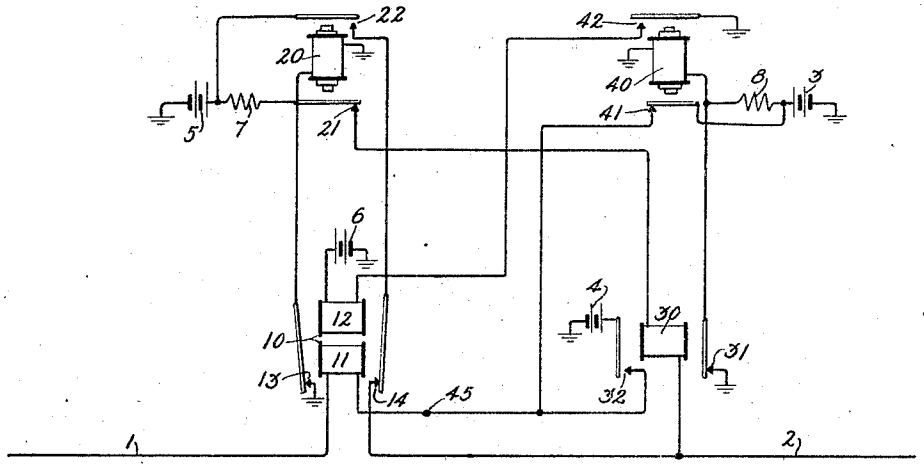
G. C. CUMMINGS.

TELEGRAPH SYSTEM.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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TELEGRAPH SYSTEM.

1,303,036. Specification of Letters Patent. Patented May 6, 1919.

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To all whom it may concern:

Be it known that I, GEORGE C. CUMMINGS, a subject of the King of Great Britain, residing at East Orange, 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 systems for repeating service between different line sections.

The principal object of this invention is to provide an organization of apparatus for carrying out repeater service between dissimilar line sections, as between a line section operated on the so-called closed circuit method and a second line circuit worked by the so-called open line circuit method.

In carrying out the present invention there is provided an arrangement of relays having different time constants of operation respectively, whereby telegraphic messages repeated in either direction between a closed-circuit-type line section and an open-circuit-type line section may be carried out in a manner to render the repeated signals correct and non-reversed with respect to the repeating operations in other directions.

This invention is illustrated diagrammatically in the accompanying drawing which shows the equipment necessary at a repeating point or station for practising the features of this invention.

In describing the operation of this system, the reference character 1 indicates a line conductor which may be understood as extending to a distant telegraphic station, not shown, and arranged to be worked by the closed circuit method. The reference character 2 indicates a second line conductor extending to another point or station and is arranged to be worked by the open circuit method. The position in which the various devices are shown in the drawing may be understood to be the normal position of the equipment during periods both of the line sections may be idle.

In briefly describing the principle of operation of this system, messages transmitted from the assumed distant station on the line 1, in establishing open and closed moments for this circuit, result in causing a line relay 10 to respond in step with such line current changes, while a slow release relay 20 will continue energized to permit the relay 10 to effect moments of current and no-current, respectively, from a battery 5 with the line conductor 2. In a converse manner, in response to the presence and cessation, respectively, of current in the line section 2, as set up at the assumed distant station which may be sending, a line relay 30 will respond in phase with such line current changes to correspondingly establish a battery 4 to act through one winding 11 of the relay 10 in repeating into the line section 1. During such sending from the distant station on the line 2, an associated slow release relay 40 will continue energized to disconnect a battery 3 from the line circuit 1 and also to establish a battery 6 to act through a holding winding 12, whereby the relay 10 will be held locked in the position in which it is shown in the drawing.

In more specifically describing the operation of this system, let it be assumed that preparatory to sending a message from the distant station on the line 1, that an operator at that point opens this line circuit. This will cause cessation of current from the battery 3 which is normally routed through contacts 41 of the relay 40, the line winding 11 of the relay 10 and the line conductor 1, and therefore the relay 10 will release its armatures to separate its contacts 13, thereby removing an earth connection, which normally short-circuits the winding of the local switching relay 20. Therefore, current from the battery 5 may now complete circuit through a resistance unit 7 and the winding of the relay 20 to earth. Thereupon, this relay will respond to separate its contacts 21 and disconnect a derived circuit which extends through the winding of the line relay 30 to the line conductor 2. In closing its contacts 22, the relay 20 connects the battery 5 to the right-hand armature or moving member of the line relay 10, but since this relay is at this moment restored to its normal position, due to the open condition of the line conductor 1, no current will be present in the line section 2. On closure of the key at the distant station on the line 1, in sending, an impulse of current from the battery 3 will be established over the circuit already traced through the winding 11 of the line relay 10, in response to which this relay will close its contacts 14 to establish the battery 5 with the line section 2, and,

although the contacts 13 of the relay 10 will at this moment reëstablish a short circuit on the winding of the local relay 20, the time constant of release of this relay, as compared with the frequency of operation of the sending key at the distant station on the line 1, will prevent this relay restoring to its normal position during the time closure of circuit through the winding 11 of the relay 12 may establish the contacts 13 during the sending operations from the line 1. On the key at the distant station being released to its open position, the line 1 will be disconnected, thereby causing cessation of current from the battery 3 which will permit releasing of the relay 10, whereupon separation of the contacts 14 of this relay will disconnect the battery 5 to cause cessation of current in the line section 2, while separation of the contacts 13 of the relay 10 will permit current from the battery 5 to again energize the slow release switching relay 20. During the operations described in connection with repeating from the line section 1 to the line section 2, as just described, it will be noted that the line relay 30 and the local circuit switching relay 40 continues inert in the positions in which they are shown in the drawing.

In describing the operations whereby messages originating at a distant station on the line 2 may be repeated into the line 1, an initial application of current to the line 2 at the distant station will take place. This current incoming from the line 2 from the distant station may traverse the winding of the line relay 30, the contacts 21 of the relay 20 and the contacts 13 of the relay 10 to earth, thereby causing the operation of the line relay 30. Separation of the contacts 31 of the latter relay removes an earth connection to discontinue a short-circuit normally established on the winding of the switching relay 40, while the closing of the contacts 32 of the relay 30 will establish a battery 4 through the winding 11 of the relay 10 over the line conductor 1. The disconnection of the short circuit on the winding of the relay 40 permits current from the battery 3 to flow through a resistance unit 8 in causing the operation of this relay. Separation of the contacts 41 of the relay 40 disconnects the battery 3 from the lead extending to the circuits of the line section 1, while closure of the contacts 42 of the relay 40 will complete a circuit from the battery 6 through the holding winding 12, whereby relay 10 will be locked in its operated position, which is the position shown in the drawing. Following a first inclusion of current with the line section 2 at the distant station, the next step in transmission will result in cessation of current in this line section in response to which the relay 30 will be deënergized to separate its contacts 32 to disconnect the battery 4 to thereby deënergize the line section 1, while reclosing of the contacts 31 of the relay 30 will reëstablish the short circuit on the winding of the relay 40. The latter relay has the same time constant characteristics as the relay 20 and operates in a manner corresponding with the description already given of the operating characteristics of the relay 20 associated with the line conductor 1. Therefore, during the time messages may be under transmission from the line section 2 to the line section 1, this slow release relay will continue energized irrespective of the relatively rapid operations of the transmitting key at the distant station on the open-circuit-type line section 2. Although the contacts 32 may disconnect the battery 4 from the line conductor 1 in phase with cessations of current in the line section 2 and thereby deënergize the line winding 11 of the relay 10, this relay will continue energized due to the presence of current from the battery 6 as established through the holding winding 12 and the contacts 42 of the switching relay 40.

From the foregoing description, it will be clear that, in the transmission of signaling impulses between the two line sections, cessation of current in the line 1 will correspond with absence of current in the line 2 and conversely, that the presence of current in the line section 1 will correspond with inclusions of current with the line section 2, a corresponding relation being present during the transmission of messages from the open-circuit-type line section 2 to the closed-circuit-type line section 1. To those skilled in the art, it will therefore be obvious that such corresponding and uniform conditions of current changes in the different line sections will result in the signals arriving at the respective receiving stations in their true and correct form and prevent the so-called reversal of signals which would ordinarily take place if it were attempted to employ the usual telegraphic repeater equipments for service between a closed-circuit-type and open-circuit-type line sections. This non-reversing feature with respect to inversion of impulses at a receiving station applies particularly to situations wherein only a single repetition of the impulses is carried out.

It may be pointed out that, in case the rate of sending on either line section should become sufficiently slow to permit the respective slow release relay 20 or 40 to restore, such condition would not necessarily interfere with the transmission, since these relays would merely re-operate at a proper moment to again establish the circuits in a proper condition to repeat the signals. In the actual transmission of messages it frequently transpires that these switching relays 20 and 40 may restore in connection with spacing or similar signaling intervals

and this feature is taken advantage of in order to permit a receiving operator to effect a so-called "break" signal. As well understood in the art, the term "break" is applied to the operation whereby a receiving operator may wish to make a request to the sending operator relative to repeating some portion of a message or a request for other information likely to be desired in connection with a message under transmission. Since a break operation may be applied at an instant the equipment at the repeating station is in the position in which it is shown in the drawing, the operation of the apparatus at such times will be exactly similar to the operations already described for the initiation of signals in either line section and therefore no further description will be necessary for the break operations.

In order that an attendant at the repeater station may communicate with the distant stations on each of the lines 1 and 2 a transmitting key may be inserted serially with the circuit of the line 1 at the point 45.

What is claimed is:

1. In a telegraph repeater, an open-circuit-type line section, a line relay therefor and a local circuit switching relay associated therewith, a closed-circuit-type line section, a line relay therefor and a local circuit switching relay associated therewith, means controlled by the line relay of said open-circuit-type line section to control the operation of the associated local circuit relay, and means controlled by said last-mentioned line relay for establishing current and no-current intervals with said closed-circuit-type line section in phase with corresponding current and no-current intervals in said open-circuit-type line section.

2. In a telegraph repeater, a first line section equipped for operation by the so-called closed circuit method, a compound wound line relay therefor, a second line section equipped to be operated by the so-called open circuit method, and means controlled by said line relay for establishing intervals of current and no-curent with said second line section in phase with corresponding conditions established in said first line section.

3. In a telegraph repeater, a first line section equipped to be worked by the open circuit method, a line relay therefor, a second line section equipped to be worked by the closed circuit method, and means controlled by said line relay for establishing intervals of current and no-current with said second line section in a manner to correspond with similar changes in said first line section.

4. In a telegraph repeater system, a first line section equipped to be operated by the open circuit method, a second line section equipped to be operated by the closed circuit method, a line relay for said first and second line sections respectively, slow release relays respectively associated with said first and second line sections, means controlled by the line relay of each of said line sections to respectively effect the continued operation of the associated slow release relay, and means controlled by said slow release relays for respectively establishing circuits for the energization of said line sections.

5. In a telegraph repeater, a first line section, equipment for operating said line section by the closed circuit method, a line relay for said first line, a slow release relay controlled by said line relay, a second line section, equipment for operating said second line section by the open circuit method, and means jointly controlled by said line relay and said slow release relay for establishing moments of current and no-current with said second line section to correspond with similar current changes in said first line section.

6. In a telegraph repeater, a first line section, equipment to provide that said line section may be worked by the open circuit method, a line relay for said line section, a slow release relay, means operated by said line relay for controlling said slow release relay, a second line section, equipment to provide that said second line section may be worked by the closed circuit method, and means jointly controlled by said line relay and slow release relay to establish intervals of current and no-current in said second line section in phase with corresponding current changes in said first line section.

In witness whereof, I hereunto subscribe my name this 18th day of October A. D., 1918.

GEORGE C. CUMMINGS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."