

Aug. 21, 1934.

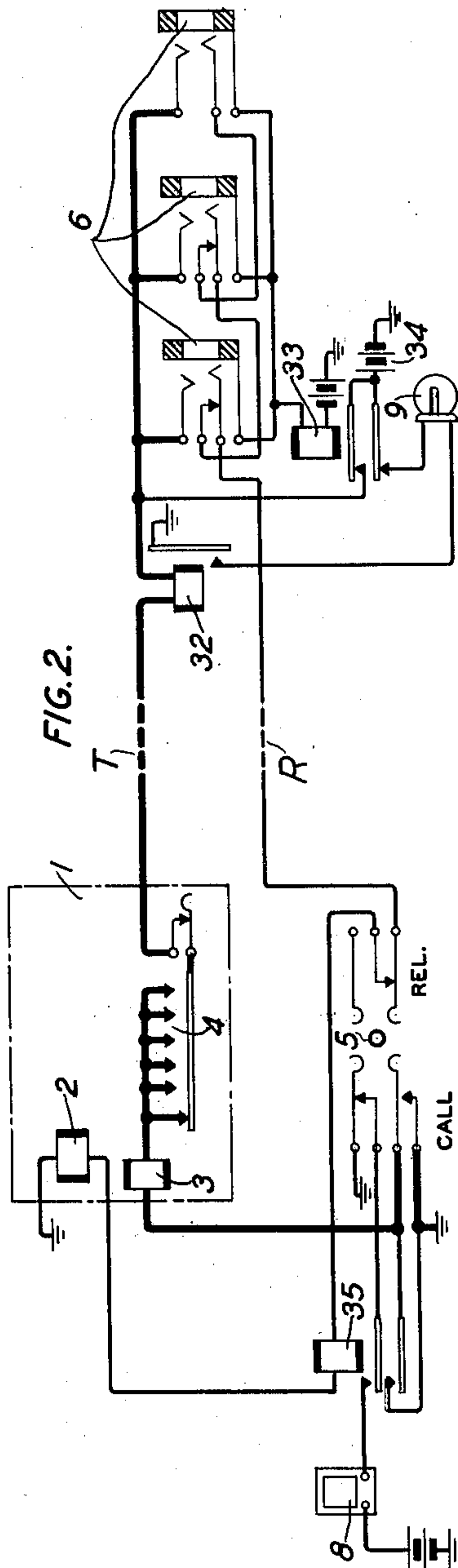
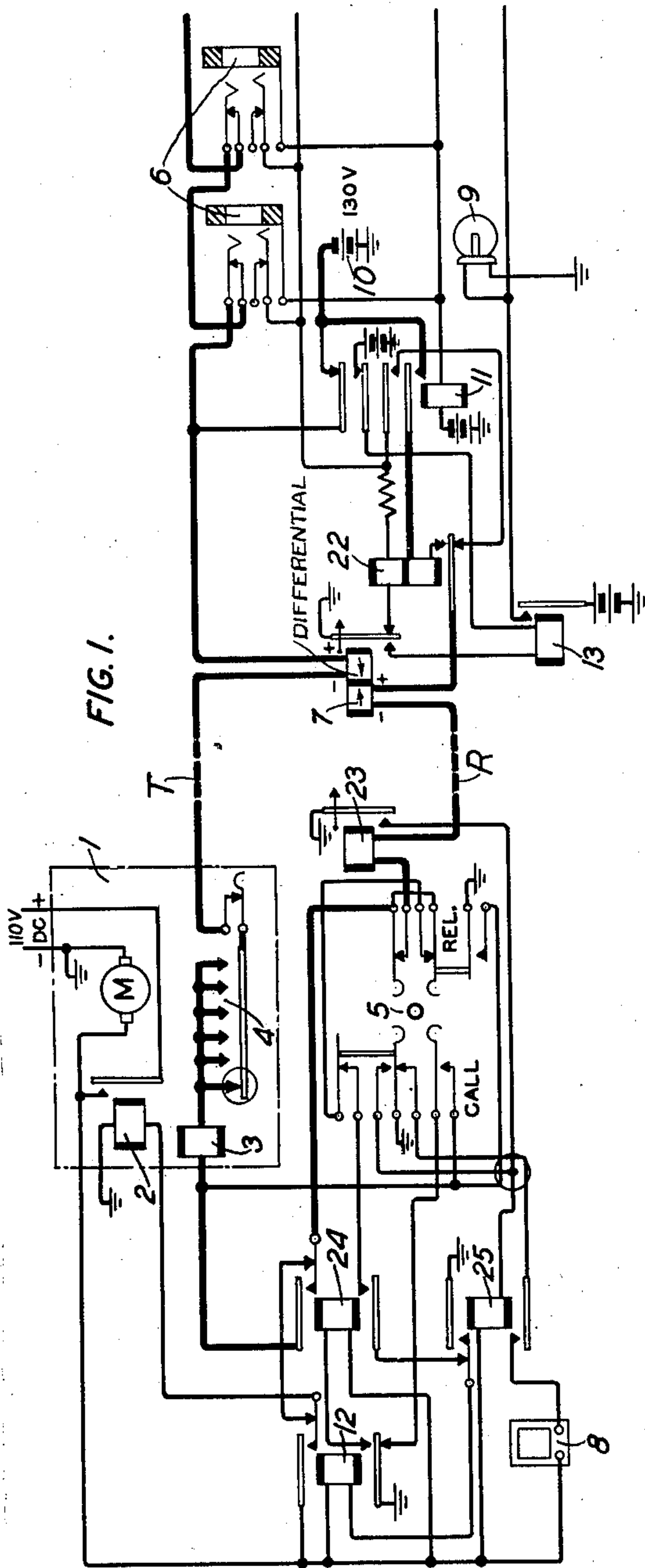
F. S. KINKEAD ET AL

1,970,938

TELEGRAPH EXCHANGE SYSTEM

Filed June 25, 1931

2 Sheets-Sheet 1



INVENTORS F. S. KINKEAD
G. J. KNANDEL
BY *J. W. Schmied*
ATTORNEY

Aug. 21, 1934.

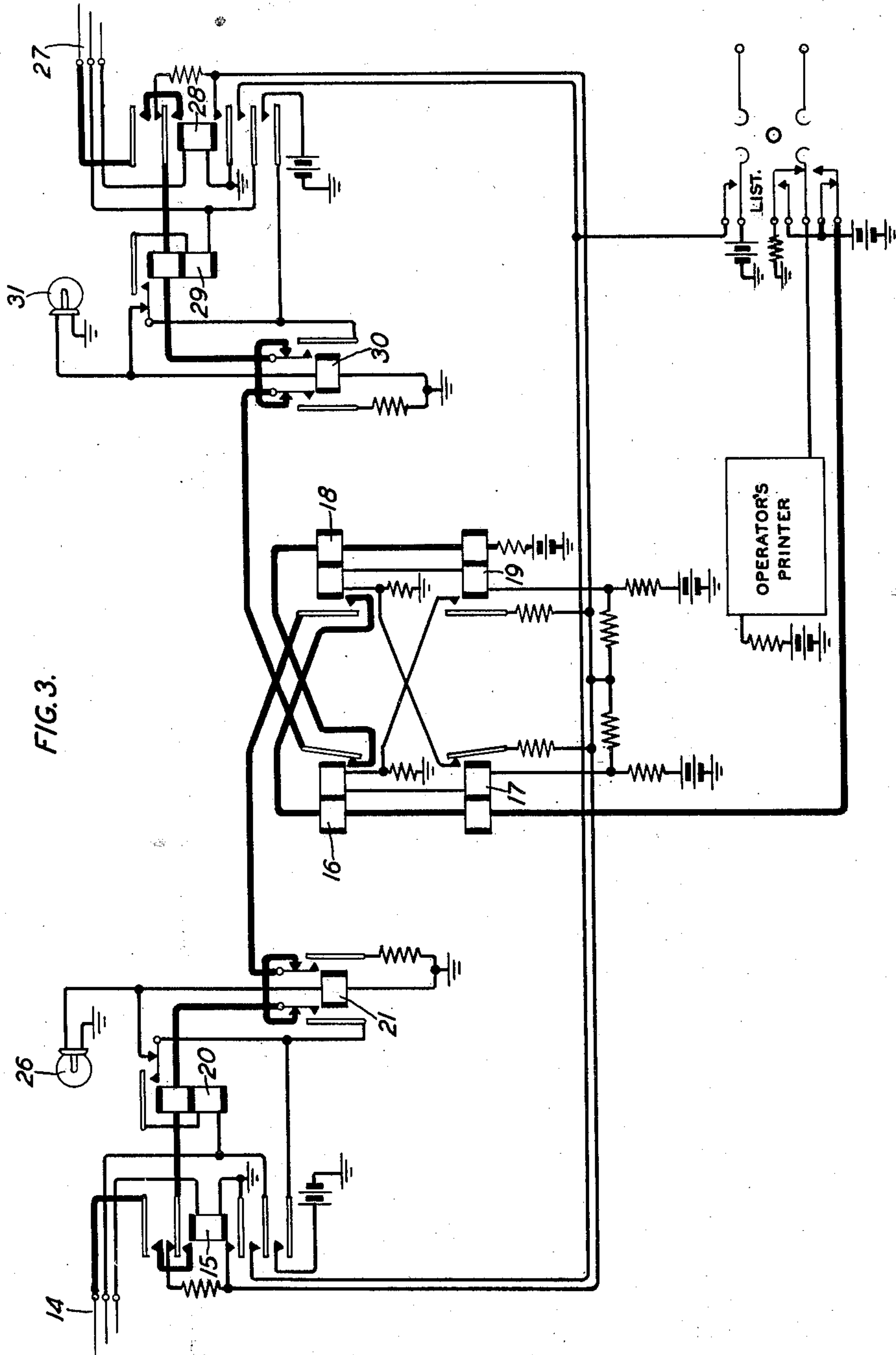
F. S. KINKEAD ET AL

1,970,938

TELEGRAPH EXCHANGE SYSTEM

Filed June 25, 1931

2 Sheets-Sheet 2



INVENTORS F.S. KINKEAD
G.J. KNADEL
J. W. Schmied
ATTORNEY

UNITED STATES PATENT OFFICE

1,970,938

TELEGRAPH EXCHANGE SYSTEM

Fullerton S. Kinkead, Brooklyn, N. Y., and George J. Knandel, Bloomfield, N. J.; said Kinkead assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York, and said Knandel assignor to American Telephone and Telegraph Company, a corporation of New York

Application June 25, 1931, Serial No. 546,700

3 Claims. (Cl. 178-411)

This invention relates to printing telegraph exchange systems and more particularly to the station circuit for use at a subscriber's printing telegraph station.

An object of this invention is to enable a subscriber at a printer station in a telegraph exchange system to communicate over the system in a convenient and efficient manner.

This invention comprises a circuit arrangement including relay and key switching means whereby a subscriber at the printer station may signal an operator at a distant central office for communication over the telegraph exchange system. Means are provided whereby, after communication ceases, the subscriber may indicate to the central office operator that disconnection from the transmission circuit is desired. Circuit means permit the starting and stopping of the printer set motors from the distant central office. A buzzer located at the subscriber's premises is utilized to attract the attention of the subscriber whenever a calling subscriber is connected to the communication circuit.

One feature of this invention is a circuit arrangement whereby the motors for the subscriber's printer set are controlled from the central office over a path traced from one side of the loop circuit to ground, this control path being transferred to a circuit local to the subscriber's station as soon as the printer set is ready for communication. This feature enables the switchboard operator to start, transmit signals to, and stop the printer of an unattended station.

Another feature of this invention is a three-position key, for use in initiating a call when thrown in one position and for disconnecting the circuit when thrown in the reverse position.

A further feature relates to the means employed for causing a flashing recall signal at the switchboard.

Referring to the drawings:

Fig. 1 illustrates schematically a particular embodiment of this invention wherein a subscriber's station circuit and associated line jack circuit are adapted for metallic loop signaling;

Fig. 2 illustrates schematically another embodiment wherein a subscriber's station circuit and associated line jack circuit are adapted for ground return operation; and

Fig. 3 illustrates schematically a cord circuit at the central office arranged to cooperate with the circuits of Fig. 1 and Fig. 2.

In Figs. 1 and 2, a subscriber's station circuit comprising a printer set 1 and associated apparatus is shown connected to the central office by

line conductors T and R, and terminating thereat in line jacks 6, 6'. Printer set 1 is comprised essentially of a control relay 2 adapted to start and stop the motor driving means M of the set, a line relay 3 for recording signal impulses and sending contacts 4 serially connected in the tip side T of the loop. At the station also is a key 5 which is used to initiate a call by actuating the key to the calling position and to inform the central office operator that disconnection from the communication circuit is desired by actuating the key to the release position. A buzzer or indicator 8 is employed to attract the attention of the subscriber whenever an incoming call is connected to the loop circuit.

The operation of the circuit will now be described.

Assuming that the subscriber of Fig. 1 desires to initiate a call to the central office, key 5 will be actuated to the left or calling position. This action will close a circuit to light lamp 9 in the line jack circuit at the central office as an indication to the operator that the subscriber desires a connection over the exchange system. This circuit is traced from negative 130-volt battery 10 at the central office, through the upper break contacts of relay 11, one winding of differentially wound slow release relay 7, tip T of the loop, sending contacts 4 and line relay 3 of printer set 1, left lower make contact of key 5 to ground on the contact and armature of relay 12, thus operating the relay 7. The operation of relay 7 at the central office causes the operation of relay 13 from ground on the armature and make contact of 7 to battery through the winding of relay 13 and inner break contact of relay 11, in turn lighting lamp 9 over an obvious circuit.

The central office operator, upon noticing lighted lamp 9, will insert the answering plug 14 of the cord circuit, Fig. 3, into line jack 6 associated with the lighted lamp 9. The cord circuit employed is a type well known in the art, and comprises a circuit having four polar relays 16, 17, 18 and 19 for repeating signal impulses between line sections to which the cord circuit is connected. This repeater circuit is disclosed in the patents to J. M. Fell, 1,479,430, January 1, 1924 and F. S. Kinkead, 1,752,436, April 1, 1930, which are hereby made part of this application as if fully included herein.

The insertion of plug 14 into jack 6 will operate the relay 11 in the line jack circuit and relay 15 in the cord circuit over a path traced from battery through the winding of relay 11, sleeve of

jack 6, sleeve of answering plug 14, winding of relay 15 to ground. The operation of relay 11 will remove the battery on its inner contacts from the winding of relay 13 which will now release, in turn, extinguishing lamp 9. Relay 11, in operating, will also remove the negative battery 10 from the tip side T of the loop circuit which will now be replaced by positive battery from the cord circuit. This last circuit is traced from T of the line, winding of relay 7, tip of jack 6, tip of plug 14, upper outer and inner make contacts of relay 15, upper winding of relay 20, break contacts of relay 21, make contact of relay 18 (relay 18 operated when relay 15 operated), one winding each of relays 16 and 17, normal break contact of the listening key to positive battery. The positive battery over the tip of plug 14 will operate relay 20 and keep operated, for the moment, relay 7. Relay 20, in operating, will lock up on a circuit traced from positive battery on the lower outer make contact of relay 15, upper make contact and winding of relay 20, ring of plug 14, ring of jack 6, inner make contact of relay 11, break contact of relay 22, other winding of relay 7, ring side R of the loop circuit, winding of relay 23, right break contact of key 5, upper break contacts of relays 24 and 12, winding of control relay 2 to ground, thus operating relays 2 and 23. Differentially wound, neutral relay 7 will remain operated since the currents through both of its windings are in such direction as to aid in operating the relay. Relay 2, in operating, will connect 110 volt DC power supply to the motor driving means M over an obvious circuit and will also connect the DC supply to the station apparatus to condition the station circuit for proper operation at this time.

The operation of slow release relay 23 causes the operation of relay 25 on a circuit traced from ground on the armature and make contact of 23, through the winding of relay 25 to the ungrounded side of the DC supply on the make contact of relay 2. Relay 23 is designed to be slow in releasing so as to hold up on printer signals. Relay 25, in operating, will cause the operation of relay 12, in turn, operating relay 24 and providing a locking circuit for control relay 2. Relay 12 is operated on a path from ground on the armature and make contact of relay 25 to the DC supply through the winding of relay 12 and make contact of relay 2. Relay 24 is operated on a path from ground on the armature and make contact of relay 12 to the DC supply through the winding of relay 24 and the make contact of relay 2. Relay 12, in operating, provides a path to lock up control relay 2 through the upper make contact of relay 12 and the make contact of relay 2. The operation of relay 24 closes T and R of the loop through the station circuit and removes ground from the ring side R. It is to be noted also, that the operation of relay 12 removed ground from the tip side T of the loop. The loop circuit is now isolated from ground.

At this time, differentially wound relay 7 will release since positive battery from the cord circuit is applied to both of its windings over a closed metallic loop. The release of relay 7 will cause the operation of relay 22 on a path from ground on the armature and break contact of 7, upper winding of relay 22, ring of jack 6 and plug 14, winding and contacts of relay 20, to positive battery on the lower outer make contact of relay 15, thus keeping operated the relay

20. The operation of relay 22 will transfer the ring side R of the loop from positive battery over the ring of the cord circuit to negative 130 volt battery 10 in the line jack circuit. This circuit is traced from R of the loop, one winding of relay 7, make contact and lower winding of relay 22, lower inner make contact of relay 11 to negative battery 10. It is to be noted that the circuit is now closed from negative battery 10 over R of the loop through the station apparatus, back over T of the loop, to positive battery in the cord circuit. Current is now flowing through each of the two windings of differentially wound relay 7 in such directions as to oppose each other and to prevent the operation of relay 7 which continues to stay released.

The operator at the central office may now communicate with the subscriber by actuating the listening key in the cord circuit and typing on the keyboard of her printer set. The actuation of the listening key will connect the operator's printer in series with the tip side of the line and will replace the battery on the listening key. Upon receiving the code number of the subscriber with whom the calling party wishes to communicate, the operator will insert calling plug 27 of the cord circuit into jack 6 of the called subscriber's line. This action will cause the operation of relay 28 in the cord circuit and relay 11 in the line jack circuit of the called subscriber, in a manner similar to that heretofore described in connection with the operation of relay 15 and relay 11 in the line jack circuit of the calling subscriber's circuit. Positive battery will be connected over the ring side R of the loop to operate relay 22 on a path from positive battery on the upper make contacts of the listening key in the cord circuit, lower middle make contacts of relay 28, ring of plug 27, ring of jack 6, upper winding of relay 22 to ground on the armature and break contact of relay 7. Disconnect lamp 31 will light up on a path from battery on the lower outer make contacts of relay 28, break contacts of relay 29 to ground through the lamp. The operation of relay 22 will connect R of the loop through the lower winding of relay 22 to negative battery 10 on the inner make contact of relay 11. This negative battery on the ring R of the loop will cause the operation of relay 23 and relay 2 in the called subscriber's station circuit on a path from R of the loop, winding of relay 23, right break contact of key 5, upper break contacts of relays 24 and 12, winding of control relay 2 to ground. The operation of relay 2 will connect the power supply to the motor driving means M and to the station apparatus. Relay 23, in operating, will operate relay 25 over a circuit hereinbefore described. Relay 25, in operating, will actuate buzzer 8 to attract the subscriber's attention, on a circuit traced from ground on the left inner break contact of key 5, lower make contact of relay 25, buzzer 8 to the DC supply. Relay 25, in operating, also causes the operation of relay 12, in turn, operating relay 24. This has been described hereinbefore. Relay 2 will lock up through its own contacts and those of relay 12. The tip side T of the loop will now be closed through the station apparatus to the ring side R of the loop. Buzzer 8 will continue to buzz until the subscriber actuates key 5 to the calling position which will remove the ground on key 5 from buzzer 8. The closure of T and R through the station apparatus will cause the operation of relay 29 in the cord circuit on a circuit traced

from negative battery 10 over R of the loop, back over T of the loop, tip of jack 6, tip of cord 27, upper outer and inner make contacts of relay 28, upper winding of relay 29, break contacts of relay 30, make contacts of relay 16, one winding each of relays 18 and 19 to positive battery. Relay 29, in operating, will extinguish lamp 31 and lock up over its contacts, lower winding and ring side of the cord to ground through the winding of relay 22 and back contacts of relay 7. Differential relay 7 will be unoperated at this time due to the opposing current through its windings.

If the called subscriber does not answer, the operator or the calling subscriber may transmit to the printer set 1 of the called party on an unattended basis, the station circuit of the called subscriber now being in condition for the reception of signaling impulses. Relay 23 is designed to be slow in releasing and will remain operated during the transmission of impulses so as to prevent the station circuit from returning to normal while signals are being transmitted from the switchboard on an unattended basis.

To give the disconnect signal, the subscriber actuates key 5 from the left or calling position to the right or release position momentarily, and then restores the key to normal. The actuation of key 5 to the release position will open the R side of the loop and place ground on the T side of the loop, thus causing the release of relay 23. The release of relay 23 will release relay 25, in turn, opening up the operating path of relay 12 which will also release and cause the release of relays 24 and 2. The return to normal of control relay 2 stops the operation of the motor driving means M. The opening of the ring side R of the loop will also cause the release of relay 22 in the line jack circuit. The tip T of the loop is grounded by the operation of key 5 to the release position on a circuit traced from ground through the lower outer right make contact of key 5, winding of printer line relay 3 and sending contacts 4 of printer set 1, T of the loop, one winding of relay 7 to battery over the tip of the cord circuit, operating the relay 7. Differential relay 7 operates at this time since current is now flowing in only one of its windings. It is to be noted that relay 20 in the cord circuit does not release at this time since it is kept operated by current flowing through its upper winding over the tip side of the cord. Relay 20 will stay operated until key 5 is returned to normal, at which time, ground is removed from the tip T of the loop.

The release of relay 20 will light the disconnect lamp 26 in the cord circuit as an indication to the operator that the subscriber wishes to be disconnected from the system. The release of relay 20 also causes the operation of relay 21. The lamp circuit for lighting lamp 26 is traced from battery on the lower outer make contact of relay 15, break contact of relay 20 to ground through lamp 26. Relay 21 is operated from the same battery on the break contact of relay 20 which lights the lamp. The actuation of key 5 to normal will remove ground from T of the line and cause the release of relay 7.

Relay 7 is designed to be slow in releasing to insure that relay 20 in the cord circuit has completely released before the armature of relay 7 is restored to its normal position. Otherwise, relay 20 may remain operated from the ground on the armature and break contact of 7 over the ring side of the cord. Although the disconnect feature has been described only in connection with

the answering plug, it should be understood that the circuits associated with the calling plug function in an identical manner.

It is often desirable to attract the attention of the operator at the central office while the subscriber is still connected to a communication circuit over the exchange system. This may be accomplished by alternately actuating key 5 to the calling and release positions. When this is done the disconnect lamp in the cord circuit will be lit during the time the key is in its normal position after being actuated to the release position. The actuation of key 5 to its calling position while the cord circuit is connected to jack 6 will cause the reoperation of the relays in the subscriber's station circuit in a manner similar to that hereinbefore described in connection with initiating a call.

Fig. 2 illustrates a subscriber's station circuit and associated line jack circuit adapted for ground return operation. To initiate a call, key 5 is actuated to the calling position. This action will place ground on the tip side T of the loop to operate relay 32 in the line jack circuit on a path traced from battery on the inner break contact of relay 33, winding of relay 32, T of the loop, sending contacts 4 and winding of line relay 3 of the subscriber's printer set, lower left make contacts of key 5 to ground. Relay 32 in operating will light up lamp 9 over an obvious circuit.

The central office operator, upon noticing the lighted lamp, will insert plug 14 of the cord circuit into one of the jacks 6 associated with the lighted lamp. This action will cause the operation of relay 33 in the line jack circuit and relay 15 in the cord circuit on a path from battery through the winding of relay 33, sleeve of jack 6, sleeve of plug 14, winding of relay 15 to ground. The operation of relay 33 will extinguish lamp 9 and remove battery 34 from the tip side T of the loop. This battery, however, is replaced by positive battery in the cord circuit over the tip of the plug 14. The circuit traced by the battery over the tip of the plug is identical with that hereinbefore described in connection with the operation of the circuit illustrated in Fig. 1. Relay 20 will operate over this circuit.

The insertion of plug 14 in jack 6 also causes the operation of relays 2 and 35 in the station circuit over a circuit traced from positive battery on the lower outer make contact of relay 15, make contact and one winding of relay 20, ring of plug 14, ring of jack 6, R of the loop, right break contact of key 5, windings of relays 35 and 2, in series, to ground. Relay 20 will lock up over this circuit. Control relay 2, in operating, will condition the printer set for operation. Communication may now take place over the tip T of the loop on a circuit from positive battery in the cord circuit to ground in the station circuit. Relay 3 will follow all signals.

A recall signal from the subscriber's set is given by operating key 5 alternately to the calling and release positions. Each time the key is actuated to the release position, the tip and ring sides of the loop are opened, causing relay 20 in the cord circuit to release and lamp 26 to light, and each time the key is actuated to the call position, the tip and ring sides of the loop are closed through to ground at the station, causing relay 20 to operate and lamp 26 to be extinguished.

A call may be received from the central office by the insertion of plug 27 into jack 6. This action will operate relays 28 and 33 over the sleeve

circuit. Relays 2 and 35 of the station circuit will operate over the ring of the loop from positive battery on the upper make contacts of the listening key in the cord circuit, lower middle make contacts of relay 28, ring of plug 27 and jack 6, R of the loop, right break contacts of key 5 to ground through the winding of relays 35 and 2. The operation of relay 35 will cause the operation of buzzer 8 over an obvious circuit, to attract the attention of the subscriber. It should be noted, also, that the operation of relay 35 connected ground from its lower contact to the tip T of the loop through line relay 3 and sending contacts 4 of printer set 1, thus closing through the tip of the loop for communication purposes and causing the operation of relay 29 in the cord circuit. The subscriber may answer by operating key 5 to the calling position, thus causing the release of buzzer 8. However, should the subscriber at the called station not answer, signals may be sent to the called subscriber's station set on an unattended basis.

1. In a telegraph exchange system, in combination, a printer set, a motor driving means for said set, circuit means at said printer set, a three-position switching member located at said printer set, a switchboard, a normally deenergized loop circuit extending from said circuit means to said switchboard, a plurality of signal indicating

means at said switchboard, one of which is arranged to operate when said switching member is actuated to one of its operated positions, and a link circuit at said switchboard arranged to be connected to said loop circuit when said indicating means operates whereby said loop circuit is energized and said circuit means is operated for starting said motor driving means, said circuit means being responsive to the actuation of said switching means to another of its operated positions for stopping said motor driving means.

2. In a telegraph exchange system according to claim 1, wherein the other of said signal indicating means is arranged to operate when said switching member is actuated to the second mentioned operated position.

3. In combination in a subscriber's station circuit, a printer, motor driving means for said printer, a transmission line, a relay serially connected in said line and adapted when operated by current over said line to actuate said motor driving means, and circuit means for maintaining the actuation of said motor driving means, said relay being adapted to lock up over said circuit means, and means for releasing said relay to stop said motor driving means.

FULLERTON S. KINKEAD.
GEORGE J. KNADEL.

30

35

40

45

50

55

60

65

70

75

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150