

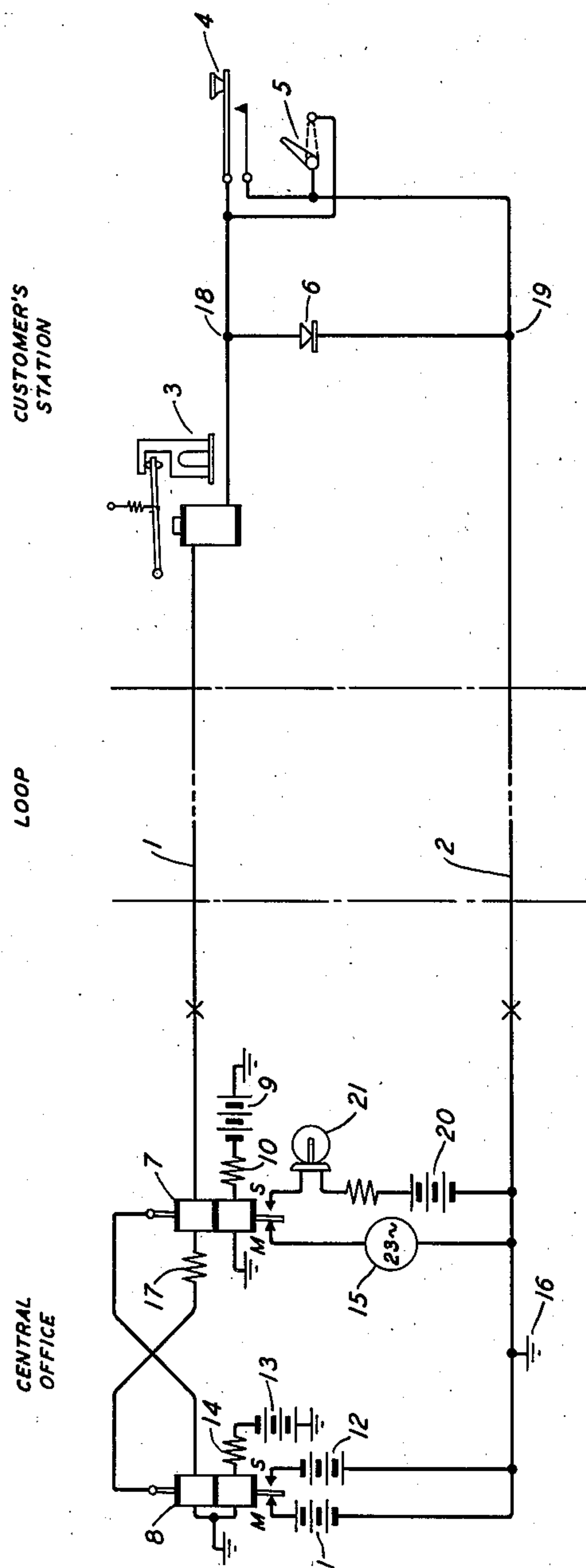
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OPEN TELEGRAPH ALARM CIRCUIT

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OPEN TELEGRAPH ALARM CIRCUIT

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This invention relates to telegraph systems and more particularly to open telegraph circuit alarm circuits.

As is well known in the telegraph art, particularly in the operation of Morse telegraph circuits, a telegraph key which is inadvertently left open at a local telegraph station is a source of considerable difficulty, as under these circumstances it is impossible to communicate with the station over the open telegraph circuit. If, as is frequently the case, the station is one of a group of stations served by the single circuit, it is impossible to communicate with any station of the group.

A number of circuit arrangements have been suggested to obviate this difficulty. The circuit of the invention herein represents an improvement over presently known arrangements.

It is an object of the invention herein to improve open telegraph key alarm circuits.

It is a further object of the invention herein to provide an open telegraph key alarm circuit which includes an alarm at the station where the key is open to attract the attention of the station operator to the open key; further to provide an indication at the central station that the key has been closed and also to automatically disconnect the source of signaling current from the line which was in trouble after the open key at the station has been closed.

A feature of this invention is a copper oxide rectifier, permanently connected at the station in shunt around the station key, to provide a path for signaling current of a particular polarity, which is impressed on the line when a station key is left open, to operate the station sounder as an alarm indicating the open key condition.

A further feature of this invention is an improvement comprising a pair of polar relays at the central station which cooperate to switch twenty-three cycle positive and negative battery reversals onto the station line, one of which relays responds to the closing of the open key at the station to operate a signal at the central station indicating that the open key has been closed and simultaneously disconnects the source of reversals to remove the open key signaling current.

Reference to the single figure of the drawing which shows the open telegraph key alarm circuit and the following detailed description, it is believed, will provide an understanding of the invention.

The circuit as shown is in condition to transmit signals from the central station to the local station indicating the open telegraph key condi-

tion. It is to be understood that the telegraph loop and local station circuit shown to the right of the figure has already been connected to the central station alarm equipment shown at the left of the figure. These connections, which may be by means of jacks and flexible cords or by means of keys or any other convenient means, are indicated by an X in each of the two conductors 1 and 2 which connect the central and local stations. At the local station the conventional sounder 3 and Morse key 4 are indicated. The circuit through the Morse key 3 should be closed through the switch 5 when the circuit is idle. The switch 5 is shown in its open condition. Its alternate or closed position is indicated in dotted lines. As is well known, when the customer at the local station wishes to transmit, the switch 5 is opened so that the loop circuit may be opened or closed by operating the key 4. Connected permanently in shunt with the key 4, across the conductors 1 and 2, is the copper oxide rectifier 6 or "varistor" as it is otherwise known. It is characteristic of such copper oxide rectifiers that they present a very high resistance to currents of one polarity and a low resistance to currents of the opposite polarity. It is connected across the loop in such manner that it offers a low resistance to currents supplied from negative battery, that is to say, from a battery of which the positive pole is grounded. It presents a high resistance to currents of the opposite polarity.

At the central station there are shown two polar relays 7 and 8. Each of these relays has two windings. The effect of current flowing from battery 9 through resistance 10 and the bottom winding of relay 7 is to tend to operate the armature of relay 7 to the left, to engage its left-hand contact. When current flows from battery 11, having its negative terminal grounded, through the upper winding of relay 7, its effect is to tend to operate the armature of relay 7 to engage its right-hand contact and, when it flows, this effect will preponderate over the effect of the current through the bottom winding of relay 7 and the armature of relay 7 will be actuated to the right to engage its right-hand contact.

When current from battery 12, having its positive terminal grounded, flows through the top winding of relay 7, its effect is to augment the effect of battery through the bottom winding of relay 7 and the armature of relay 7 will be maintained on its left-hand contact.

The effect of current flowing from battery 13, through resistance 14 and the bottom winding of relay 8, is to tend to actuate the armature of re-

lay 8 to engage its left-hand contact. When current is supplied from the 23-cycle source 15, through the top winding of relay 8 its effect is to actuate the armature of relay 8 to engage each of its contacts alternately.

When the loop circuit has been connected to the open key alarm circuit as indicated, and while the key 4 and switch 5 remain open, the path through the key 4 and switch 5 is broken. The armature of relay 7 is actuated to the left to engage its left-hand contact due to the current through its bottom winding. A path may be traced from ground 16 through a source of 23-cycle reversals 15, through the left-hand contact and armature of relay 7 and the top winding of relay 8 to ground. The armature of relay 8 is actuated in response to this current to engage its associated right and left-hand contacts alternately.

While the armature of relay 8 is in engagement with its left-hand contact, a circuit may be traced from ground 16 through battery 11, the left-hand contact and armature of relay 8, through resistance 17, the upper winding of relay 7, over the top loop conductor 1, extending from the central station to the local station, and through the local station sounder 3 to the junction point 19. Here parallel branches are formed. One branch is open. That is the branch extending through the open key 4 and open switch 5. The other branch extending through the copper oxide rectifier 6 presents a very high resistance to battery of the polarity of battery 11, so that substantially no current flows. The branches join at 19 and return over the lower loop conductor 2 to ground 16.

When the armature of relay 8 is in engagement with its right-hand contact, negative battery 12, connected between ground 16 and the right-hand contact of relay 8, is connected to the loop circuit heretofore traced in place of battery 11. The copper oxide rectifier 6, as has been pointed out above, presents a low resistance to current supplied from battery of the polarity of battery 12. Current will therefore flow around the loop circuit for this condition, passing through the station sounder which will respond each time the armature of relay 8 engages its right-hand contact.

During this interval while the local station is being signaled to inform the operator thereof of the open key condition, the armature of relay 7 will be maintained in engagement with its left-hand contact to continue to supply the 23-cycle battery reversals to the upper winding of relay 8. This is the case because, as has been explained, current through the bottom winding of relay 7 actuates the armature of relay 7 to the left. Current from battery 12 through the top winding of relay 7, during the time that it is flowing, augments the effect of the current through the bottom winding of relay 7. In order to actuate the armature of relay 7 to the right, sufficient current must flow from battery 11 to overcome the effect of the biasing current through the bottom winding of relay 7. Sufficient current for this cannot flow through the copper oxide rectifier 6.

In response to the operation of the sounder 3, the operator at the local station will close the switch 5. The closing of the switch 5 closes a low resistance shunt around the copper oxide rectifier 6, permitting current of either polarity 11 or 12 to flow therethrough. If, at the instant the key 4 is closed, the armature of relay 8 is in engagement with its left-hand contact, current

from battery 11 will flow through the upper winding of relay 7 and around the loop operating the armature of relay 7 to engage its right-hand contact. If the armature of relay 8 is in engagement with its contact 12 at the instant the switch 5 is closed, relay 7 will not be operated until the armature of relay 8 is actuated to engage its left-hand contact by the next current reversal from source 15 an instant later.

The operation of the armature of relay 7 to the right disconnects the source of 23-cycle reversals 15 from the top winding of relay 8 and closes a circuit from ground 16, through battery 20, lamp 21, the right-hand contact and armature of relay 7 and the top winding of relay 8 to ground, lighting lamp 21 as a signal that the circuit through the switch 5 at the local station has been closed. The effect of this current through the upper winding of relay 8 is to operate the armature of relay 8 to engage its right-hand contact. If the switch 5 should be opened while this condition still prevails, the sounder 3 will again be operated.

After the switch 5 is closed, the loop circuit is disconnected from the alarm circuit at the central station and restored to its regular telegraph circuit termination in which negative battery is applied to loop conductor 1, and positive battery is connected to loop conductor 2. When the connection to the loop is broken, the armature of relay 7 is operated to engage its left-hand contact. If it is desired, a single pole, single throw manual switch (not shown) may be inserted in the connection between the 23-cycle battery reversal supply 15 and the left-hand contact of relay 7, so that the source of reversals may be disconnected when the open key alarm circuit is not in use. Disconnection of the 23-cycle battery supply, alternatively, may be effected automatically by means of a sleeve relay (not shown) connected to the open key alarm jack circuit (not shown) and controlled by the insertion of the flexible connection mentioned above at the junction X in conductor 1. If it is desired, multiple jacks may be connected at the junctions marked X in conductors 1 and 2 to provide access to the open key alarm circuit at a number of different positions in a test or service board so that one such circuit may serve as many test or service positions and the loop circuits terminated thereat as may be desired.

What is claimed is:

1. In a telegraph system, an open telegraph key alarm circuit comprising a telegraph circuit having a rectifier shunting a telegraph key, a telegraph sounder in series with said rectifier, means for impressing electromotive force of opposite polarities on said circuit so as to operate said sounder in response to electromotive force of one of said polarities when said key is open to indicate the open condition, and polar relay means connected to said circuit responsive to the closing of said key for indicating that said key has been closed.

2. In a telegraph circuit, a local telegraph station, a central telegraph station, a telegraph circuit connecting said stations, a telegraph key connected to said circuit at said local station, signaling means connected to said circuit at said local station, for indicating that said key is open, responsive to signal control means connected to said circuit at said central station, automatic signaling means at said central station responsive to the closing of said key for indicating that said key has been closed and automatic means also at

said central station responsive to the closing of said key for disconnecting said signal control means.

3. In combination in an open telegraph key alarm circuit, a telegraph circuit normally closed when idle, telegraph transmitting means connected to said circuit at a local station, means connected to said circuit at a central station for impressing a signaling current on said circuit to operate a signal at said station for indicating that said circuit is open, automatic signaling means and automatic signaling current disconnection means both at said central station and both responsive to the closing of said circuit at said local station for indicating that said open circuit has been closed and disconnecting said signaling current therefrom.

4. In combination in an open telegraph circuit alarm circuit, a telegraph circuit connecting a

local telegraph station with a central telegraph station, normally closed telegraph signal transmitting contacts at said local station, a copper oxide rectifier shunting said contacts at said local station, open transmitting key indicating means connected to said telegraph circuit at said local station, a first polar relay connected to said telegraph circuit at said central station for connecting batteries of opposite polarities alternately to said telegraph circuit, to operate said indicating means as a signal that said contacts are open, and a second polar relay connected to said telegraph circuit at said central station responsive to the closing of said contacts for operating signal means indicating that said contacts have been closed and to prevent the further operation of said first relay.

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