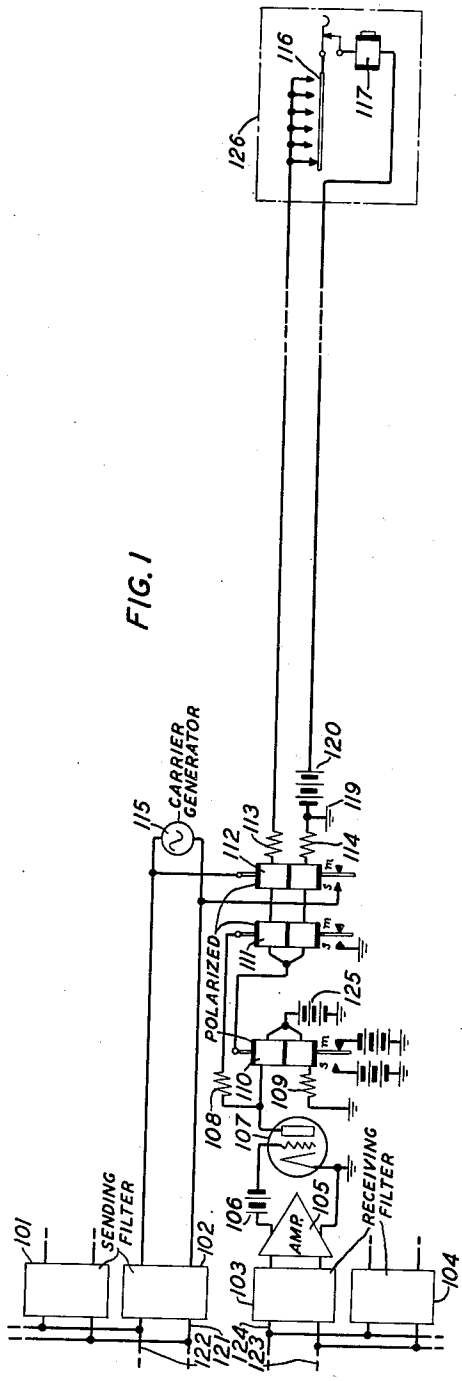
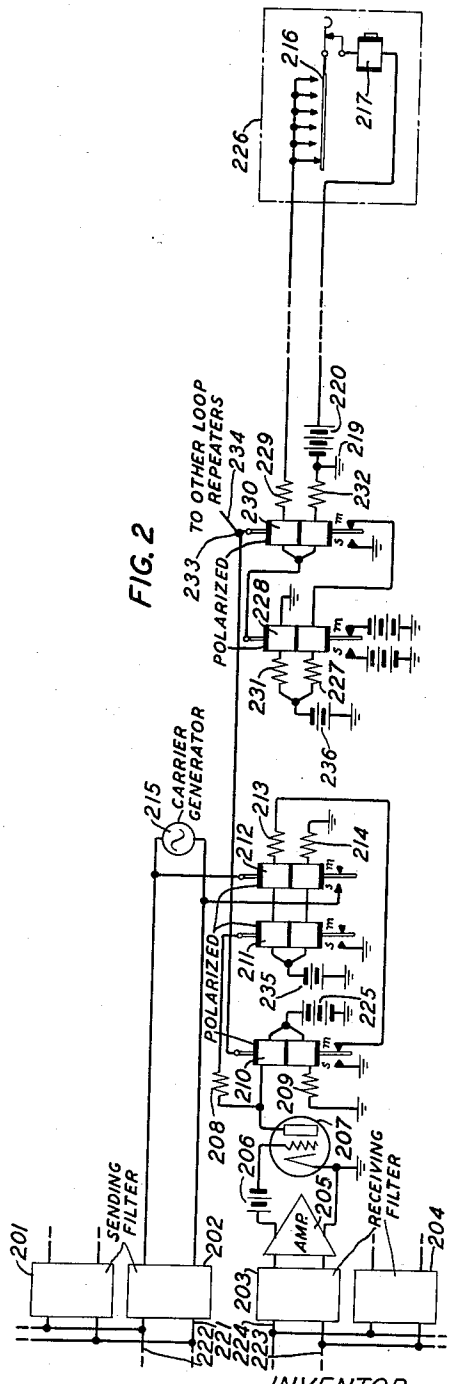
March 26, 1940. V. P. THORP 2,194,918

TELEGRAPH SYSTEM

Filed April 22, 1939





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Patented Mar. 26, 1940 2,194,918

UNITED STATES PATENT OFFICE

2,194,918

TELEGRAPH SYSTEM

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Application April 22, 1939, Serial No. 269,505

12 Claims. (Cl. 178—58)

This invention relates to improvements in carrier telegraph circuits and more particularly to an improved breaking feature in a carrier telegraph circuit interconnected to half duplex loop circuits.

An object of this invention is to provide an improved breaking feature in a carrier telegraph circuit.

A more specific object of this invention is to provide improved means for breaking a sender transmitting over a carrier telegraph channel to a single telegraph station connected to a subscriber's loop circuit.

Another more specific object of this invention is to provide improved means for breaking a sender transmitting over a carrier telegraph channel to a plurality of telegraph stations all of which are interconnected by means of a telegraph hub circuit.

A feature of this invention is a break relay in which an armature and only a single contact are required.

A further feature of this invention is an arrangement for reducing contact troubles on a break relay by means of passing a low valued current of but one polarity through an armature and a single contact.

A further feature of this invention is an arrangement wherein the adjustment of the break relay is unimportant.

A further feature of this invention is that in the case of the application to a hub circuit the transmission path for the received signals includes only one relay instead of two as heretofore.

A further feature is that the break relay is used for breaking only and does not repeat signals.

A further feature is that the break feature herein does not require the opening of any of the receiving relay windings for breaking purposes.

A further feature is that the arrangement of the break feature herein facilitates changing from balanced loop to hub or telegraph service board operation, greatly reducing the number of wiring changes necessary at conversion.

These and other features will become apparent from the description which follows when read in relation with the associated drawing.

Fig. 1 of the associated drawing discloses the improved breaking arrangement applied to a telegraph connection involving a carrier telegraph circuit and a local telegraph station connected to said carrier circuit by means of a subscriber's telegraph loop circuit.

Fig. 2 of the associated drawing discloses the improved breaking arrangement applied to a telegraph connection involving a carrier telegraph circuit and a plurality of local telegraph stations connected to said carrier circuit by means of a telegraph hub circuit.

In the circuit per Fig. 1 a number of carrier channels are indicated as connected through filters and multipled to two pairs of conductors 121 and 122 and 123 and 124, respectively, extending to a distant station. Conductors 121 and 122 serve in transmitting signals from the subscriber's station 125 at the right of Fig. 1 or for similar stations connected through their respective filters to the distant carrier station. Conductors 124 and 125 serve in receiving signals transmitting from the distant carrier station to the subscriber's station 125 or other similar stations through their respective filters. Other subscribers' stations may be connected through individual sending filters such as 101 and the same transmitting conductors 121 and 122 to the distant central carrier station. From that point they may be extended through proper filters to other subscribers' facilities associated with the distant central office.

Similarly, a plurality of subscribers' circuits may be connected through sending filters at the distant station to the receiving carrier pair 123 and 124. Receiving filters such as 104 separate the receiving signals and impress them on the proper loop circuit.

When a marking signal is being received, the output of a generator, such as 115 at the distant station, will be passed by a filter, transmitted over conductors 123 and 124, passed by filter 103, amplified by amplifier 105 and impressed as an alternating voltage between the grid and cathode of rectifier tube 107. Current will flow from plate battery 125 through the top winding of polar relay 110, from the plate to the cathode of tube 107 and to ground. Polar relay 110 is normally biased by a current flowing from battery 125, through the bottom winding of relay 110 and resistance 109 to ground. The effect of the current through the top winding of relay 110, which tends to operate the armature of said relay to the right, preponderates over the effect of the current through the bottom winding, which latter tends to operate said armature to the left, and the armature is operated to its right-hand or marking contact. The output of the distant generator is short-circuited for the spacing condition. Receiving

filter 103 then passes no current. Biasing battery 106, impressed between the grid and cathode of tube 107 with its negative terminal connected to said grid, is effective to cut off the flow of current through the top winding of polar relay 110. The effect of the current through the bottom winding of said relay then operates its armature to engage its left-hand or spacing contact. Thus marking and spacing signals may be received and repeated by relay 110.

While the armature of relay 110 is in engagement with its marking contact, negative battery is connected over a circuit through said marking contact and armature to the apex of relay 111 where a parallel circuit is formed. One branch of said parallel circuit extends through the bottom or biasing winding of relay 111, the bottom winding of relay 112 and resistance 114 to ground 119. The effect of the current through the bottom windings of relays 111 and 112 is to tend to operate the armature of said relays to the left to engage their spacing contact. This effect is overbalanced, however, by the effect of the current flowing in the other parallel branch of the circuit through the top windings of relays 111 and 112 which preponderates to hold the armatures of said relays at their right-hand or marking contacts. The circuit through this parallel branch may be traced through the top windings of relays 111 and 112, resistance 113, the top conductor of the subscriber's loop to subscriber's station 126. There it passes through the contacts of key 116, the winding of receiver 117 and thence through the bottom conductor of the subscriber's loop to the positive terminal of battery 120 and through said battery to ground 119. For this condition the battery of the marking contact of relay 110 is in series with battery 120 and receiving magnet 117 is energized. For the spacing condition when the armature of relay 110 is operated to engage its left-hand or spacing contact, the batteries are opposed and receiving magnet 117 is deenergized. The mechanism associated with the receiving magnet 117 which may be the well-known sounder or teletypewriter follows the marking and spacing signals of relay 110. The armatures of relays 111 and 112 are maintained in engagement with their right-hand or marking contacts for both the marking and spacing conditions of relay 110, as when the armature of relay 110 is engaged with its spacing contact the current through the bottom windings of relays 111 and 112 is reversed in direction and its effect is then to operate the armatures of said relays to the right to maintain them in engagement with their marking contacts.

In transmitting in the opposite direction from station 126 toward the distant terminal, the contacts of key 116 are alternately opened and closed. The armature of relay 110 is held on its marking contact while signals are being sent from station 126 as the output of the distant carrier generator, corresponding to 115, is impressed on the line to maintain relay 110 in the marking condition. While key 116 is closed, the armature of relay 112 is maintained in engagement with its marking contact and the output of carrier generator 115 is impressed through sending filter 102 on the transmitting pair 121 and 122. When the contacts of key 116 are opened, the top winding of relay 112 is deenergized and the effect of current flowing through the bottom winding of said relay operates the armature of said relay to engage its spacing contact. This short-circuits the output of carrier generator 115 and no current flows through filter 102 resulting in a spacing signal at the distant terminal. Thus marking and spacing signals are transmitted from local station 126 to the distant station.

If signals are being received at station 126 and the subscriber thereat wishes to break the sender at the distant station, the break key is opened. This deenergizes the top windings of relays 111 and 112. When the next marking signal is received by relay 110, if it is not then receiving a marking signal, the armatures of relays 111 and 112 are operated to engage their spacing contact. A permanent spacing signal is transmitted to the distant station when the armature of relay 112 remains in engagement with its spacing contact. When the armature of relay 111 is in engagement with its spacing contact, a circuit may be traced from battery 125, through the top winding of relay 110, resistance 108 and the armature and spacing contact of relay 111 to ground. The effect of the current through the top winding of relay 110 for this condition is such that the armature of said relay is maintained at its marking contact regardless of whether or not signals are being transmitted from the distant station. Thus the transmission from the distant station is stopped or, as it is expressed in the art, the receiving station "breaks" the sender.

Fig. 2 discloses an arrangement for applying the new break feature to a hub circuit connected to a carrier circuit. Only one subscriber's station 226 and its associated loop is shown connected to the hub which is represented by point 233. A number of subscribers' station and loop circuits will ordinarily be connected to the hub. A group of subscribers associated in a particular hub will be interconnected by one carrier channel to the distant carrier station. Other hub circuits or individual subscribers' loop circuits may be impressed on other carrier channels on the same four-wire circuit. As in Fig. 1, the filters for permitting this are indicated in Fig. 2 by filters 201 and 204. The relays shown in Fig. 2 are in their marking positions. For the marking condition the output of a generator such as 215 connected at the distant station is being received over conductors 223 and 224 through filters 203 and amplifier 205 and is being impressed as an alternating voltage between the grid and cathode of vacuum detector tube 207. Current flows from plate battery 225 under control of said voltage through the top winding of relay 210 to the anode of tube 207, thence to the cathode of said tube to ground. The effect of this current is to tend to operate the armature of relay 210 to the right to engage its marking contact and it preponderates over the effect of the current flowing from battery 225 through the bottom winding of relay 210 and resistance 209 to ground, which tends to operate the armature of said relay to its left-hand or spacing contact. The armature of relay 210 is therefore operated to the right to engage its marking contact. For this condition a circuit may be traced from battery 235, through the top windings of relays 211 and 212, resistance 213, marking contact and armature of relay 210, through the hub point 233, armature and marking contact of relay 230, bottom winding of relay 228 and resistance 227 to battery 236. The voltages of batteries 235 and 236 are equal and they are opposed in polarity. No current flows through this path, therefore, for this condition. A path may also be

traced from battery 235, through the bottom windings of relays 211 and 212 and resistance 214 to ground. The effect of this current holds the armatures of relays 211 and 212 in engagement with their right-hand or marking contacts. A path may also be traced from battery 236, through resistance 231 and the top winding of relay 228 to ground. The effect of this current is to operate the armature of relay 228 to engage its right-hand or marking contact. When the armature of relay 228 is in engagement with its marking contact, a circuit may be traced, from negative battery, through marking contact and armature of relay 228 to the apex of relay 230 where it divides to form parallel branches. One branch may be traced through the bottom winding of relay 230 and resistance 232 to ground 219. The other branch may be traced through the top winding of relay 230, resistance 229, top conductor of the subscriber's loop to the subscriber's station 226. There it passes through the contacts of key 216 and receiving magnet 217. Then it extends through the bottom conductor of the subscriber's loop to the positive terminal of battery 220 and through said battery to ground 219. For this condition the batteries at each end of the loop are in series and the effect of the current through the top winding of relay 230, which tends to operate the armature of said relay to engage its right-hand or marking contact, preponderates over the effect of the current through the bottom winding of said relay, which tends to operate the armature of said relay to engage its left-hand or spacing contact and the armature is held in engagement with its right-hand or marking contact. For the transmission of a spacing signal from the distant station to station 226 the output of the generator, such as 215, at the distant station, is short-circuited. No signals are passed, therefore, by receiving filter 203 or amplifier 205. Biasing battery 206, connected between the grid and cathode of tube 207 with its negative terminal connected to said grid, is effective to stop the flow of current through the top winding of relay 210. Current through the bottom or biasing winding of relay 210 from battery 225 is effective to operate the armature of said relay to the left to engage its spacing contact. This connects ground from said spacing contact, through said armature to the hub point 233 and thence through the armature and right-hand or marking contact of relay 230, the bottom winding of relay 228 and resistance 227 to negative battery 236. The effect of current flowing through the bottom winding of relay 228 for this condition preponderates over the effect of current through the top winding of said relay and the armature of said relay is operated to engage its left-hand or spacing contact. This connects positive battery to each end of the subscriber's loop, deenergizing the top winding of relay 230. The current through the bottom winding of relay 230 is reversed and it is, therefore, effective to maintain the armature of said relay in engagement with its right-hand or marking contact. Receiving magnet 217 is alternately energized and deenergized to operate a sounder such as 218 or a teletypewriter. Since other subscribers' loops may be connected to the hub point 233 by means of conductor 234, signals received by relay 210 will be impressed through the armature of marking contacts of relays similar to 230 on the bottom windings of relays corresponding to relay 228 in each case and relays corresponding to relay 228 will impress the received signals on their respective subscribers' loop circuits.

If the subscriber at station 226, or any other subscriber connected to the hub, wishes to break, the contacts of the break key or a corresponding key at any of the other stations connected to the hub will be opened. Relay 230 or a corresponding relay in any of the other loops which has been opened will have its top winding deenergized and its armature will be actuated to engage its spacing contact under the influence of current in its bottom or biasing winding. A circuit may then be traced from ground, through the spacing contact and armature of relay 230 or of any similar relay, to hub point 233, through the armature and marking contact of relay 210, resistance 213, top windings of relays 212 and 211 to negative battery 235. The effect of current through the top windings of relays 211 and 212 will preponderate over the effect of current through the bottom windings of said relays and the armatures of said relays will be operated to the left in each instance to engage their spacing contacts. When the armature of relay 211 is in engagement with its spacing contact, a circuit may be traced from battery 225, through the top winding of relay 210 and resistance 208, through the armature and left-hand or spacing contact of relay 211 to ground. The effect of current flowing through the top winding of relay 210 for this condition maintains the armature of relay 210 in engagement with its right-hand or marking contact regardless of whether or not signals are being received from the distant station. When the armature of relay 212 remains in engagement with its left-hand or spacing contact, the output of generator 215 is short-circuited and the distant station receives a permanent spacing signal which interrupts his sending.

The breaking arrangement shown in both Fig. 1 and Fig. 2 results in the following advantages common to both individual loop and hub circuit operation.

Since no current flows through the top windings of relays 110 and 210 while a spacing signal is being received, the current required through the bottom windings of these relays need be only great enough to operate their armatures to their spacing contacts for this condition. A very small current is adequate for this purpose since the polar receiving relays 110 and 210 are quite sensitive. The current through the top windings, therefore, necessary to overcome the effect of the current through the bottom windings when a break signal is being transmitted toward the distant station, may be correspondingly small. A current of approximately 4 milliamperes has been found adequate for this purpose. Thus, the current through the spacing contacts of relays 111 and 211 need be but 4 milliamperes for the breaking condition. Further, but one pair of contacts is required on each relay, namely, a spacing contact, and its cooperating contact on the armature. The set of marking contacts is not required. Current of one polarity only is passed through the armature and spacing contact of each of relays 111 and 211. This results in long contact life for these relays with very little maintenance being required.

Further, the adjustment of the break relays is unimportant. The break relays 111 and 211 follow signals transmitted toward the distant station but they do not repeat signals. Since their only essential function is to close their spacing contacts in response to a break signal trans-

mitted toward the distant station, whether or not they are biased is unimportant.

What is claimed is:

1. In combination with a carrier telegraph circuit, an arrangement for breaking the sending of telegraph signals over said circuit comprising a receiving relay, a line winding thereon, a break relay, an armature and a single contact on said break relay and means responsive to the engagement of said armature and said contact for increasing the current through said line winding.

2. In a telegraph system, a carrier telegraph receiving channel, a receiving relay, a winding on said relay in series in said channel, a break relay, a winding on said break relay in series with a subscriber's loop circuit connected to said carrier current, an armature on said break relay, a connection between said break relay armature and said receiving relay winding, means cooperating with said break relay armature for increasing the flow of current through said receiving relay winding in response to a break signal.

3. In a telegraph system, a first telegraph central station, a second telegraph central station, a carrier telegraph transmitting channel and a carrier telegraph receiving channel connecting said stations, a local telegraph station, a differential telegraph loop circuit connecting said first central and said local stations, a receiving relay, a winding on said relay in series in said receiving channel, a break relay and a sending relay, a winding on said break and a winding on said sending relays in series in said loop, an armature on said break and an armature on said sending relays, means responsive to the opening of said loop to operate said armature at said break relay to increase the current through said receiving relay winding to prevent further operation of said receiving relay armature and means on said sending relay responsive to said opening to operate said armature on said sending relay to transmit a steady spacing signal over said transmitting channel.

4. In a telegraph system, a first and second telegraph station, means comprising a carrier telegraph transmitting channel, a carrier telegraph receiving channel and a differential telegraph loop circuit connecting said stations, means comprising a break relay in said loop circuit having an armature and a single actively cooperating contact for interrupting the transmission of telegraph signals between said receiving channel and said loop circuit and means for transmitting simultaneously a steady spacing signal over said carrier transmitting channel, both of said means responsive simultaneously to identical control means at said second station.

5. In a telegraph system, a carrier telegraph circuit, a sending subscriber's telegraph station and a receiving subscriber's telegraph station connected thereto, breaking means connected to said receiving station responsive to control means at said receiving station for interrupting the transmission of signals from said transmitting station, said breaking means comprising a polar relay having a winding in the transmission path between said stations and an armature operatively engaging one contact only.

6. In a carrier telegraph system, a carrier telegraph transmission path, a receiving relay having a winding in said path, means in said system for receiving a current of a first value through said winding for a marking signal and a current of a second value for a spacing signal and means for changing the current value through said winding to a third value for a break condition.

7. In a carrier telegraph system, a carrier transmission path, a receiving relay, a first winding thereon in series in said path, a second winding thereon, an armature and a marking and spacing contact thereon, means for conducting an electric current through said second winding to bias said armature to tend to engage said spacing contact, means for passing an electric current of a first and second value through said first winding to operate said armature to engage its marking and spacing contacts alternately in response to received marking and spacing signals, and breaking means for increasing the current through said first winding to hold said armature in engagement with its marking contact while a spacing signal is being received through said first winding.

8. A first and a second telegraph station, a first and a second carrier telegraph terminal, a first telegraph loop circuit connecting said first station and said first terminal, a second telegraph loop circuit connecting said second terminal and said second station, a carrier telegraph circuit connecting said first loop to said second loop through said terminals in tandem, a receiving relay having a winding in series with said carrier circuit at said second terminal, means connected to said relay for impressing marking and spacing signals on said second loop, and relay means in said second loop for augmenting the marking ampere turns in said receiving relay while a spacing signal is being received by said receiving relay to maintain said receiving relay in its marking condition when said second station transmits a break signal.

9. In a telegraph connection comprising a four-wire carrier circuit and a subscriber's loop and station circuit, a break relay having a winding in series with the loop, an armature and a contact cooperating with said armature both on said relay, a telegraph receiving relay connected to said carrier circuit and means for establishing an operative electrical circuit comprising a winding on said receiving relay, said armature and said contact when a break signal is transmitted from said station circuit.

10. In a telegraph system, a carrier telegraph receiving channel, a subscriber's telegraph loop and station circuit connected thereto, a receiving relay, an armature, a marking and spacing contact cooperating therewith and a first and second winding all on said relay, said first winding connected in series in said channel, a break relay connected in said loop, an armature and a contact cooperating with said armature all on said break relay, means for transmitting electric current through said first winding for a marking signal, means for reducing said current substantially to zero for a spacing condition, means for supplying a biasing current of the order of 2 milliamperes through said second winding to operate said armature on said receiving relay to engage its spacing contact, and break signal control means in said loop for operating said armature on said break relay to engage its cooperating contact to supply current of the order of 4 milliamperes through said first winding to overcome the effect of said biasing current when a break signal is transmitted from said station.

11. In a telegraph connection between a carrier telegraph circuit and a direct current telegraph circuit, the method of reducing maintenance required by break contacts cooperating

with a receiving relay to break a distant sender which includes (1) receiving carrier current for the marking condition, (2) receiving substantially zero current for the spacing condition, (3) using current of a value only slightly greater than zero value for biasing while said zero current is being received, and (4) overcoming said bias by a current of a value only slightly greater than said biasing current to maintain the marking condition, thus requiring only a small current through said breaking contact for the receiving relay when a break signal is transmitted to the distant carrier station.

12. A four-wire carrier telegraph circuit, a plurality of subscribers' telegraph loop circuits connected thereto in a telegraph hub circuit, one relay only having a winding in series with the carrier circuit incoming from a distant carrier station for receiving telegraph signals from said station and means connected to said relay responsive to breaking means in any of said loop circuits for preventing the operation of said relay when a break signal is transmitted from any of said loop circuits.

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