sets of storage devices in the receiver and printer, so that the storage devices which had previously been associated with the distributors are now associated with the receiver and printer and vice versa.

This invention is illustrated in the drawing, which is a diagrammatic representation of the circuits involved.

In the figure, the invention is represented as comprising a system in which two sets of signal storing means are interposed between each of the distributors and the receiver and

transmitter, each distributor having two sets of segments. This system, as shown, is arranged for duplex working with a 5-unit code, but is readily adaptable to other forms of operation.

A polarized relay 1 is connected to a line 2 and the rotating brush arm 3 of a transmitting distributor 4 which, in the form represented, has two sets of segments 11 to 15 inclusive and 21 to 25 inclusive, over which wipes brush 5 of arm 3. The armature 6 of relay 1 has a right contact 7 connected to the positive pole of a battery 8, the other pole of the battery being connected to ground 9, and also a left dead contact. This armature 6 is connected to the rotating arm 10 of a receiving distributor 16, which, in the form shown, has two sets of conducting segments 31 to 35 inclusive and 41 to 45 inclusive, over which wipes the brush 17 carried by arm 10. An artificial line AL is also provided to adapt this system to duplex working.

Each of the segments 11 to 15 inclusive of transmitting distributor 4 is connected in order to sources of positive and negative battery through the upper armatures and their front and back contacts respectively of a plurality of relays 51 to 55 inclusive, whereas each of the segments 21 to 25 inclusive of transmitting distributor 4 is connected in order to sources of negative and positive current through the upper armatures and their front and back contacts respectively of a plurality of relays 61 to 65 inclusive. The lower armatures of relays 51 to 55 inclusive and relays 61 to 65 inclusive are connected on one side to the positive pole of a grounded battery and when attracted the armatures engage front contacts of these relays, which contacts connect with the relay windings. The windings of relays 51 to 55 inclusive are connected on one side in multiple to a ground through a back contact and left armature of a clear-out relay 56. On the other side, the windings of relays 51 to 54 inclusive are connected in order to the front contacts of right and left armatures of switching relays 57 and 58, and the winding of relay 55 is connected to the front contact of left armature of switching relay 59. The windings of relays 61 to 65 inclusive are connected on one side to ground through back contact of left-hand armature of clear-out relay 66. On the other side the windings of relays 61 to 64 are connected to the back contacts of left and right armatures of switching relays 57 and 58, and the winding of relay 65 is connected to the back contact of left armature of switching relay 59. The windings of switching relays 57, 58 and 59 are connected in series to ground and through a front locking contact of relay 59 and its right armature to a back contact and left armature of a clear-out re-

lay 60, thence to grounded battery. Both armatures of relays 57 and 58 and the left armature of relay 59 are connected in order to five movable contacts 46 to 50 inclusive, of a transmitting mechanism 67. The movable contacts 46 to 50 inclusive normally rest against the left-hand stationary contacts, but when selectively actuated to transmit signaling impulses they are moved into engagement with right-hand contacts which are connected in multiple to the positive pole of a grounded source of battery 68. Grounded magnet 69 is adapted to control the movable contacts 46 to 50 inclusive of the transmitter 67 and is connected to a front contact of right armature of clear-out relay 56 and therethrough to grounded battery.

Each of the segments 31 to 35 inclusive of the receiving distributor 16 are connected in order to one side of the windings of a plurality of relays 71 to 75 inclusive, which are connected in multiple on the other side to ground through the back contact and left armature of clear-out relay 76. The segments 41 to 45 inclusive of the receiving distributor 16 are connected in order to one side of the windings of a plurality of relays 81 to 85 inclusive which are connected in multiple on the other side to ground through the back contact and left armature of clear-out relay 86. The windings of relays 71 to 75 and 81 to 85 inclusive are connected on one side with front contacts with which the lower armatures of these relays engage when attracted, these armatures being connected in multiple to the positive pole of a grounded battery.

The upper armatures of relays 71 to 75 inclusive are connected in order on one side through front contacts and right and left armatures of switching relays 78 and 79 and front contact and left armature of a switching relay 80 to the selecting magnets 87 to 91 inclusive of a suitable recording mechanism 101, for example, a printer. On the other side the armatures of relays 71 to 75 inclusive are connected to front and back contacts of said relays, the front contacts being dead and the back contacts being connected in multiple to a segment 96 of the local distributor 100. The printer selecting magnets 87 to 91 inclusive are connected in order to the left and right-hand armatures of switching relays 78 and 79 and the left-hand armature of switching relay 80. The switching relay 78 is grounded and connected in series with relays 79 and 80. This latter relay has a front contact and right-hand armature connected to the back contact and armature of a clear-out relay 77 which armature is connected to a grounded battery. The recording mechanism 101 is provided with an operating magnet which is grounded and connected to the front contacts and right-hand armatures of clear-

out relays 76 and 86 and thence to a grounded battery.

The upper armatures of relays 81 to 85 inclusive are connected in order on one side through back contacts and right and left armatures of switching relays 78 and 79 and back contact and left armature of switching relay 80. On the other side the armatures of relays 81 to 85 are adapted to be connected to the front and back contacts of said relays, the back contacts being dead and the front contacts being connected in multiple to a segment 93 of the local distributor 100.

The local distributor 100 is provided with a plurality of segments 92 to 97 inclusive over which wipes the brush 99 on an arm 98 which is connected to the positive pole of a grounded battery. This arm 98 is on the same shaft with the arms 3 and 10, and has the same angular positions. Segment 92 is connected to ground through the windings of clear-out relays 60 and 66. Segment 93 is connected to the front contacts of the upper armatures of relays 81 to 85 inclusive. The segment 94 is connected to ground through the winding of clear-out relay 86, and through the windings of relays 78, 79 and 80. Segment 95 is connected to ground through the windings of clear-out relay 56 and the windings of relays 57, 58 and 59. Segment 96 is connected to the back contacts of the armatures of relays 71 to 75 inclusive. Segment 97 is connected to ground through the windings of clear-out relays 77 and 76.

Let it be assumed, for the purpose of describing the operation of the system, that each of the brush arms 3, 10 and 98 are just commencing their travel over the right half of their respective sets of segments. At this time brush 5 is commencing to wipe over segment 11, brush 99, over segment 92 and brush 17 will be between segments 45 and 31. Prior to this instant, the distributor 4 has been receiving a signal combination, through segments 21 to 25 inclusive, from storage relays 61 to 65 inclusive, and distributor 16 has been transmitting a signal combination to storage relays 81 to 85 inclusive through segments 41 to 45 inclusive. At the same time transmitter 67 was connected to storage relays 51 to 55 inclusive through the front contacts of switching relays 57 to 59 inclusive, which were energized, and printer 101 was connected to storage relays 71 to 75 inclusive through front contacts of switching relays 78 to 80 inclusive, which were energized, but later in said period were deenergized, so that the printer 101 is now connected to storage relays 81 to 85 through the back contacts of switching relays 78 to 80 inclusive.

As soon as brush 99 touches segment 92, a circuit is momentarily closed through clear-out relays 66 and 60, which results in storage

relays 61 to 65 inclusive being restored to normal condition and deenergizes switching relays 57 to 59 inclusive, thus connecting the transmitter 67 with storage relays 61 to 65 inclusive. Operating magnet 69 is energized through front contact and right armature of clear-out relay 66, thereby moving the selected contacts of contacts 46 to 50 and energizing the corresponding ones of storage relays 61 to 65 inclusive. We will assume that contacts 46, 48 and 50 have been so actuated as to energize storage relays 61, 63 and 65. These relays lock themselves through their lower armatures and left armature of relay 66 and put current of negative polarity on segments 21, 23 and 25 through their upper armatures. Brush 5, during this time, is wiping over segments 11 to 15 inclusive and transmits to line the signal combination previously set up in storage relays 51 to 55 inclusive, our assumption being that contacts 46, 48 and 50 were actuated on this previous signal, storage relays 51, 53 and 55 were locked up and are putting current of positive polarity on segments 11, 13 and 15. Thus the signal sent out through segments 11-15 will be composed of current impulses as follows:

+ - + - +

whereas that sent out immediately thereafter from relays 61 to 65 inclusive will be

- + - + -

Just how these signaling impulses affect the distant receiver will be hereinafter disclosed. When the local distributing brush 99 has just left the last segment of the right half, brush 5 of the transmitting distributor 4 has picked up the last impulse of this combination from segment 15 and is due to move to the left half and pick up the signal combination set up thereon as just described. When the local distributing brush 99 engages segment 95, energizing circuits are established through switching relays 57, 58 and 59 inclusive, and through the clear-out relay 56. The energization of relay 56 opens the holding circuits of relays 51 to 55 inclusive and establishes an energizing circuit through operating magnet 69, which latter magnet controls the set of contacts 46 to 50 inclusive. The energization of relays 57 to 59 inclusive disconnects the transmitter contacts from the set of storage relays 61 to 65 inclusive and connects the transmitter contacts to the set of relays 51 to 55 inclusive. Relay 59, upon attracting its right-hand armature, establishes a holding circuit for relays 57 to 59 inclusive through the back contact and armature of relay 60. This holding circuit remains undisturbed until magnet 60 is energized by brush 99 engaging segment 92 of the local distributor.

While the above described operations were

taking place in the transmitting circuit, a somewhat similar set of changes was taking place in the receiving circuit. Assuming that the signals sent out by transmitting distributor 4 are received at distributor 16, and keeping in mind that each of these signals is for the same letter and should operate relays 88 and 90 in the printer, we see that as brush 17 moves over segments 31 to 35 inclusive, the signal impulses received over the line are + - + - + and as brush 17 moves over segments 41 to 45 inclusive the signal impulses received over the line are - + - + -. Therefore, as brush 17 contacts with segment 31, a positive impulse is received, which energizes relay 71 and locks it up through its lower armature and the left armature of clear-out relay 76 to ground. This moves its upper armature to its front dead contact. Just before brush 17 contacts with segment 32, local distributor brush 99 contacts with segment 93, sending a pulse to the receiving circuit through the upper armatures of those of relays 81 to 85 inclusive which may have been energized by the previous signal, through back contacts and armatures of relays 78, 79 and 80, through certain of relays 87 to 91 inclusive. Brush 17 then moves to segment 32, and since a negative impulse is on the line, does not energize relay 72 because armature of line relay 1 is off battery under negative impulse. Brush 99 next contacts with segment 94 and a pulse is sent through the clear-out relay 86 to clear-out relays 81 to 85 inclusive and also to relays 78 to 80 inclusive, energizing the same and putting relays 87 to 91 inclusive in circuit with the relays 71 to 75 inclusive. At the same time a pulse is sent to magnet 70 through back contact and armature of clear-out relay 86 so as to restore the relays 87 to 91 inclusive to a normal position. Brush 17 then continues to wipe over segments 33, 34 and 35 and, as assumed, the current impulses on the line are such as to energize relays 73 and 75 and lock them up. As brush 17 leaves segment 35, certain of relays 71 to 75 inclusive are locked up ready to aid in the operation of printer 101 in accord with the signal; relays 81 to 85 are cleared out ready for the next signal; and switching relays 78 and 79 are connected to relays 71 to 75. Therefore, brush 17 moves to segment 41, and since the second signal has an initial impulse of negative polarity, relay 81 is not energized because the armature of line relay 1 is off battery. Brush 99 then contacts with segment 96 and sends a pulse through the armatures of those of relays 71 to 75 which were not energized, namely, relays 72 and 74. This results in the sending of a pulse through right armature of relay 78 to relay 88 and through right armature of relay 79 to relay 90 as

desired. Brush 17, in the meantime, has contacted with the segment 42 in response to a plus impulse. The relay 82 is thereupon energized and locks up. Brush 99 then contacts with segment 97 and closes a circuit through cut-off relay 77, thereby opening the holding circuit for relays 78 to 80 inclusive, whereupon the armatures of these relays drop back to normal and connect with wires leading to relays 81 to 85 inclusive. The engagement of brush 99 with segment 97 also closes a circuit through clear-out relay 76, thereby clearing out relays 71 to 75 inclusive and energizing magnet 70 to restore relays 87 and 91 to normal. Brush 17 then wipes over segments 43, 44 and 45 and energizes relay 84 in response to the positive line impulse sent through segment 44. As brush 17 leaves segment 45, relays 82 and 84 are locked up, and when brush 99 gets around again to segment 93, it sends a pulse through the upper armatures of these relays, through right armatures of relays 78 and 79 to relays 88 and 90 as desired. When brush 99 moves to segment 94, relays 81 to 85 are cleared out as previously described and the operations are thereupon continued as before. It is thus seen that in the transmission of signals, although the signal combinations for the same letter sent out by the alternate action of the two sets of storage relays in the transmission circuit contain a different arrangement of impulses, nevertheless the circuit arrangements are such that the same operating relays in the printer are energized by these successive combinations of impulses representing the same character.

It is evident, then, that this system provides a complete overlap for the storing of signals to enable a high capacity to be maintained, provides for synchronism by current reversals and insures a quick and positive switching of the transmitter and receiver to the alternate sets of storage relays. Because the time interval involved in this switching operation is so small it is apparent that more than two sets of segments can be provided in the distributors and the system can, therefore, be extended to employ more than the two sets of relays here disclosed.

What is claimed is:

1. In a telegraph system, in combination with a line, a selecting mechanism, a plurality of sets of relays between said mechanism and said line, a plurality of switching relays between said mechanism and said sets of relays, and means for energizing and deenergizing the switching relays successively to connect said selecting mechanism with said sets of relays.

2. In a telegraph system, in combination with a line, a selecting mechanism, a distributor connected with the line and having a plurality of sets of segments, a plurality of sets of signal storing devices, each set

being associated with a set of segments, relay switching means between said storing devices and said selecting mechanism and adapted to be actuated to connect one of said sets of storing devices to the selecting mechanism while the others of said sets are being associated with the distributor.

3. In a telegraph system, in combination with a line, a selecting mechanism, a distributor connected with the line and having a plurality of sets of segments, a plurality of sets of relays between said distributor and said selecting mechanism, each set being associated with a set of segments, a plurality of switching relays between said sets of relays and said selecting mechanism, and means for energizing and deenergizing said switching relays to connect them successively with said sets of relays.

4. In a telegraph system, in combination with a line, a selecting mechanism, a distributor connected with the line and having a plurality of sets of segments, a plurality of sets of signal storing devices between said distributor and said selecting mechanism, each set being associated with a set of segments, switching means between said storing devices and said selecting mechanism, said switching means being adapted to lock up when actuated, a source of local current, a local distributor connected to said source of current and having a plurality of segments, said switching means being adapted to be actuated from the segments of the local distributor to connect one of said sets of storing devices to the selecting mechanism while the others are being associated with the distributor.

5. In a telegraph system, in combination with a line, a selecting mechanism, a distributor connected with the line and having a plurality of sets of segments, a plurality of sets of relays, each set being associated with a set of segments, a source of local current, a local distributor connected to said source of current and having a plurality of segments, a plurality of switching relays between said sets of relays and said selecting mechanism, said relays being adapted to lock up when energized and adapted to be actuated through the segments of said local distributor to connect one of said sets of relays to the selecting mechanism while the others are being associated with the distributor.

6. In a telegraph system, in combination with a line, receiving and transmitting circuits associated with said line, a selecting mechanism in each of said circuits, a plurality of sets of signal storing devices in each of said circuits between said line and said selecting mechanism, a switching means in each of said circuits between said selecting mechanism and the plurality of sets of signal storing devices, and means for actuat-

ing each of said switching means to successively connect each of said selecting mechanisms with said sets of signal storing devices.

7. In a telegraph system, in combination with a line, receiving and transmitting circuits associated with said line, a selecting mechanism in each of said circuits, a plurality of sets of relays in each of said circuits between said line and said mechanism, a plurality of switching relays in each of said circuits between said selecting mechanism and the plurality of sets of relays, and means for actuating each of said plurality of switching relays to successively connect the selecting mechanism with said plurality of sets of relays.

8. In a telegraph system, in combination with a line, receiving and transmitting circuits associated with said line, a selecting mechanism in each of said circuits, a distributor in each of said circuits connected with the line and having a plurality of segments, a plurality of sets of signal storing devices in each of said circuits, each set being associated with a set of segments, switching means in each of said circuits between said selecting mechanisms and the plurality of signal storing devices, and means for actuating each of said switching means to successively connect the selecting mechanism with said sets of signal storing devices.

9. In a telegraph system, in combination with a line, receiving and transmitting circuits associated with said lines, a selecting mechanism in each of said circuits, a distributor in each of said circuits connected with the line and having a plurality of sets of segments, a plurality of sets of relays in each circuit between said distributor and said selecting mechanism, each set of relays being associated with a set of segments, a plurality of switching relays in each circuit between said sets of relays and said selecting mechanism, said relays being adapted to lock up when energized, and means for actuating each of said switching means to successively connect the selecting mechanisms with said sets of signal storing devices.

10. In a telegraph system, in combination with a line, receiving and transmitting circuits associated with said line, a selecting mechanism in each of said circuits, a distributor in each circuit connected with the line and having a plurality of sets of segments, a plurality of sets of signal storing devices in each of said circuits between said distributor and said selecting mechanism, each set of signal storing devices being associated with a set of segments, switching means in each of said circuits between said selecting mechanism and the plurality of signal storing devices, said switching means

being adapted to lock up when actuated, a source of local current, a local distributor connected to said source of current and having a plurality of segments, said switching means being adapted to be actuated from the segments of the local distributor to connect one of said sets of signal storing devices in each circuit to the selecting mechanism while the others are being associated with the distributor.

11. In a telegraph system, in combination with a line, receiving and transmitting circuits associated with said line, a selecting mechanism in each of said circuits, a distributor in each of said circuits connected with the line and having a plurality of segments, a plurality of sets of relays in each circuit between said distributor and said selecting mechanism, each set of relays being connected to a set of segments, a plurality of switching relays in each circuit between said selecting mechanism and said plurality of sets of relays, said relays being adapted to lock up when energized, a source of local current, a local distributor having a plurality of segments and associated with said source of local current, each of said plurality of switching relays being adapted to be actuated from the segments of the local distributor to connect one of said sets of signal storing devices to the selecting mechanism while the others of said sets are being associated with the distributor.

12. In combination, a sending station and a receiving station, a selectively operable transmitter at the sending station, selectively operable recording means at the receiving station, a plurality of sets of signal storage relays at the sending station responsive to said transmitter whereby a group of signaling impulses may be stored and held in readiness for transmission while a previously selected group of impulses is being transmitted, and a plurality of sets of signal storage relays at the receiving station whereby a

group of signaling impulses may be stored while the recording means operates in response to a previously received group of signaling impulses.

13. In combination, a sending station and a receiving station, a selectively operable transmitter at the sending station, selectively operable recording means at the receiving station, a plurality of sets of signal storage devices at the sending station responsive to said transmitter whereby a group of signaling impulses may be stored and held in readiness for transmission while a previously selected group of impulses is being transmitted, a plurality of sets of signal storage devices at the receiving station whereby a group of signaling impulses may be stored while the recording means operates in response to a previously received group of signaling impulses, and switching means at each of said stations intermediate the selectively operable means and the sets of signal storage devices.

14. In combination, a sending station and a receiving station, selectively operable transmitting means at the sending station, selectively operable recording means at the receiving station, a plurality of sets of signal storage relays at the sending station whereby a group of signaling impulses may be stored and held in readiness for transmission while a previously selected group of impulses is being transmitted, a plurality of sets of signal storage relays at the receiving station whereby a group of signaling impulses may be stored while the recording means operates in response to a previously received group of signaling impulses, and switching relays at each of said stations intermediate the selectively operable means and the sets of signal storage relays.

In witness whereof, I hereunto subscribe my name this 27th day of December A. D., 1917.

PAUL M. RAINEY.