

July 3, 1934.

C. C. LANE

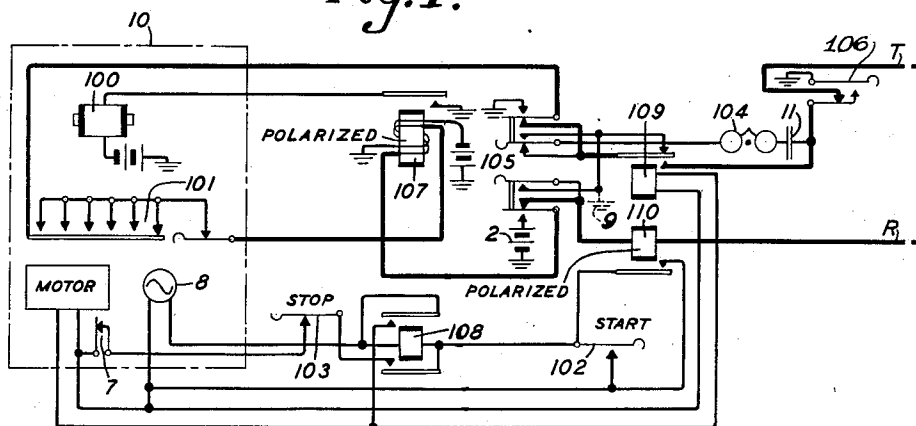
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STATION CIRCUIT FOR TELEGRAPH EXCHANGE SYSTEMS

Filed June 25, 1931

2 Sheets-Sheet 1

Fig. 1.



INVENTOR

C. C. LANE

BY

J. W. Schmed
ATTORNEY

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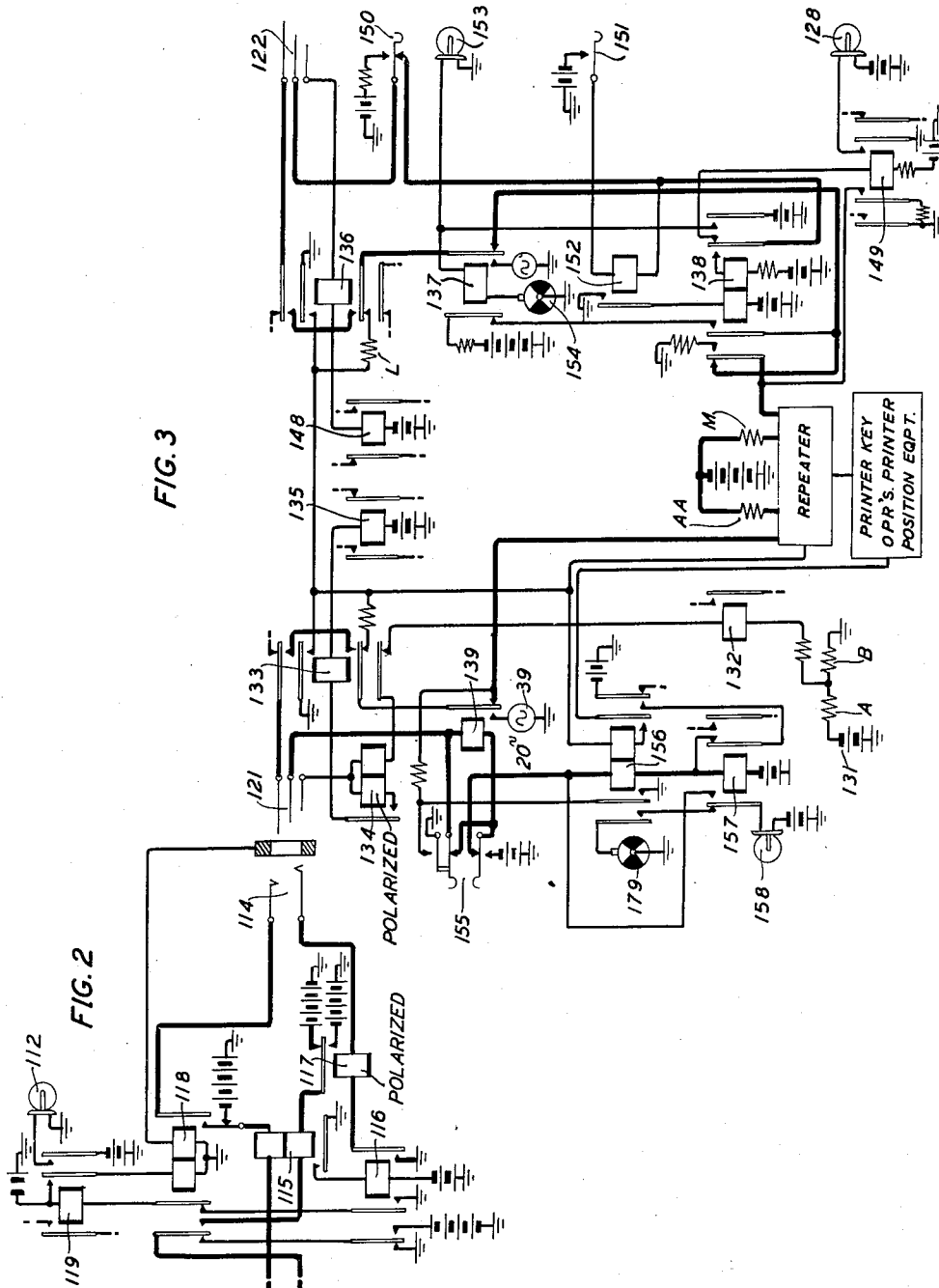
C. C. LANE

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INVENTOR
C. C. LANE
BY *J. H. Schmied*
ATTORNEY

UNITED STATES PATENT OFFICE

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STATION CIRCUIT FOR TELEGRAPH
EXCHANGE SYSTEMSCuthbert C. Lane, Little Neck, N. Y., assignor to
Bell Telephone Laboratories, Incorporated, New
York, N. Y., a corporation of New York

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7 Claims. (Cl. 178-4.1)

This invention relates to improvements in printing telegraph exchange systems and more particularly to the subscriber's printing telegraph station circuit.

3 An object of this invention is to enable a subscriber connected to a telegraph exchange system to communicate over the system in a convenient and efficient manner. More specifically, it is to provide a station circuit capable of functioning with a telegraph exchange system of a type which can furnish service which is similar, in many respects, to that which is now provided between telephone stations. Such a telegraph exchange system is disclosed in an application, 10 Serial No. 459,684, filed June 7, 1930, for Messrs. G. A. Locke and F. S. Kinkad which application is hereby made part of the present application as if fully included herein.

15 A feature of this invention is a circuit arrangement whereby the motor driving means for the subscriber's printing set is 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.

20 Another feature of this invention is a test key for use in testing the printer set locally during the time the loop is arranged so that the central office operator can ring over the circuit.

25 A further feature is the flashing key for attracting the attention of the operator at the central office while the subscriber is connected for transmission over a communication circuit.

Other objects and features will appear in the subsequent disclosure.

30 A particular embodiment of this invention comprises a circuit arrangement, including relay and key switching means, whereby a subscriber at a 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 signal the central office operator that disconnection from the transmission circuit is desired. Circuit means permit the starting and stopping of the printer set motor driving means from the distant central office. A buzzer 35 or bell located at the station is utilized to attract the subscriber's attention whenever a calling subscriber connected to the exchange system desires to communicate with the station over the communication circuit.

55 Other objects and features will appear in the

following specification and appended claims when taken in conjunction with the drawings, of which:

Fig. 1 shows the subscriber's loop circuit at the subscriber's station;

Fig. 2 shows the subscriber's loop circuit terminating at the central office; and,

Fig. 3 shows a cord circuit comprising a repeater, whereby the central office operator may connect the loop circuit of one subscriber's station with the loop circuit of any other subscriber's station connected in the system.

Referring to the drawings, Fig. 1 shows the subscriber's loop station equipment and circuit arrangement which comprises a printing telegraph sending and receiving unit 10, having a printer magnet 100, a set of sending contacts 101 and a suitable motor equipped with a pair of contacts which will open by mechanical means when motor stop signals are sent. External of the printing telegraph set and also located at the subscriber's station are switch 102 for starting the printer set motor, a stop or break key 103 for stopping the printer set motor, bell 104 whereby the central office may signal the subscriber's station, a test key 105 for testing locally the printer set while the loop is arranged so that the operator can ring, a flash key 106 for signaling the operator at the central office and several relays, the functions of which will be explained.

Fig. 2 shows the subscriber's line circuit located at the central office. A line lamp 112 is associated with the equipment at the central office whereby the subscriber may signal the operator. In addition, there are provided several relays, to be discussed, for operating the signaling circuits.

The repeater cord, which is necessary for establishing a connection between local subscribers' lines is shown in Fig. 3. This cord contains a single line repeater circuit for repeating signals in either direction between lines to which it is connected by means of answering plug 121 and calling plug 122. The repeater unit comprises a group of relays having line and auxiliary windings interconnected so as to repeat signals from either subscriber's line to the other subscriber's line. A detailed explanation of the operation of such a repeater unit will not be given in this application since a repeater of this type is fully described in U. S. Patent No. 1,752,436 to F. S. Kinkad, dated April 1, 1930 which disclosure is hereby made a part of the present application as if fully included herein. Associated with plugs 121 and 122 are signaling lamps 128, 153 and 158 used for indicating to the operator the

progress of a call. The manner of operation of the relays and their functions will be described in detail later.

Under normal conditions, when the subscriber's station circuit is not connected for communication, a circuit may be traced from the tip side T of the transmission line extending from the subscriber's premises to the central office through the contacts of flash key 106 through condenser 11 and bell ringer 104, swinging contact of key 105, normal break contact of relay 109 to ground 9. Under such conditions, ground is normally connected to the ring side R of the transmission line on a path traced from ring R through the winding of polarized relay 110, contact of key 105, one winding of relay 107, contact 101 of operator's printer set 10, upper contact of key 105, normal break contact of relay 109 to ground 9. The circuit hereinbefore traced from the tip side of the line through the bell ringer to ground permits the operation of the bell ringer to attract the attention of the subscriber at the station when ringing current is transmitted over the tip side of the line from the switchboard.

Assuming that the subscriber desires to initiate a call, start switch 102 will be pressed, which closes a circuit from one side of power supply circuit 8 through the winding of relay 108 to the other side of the power supply, causing relay 108 to operate. Relay 108, in operating, locks up through its lower contact, contact of stop key 103 through the motor control contacts 7 of the printer to the other side of power supply 8. In operating, relay 108 closes a path through its upper contact to start the motor for the printer set and also to operate relay 109 over the same circuit.

The operation of relay 109 opens the bell ringer circuit over the tip T of the loop, removes ground from the ring side R of the loop and closes the T and R leads of the loop through the subscriber's station set to operate relay 115 at the central office. This last circuit is traced from negative battery at the central office through the right side break contacts of relay 118, upper winding of relay 115, T of the loop, flash key 106 located at the subscriber's station, make contact of relay 109, contact of key 105, sending contacts 101 of the printer set, one winding of relay 107, lower contact of key 105, winding of relay 110, ring side R of loop, break contacts of relays 118 and 116 in the central office to ground. The operation of relay 115 completes a path to operate relay 116 from ground on the armature and contact of relay 115 to battery through the winding of relay 116. The operation of relay 116 in turn operates relay 119. This circuit is traced from ground on the left inner make contact of relay 116 through left inner break contact of relay 118 through the winding of relay 119 to battery. Incidentally, relay 115 is kept from releasing when relay 116 operates by the substitution of positive battery on the left outer make contact of relay 116 for ground on the left outer break contacts of this relay. This positive battery over ring side R of the loop is traced back over side T of the loop to negative the battery on the right side break contacts of relay 118 as mentioned hereinbefore. Relay 119, in operating, lights lamp 112 from battery on the right outer make contact of 119 to ground through lamp 112 indicating to the operator that the subscriber is calling. The operation of relay 119 connects battery from the right inner contact of relay 119 through the secondary winding of relay 118 to the sleeve

of jack 114 to put a busy indication on the sleeve of jack 114. The secondary winding of relay 118 is connected in opposition to the primary winding and helps to prevent relay 118 from operating.

The operator at the central office answers the call by inserting answering plug 121, Fig. 3, of the cord circuit into jack 114 of Fig. 2 of the subscriber's line. Upon insertion of plug 121 in jack 114 a circuit is completed to operate relays 132 and 134 to ground from negative battery 131 in the cord circuit through resistance A of the potentiometer comprising resistances A and B through the winding of relay 132, lower outer break contact of relay 133, through the right side winding of relay 134 to the sleeve of plug 121, sleeve of jack 114, primary winding of relay 118 to ground, thus operating relays 132 and 134. Relay 118 will now operate. Although the circuit to operate relays 132 and 134 was completed through the winding of relay 118, it will be noted that relay 118 does not operate until polarized relay 134 operates. Relay 118 is designed not to operate on the small current supplied through the high resistance circuit previously traced. The operation of relay 134 causes the operation of relay 118 on a path traced through the low resistance secondary winding of relay 134 and the low resistance windings of relays 133 and 135 to battery. Upon the operation of relay 118, the circuit path previously used to operate relay 119 will be opened and relay 119 will release causing the extinguishment of line lamp 112. The operation of relay 118 transfers the ring side of the loop circuit R from positive battery on the make contact of relay 116 to the positive battery on the break contact of relay 117 through left outer make contact of relay 118, through the lower winding of relay 115, and the break contact of relay 117. The operation of relay 134 causes it to lock up from ground through the right side winding of relay 118, through the sleeve of jack 114, through the secondary winding and left side contacts of relay 134, winding of relay 133, winding of relay 135 to battery, thus operating relays 133 and 135. The operation of relay 133 applies ground from its upper inner armature through the L resistance, lower inner break contact of relay 136, right break contact of relay 137, left outer break contact of relay 138, through the repeater and resistance M to negative 130 volt battery. This causes the repeater in the cord circuit to close, thus making it possible for the operator's set to be connected to the answering cord.

The operation of relay 133 connects the tip of the plug 121 through the upper outer and lower inner make contacts of relay 133, break contact of relay 139, through the repeater and resistance AA to negative battery. This negative battery on the tip of plug 121 completes a path over the tip of jack 114, through the right make contact of relay 118, upper winding of relay 115, to T of the loop, back over R of the loop, left outer make contact of relay 118, lower winding of relay 115, break contact of relay 117 to positive battery. This circuit energizes both windings of relay 115, the windings of which are wound differentially so as to oppose each other, causing the relay to release and in turn to release relay 116.

The operator may connect her telegraph printer set to the cord circuit by operating the printing key which is associated with the cord circuit previously inserted in jack 114 to her position and printer.

The operator operates her printer set to send

the word "operator" or "opr", which is typed up on the receiving unit 100 of the subscriber's printer. The subscriber then answers by operating the sender unit 101 to transmit to the operator's printer set information regarding the called subscriber's line. The operator, having obtained the information (let us suppose) that the call is to a local subscriber to whom she has direct access, then connects plug 122 of the repeater cord in the called subscriber's line. Both the calling and the called subscribers have line jack circuits and subscriber's station circuits similar to Figs. 1 and 2. The insertion of plug 122 into jack 114 of the called subscriber's line causes the operation of relay 118 in the line jack circuit, Fig. 2, and the operation of relays 136 and 148 in the cord circuit on a path traced from battery through the windings of relays 148 and 136, in series, sleeve of calling plug 122, jack 114, through winding of relay 118, to ground. The operation of relay 136 connects the tip of the calling plug 122 through upper outer and lower inner make contact of relay 136, break contact of relay 137, left outer break contact of relay 138, through the repeater to negative 130 volt battery through the M resistance. The tip of plug 122 completes a circuit through jack 114, Fig. 2, right side make contact of relay 118, upper winding of relay 115, tip T of loop, flash key 106, condenser 11, bell 104, key 105, break contact of relay 109, to ground 9. The operation of relay 118 in the line jack circuit will complete a circuit from positive battery through the break contact of relay 117, lower winding of relay 115, left outer make contact of relay 118, ring of loop, winding of relay 110, key 105, one winding of relay 107, sending contacts 101, key 105, normal break contact 109 to ground 9, operating relay 115. The operation of relay 115 will operate relay 116, which in turn will operate relay 149 and light the supervisory lamp 128 in the cord circuit on a path as follows: ground on the right make contact of relay 116, through the winding of the relay 117, ring of jack 114, ring of plug 122, key 150, right inner break contact of relay 138, winding of relay 149 to negative battery thus operating relay 149. The operation of relay 149, in turn, completes a circuit to light lamp 128 from ground on the left inner make contact of relay 149 to battery through lamp 128. Relay 149 in operating applies ground from left inner make contact to the repeater circuit to keep the communication path closed. This ground is traced from the left inner make contact of relay 149, through the repeater and resistance M to negative 130 volt battery. The operator now rings on the circuit by momentarily operating ringing key 151. This applies battery to the winding of relay 152 causing it to operate over a circuit through key 150 and the ring side of the cord which, as has been shown, has ground applied to it from relay 116 in the line jack circuit. The operation of relay 152 energizes the primary winding of relay 138 on a circuit traced from ground on the contact of relay 152 to battery through the left side winding of relay 138 thereby operating relay 138. Relay 138 locks up from 130 volt negative battery through its right winding and its right inner make contact to the ring side of plug 122 which is grounded by relay 116. The operation of relay 138 releases relay 149 extinguishing the calling cord lamp 128. The operation of relay 138 also lights guard lamp 153 from battery on the right outer make contact of relay 138 to ground through lamp 153. The same contact which lights the guard lamp 153 prepares a circuit for relay 137 to be operated from the interrupted ground 154. This interrupted ground 154 operates relay 137 at intervals. When relay 133 is operated and relay 137 not operated during an interval, negative 130 volt battery is applied to the tip of the calling cord, thence to the tip of the subscriber's line from 130 volt battery on the left break contact of relay 137, left inner make contact of relay 138, right break contact of relay 137, lower inner and upper outer make contacts of relay 136, tip of cord to ground in the subscriber's station over a path through his bell circuit as hereinbefore described. When relay 137 is operated, 20 cycle ringing current from the right make contact of relay 137 is applied to the tip of the line to ring the subscriber's bell over a circuit traced from the right inner contact of relay 137, lower inner and upper outer make contact of relay 136, tip of cord 122 and out over the line to the subscriber's bell at his station. These alternate ringings will continue to be applied to the line until the subscriber answers. While the ringing is continuing, relay 115 in the line jack circuit will chatter, but to prevent this chattering from affecting the supervisory guard lamp 153 in the cord circuit, relay 116 is designed as a slow-release relay which will not release while relay 115 chatters. When the subscriber does answer by depressing the start key 102 at the station set, the same relays will operate at the station as described in connection with originating a call and ground will be removed from the ring of the loop circuit; the bell circuit over the tip side of the loop will be opened and tip T and ring R of the loop will be closed through the sending and receiving circuits of the subscriber's printer. In the line jack circuit the closure of the subscriber's loop will cause both windings of relay 115 to become energized and cause relay 115 to release for reasons hereinbefore described in connection with originating a call. The circuit which energizes the upper winding of relay 115 in the line jack circuit is traced from negative battery through the left break contact of relay 137 when that relay releases in one of the interrupted intervals through the left inner make contact of relay 138, right break contact of relay 137, contacts of relay 136 to the tip of plug 122 and out over the line circuit. The release of relay 115 will release relay 116 which will remove ground from the ring side of cord 122 and thus release relay 138 and extinguish guard lamp 153. The tip of the calling cord circuit is restored to the repeater circuit and communication may now take place between subscribers through the repeater with the operator's set monitoring on the circuit. The called subscriber may acknowledge the call in some way, as by sending his code number on his printer. This will be received on the printer sets of both the operator and the calling subscriber. The operator monitors on this connection until the parties are in satisfactory communication and then disconnects her set from the circuit by restoring the printing key associated with the cord circuit to its normal position, thus leaving her set free to answer other calls. When the call is completed a disconnect signal may be sent by the subscriber by pressing stop key 103 which opens the locking circuit for re-

lay 108, causing it to release and thereby open the circuit of the power supply to the printer motor. Relay 109 will also release and the subscriber's station will return to normal and restore the condition of an open tip and grounded ring. Relay 115 in the line jack circuit will now reoperate since the ring winding only of the relay will be energized. Relay 116 will now operate from the contact of relay 115 to apply a ground to the ring of jack 114 and to the cord circuit. In the case of a calling cord, relay 149 will operate and place a ground from its right inner make contact to light and supervisory lamp 128. In the case of an answering cord, a circuit is traced from ground on the ring of cord 121, normal break contacts of key 155, one winding of relay 156, winding of relay 157 to battery, operating relays 156 and 157. Relay 157 completes a circuit to light supervisory lamp 158 from battery through the lamp, left make contact of relay 157, contacts of key 155 to ground on the ring of plug 121. The operation of relay 156 closes the answering side of the repeater from ground on its lower make contact. The operator, upon noting the lighted lamps, disconnects the repeater cord from the jacks of the calling and called subscriber's lines thus restoring all equipment to normal.

It should be noted that if the subscriber's printer set is of certain well known types in common use, the subscriber may send a disconnect signal to shut down not only her own set but also the distant subscriber's set by sending two shift signals or other motor stop signals on her printer equipment. Certain mechanism located in the subscriber's printer (not shown in the drawings since the printer forms no part of this invention) acts to open the motor control contacts. The opening of the motor control contacts releases relay 108 and has the same effect as opening the stop key 103.

A subscriber often has occasion to signal an operator after a connection has been established with the operator or with another subscriber. For this purpose flash key 106 is provided in the subscriber's equipment at his station.

Returning now to the circuit condition which exists when a subscriber is in communication with another subscriber, let us assume that a subscriber wishes to signal the operator to initiate another call. Non-locking flash key 106 at the sub-set is pressed once. This action opens the tip of the loop to the central office and places ground on the ring of the loop to energize only one winding of relay 115 in the line jack circuit and cause it to operate. Relay 115 in turn operates relay 116. As the right armature of relay 116 is now connected to the ring of jack 114 through the winding of polarized relay 117, the closure of the upper armature will connect ground to the ring of the plug inserted in jack 114. Assuming that an answering plug 122 is inserted in jack 114 a circuit is completed through relays 156 and 157 in the cord circuit causing them to operate from ground on the ring of plug 122, contacts of key 155, left winding of relay 156, winding of relay 157 to negative battery. Relay 156 locks up to ground from the upper inner make contact of relay 133, right side winding of relay 156, lower inner make contact of relay 156 to battery through the printer key. Relay 156, in operating applies ground to the answering side of the repeater holding the balance of the cord circuit closed from its left inner make contact. Relay 157 in operating, connects lamp 158 to the ring of the plug, lighting

lamp 158. The release of flashing key 106 closes the loop and removes ground from the ring releasing relay 157 which locks down due to the application of negative battery to the other side of its winding from its right inner break contact and the right outer make contact of relay 156. The answering lamp 158 is now connected to interrupted ground 179 which flashes the lamp at the rate of 0.5 second on and 0.5 second off until the operator throws the printer to monitor in on the circuit thus releasing relay 156.

Assuming that calling plug 122 is in jack 114 and that the called subscriber flashes key 106, then the ground on the ring of jack 114 from relay 116 is applied to the ring of plug 122 then to the normal contacts of key 150, right inner break contact of relay 138 to battery through the winding of relay 149 operating relay 149. In operating, relay 149 applies ground from its right inner make contact to light lamp 128. Lamp 128 will only flash in accordance with the operations of flashing 106 at the called local subscriber's set.

If the operator at the central office rings a subscriber and the subscriber does not answer the operator may start the subscriber's set and allow the calling subscriber to send a message to the unattended station. This is done by the operator pressing key 150 in the calling side of the cord circuit which applies positive battery to the ring of plug 122. It will be noted that upon insertion of plug 122 in the line jack of the called party that relay 118 in the sleeve of the line jack circuit is operated. Also, that relay 115 operated from positive battery through the break contacts of relay 117, through one winding of relay 115 to ground on the ring of the subscriber's loop. Relay 115, in turn, operates relay 116. Therefore, the application of positive battery to the ring of the cord circuit will complete a path to operate polarized relay 117, in the line jack circuit. This path is traced from ground on the right make contact of relay 116 through the winding of relay 117 to the ring of jack 114. Relay 117 is a polarized relay and the direction of current flow is usually such as to keep it unoperated, however, this positive battery being of opposite polarity to the normal battery in this circuit will cause relay 117 to operate. The operation of relay 117 will apply negative battery from its upper make contact to the ring of the subscriber's loop instead of the usual positive battery. The reversal of polarity on the ring side of the loop operates polar relay 110 at the subscriber's station which, in operating, closes the circuit of relay 108 in the same manner as does start key 102 when pressed, and puts the station in an operating condition. The motor for the printer set is thus started and the unattended station key 150 at the central office may be released. The subscriber's loops T and R will now be closed through the subscriber's station set and relay 115 in the line jack circuit will release, and line lamp 128 in the cord circuit will be extinguished. The extinguishment of lamp 128, after the release of key 150, makes known to the operator the fact that the unattended subscriber's motor for the printer set has started. If the lamp 128 does not remain extinguished after the operator has released key 150, it will be an indication to the operator that the subscriber's loop has not been closed through the station circuit. Key 150 will then be reoperated.

When a subscriber's station is in the disconnected position and it is desired to ring on the answering plug over the subscriber's line jack the

answering ringing key 155 is depressed. This introduces relay 139 into the ring circuit and causes it to operate on a circuit traced from negative battery from the lower contact of key 155, winding of relay 139 to ground on the ring of plug 121 and jack of the line. The operation of relay 139 will apply ringing current from source 39 through the make contacts of relay 139 and the make contacts of relay 133 to the tip of the plug and out to ring the bell at the subscriber's station. Key 155 while depressed applies ground from its upper make contact to the answering side of the cord repeater holding the balance of the circuit closed.

It will be noted that the ringing on the answering plug is caused by continual manual operation of key 155 while that on the calling plug is automatic after only one operation of key 151.

Key 105 at the subscriber's station is provided for testing the printer set locally while the line is arranged so that the operator can ring. The operation of key 105 disconnects T and R of the line from the subscriber's set, the tip T of the line being connected through the ringer circuit directly to ground and the ring R being connected to ground through the contacts of key 105. Battery will then be connected through the lower make contact of key 105 to operate relay 107 on a circuit traced from ground through the upper make contact of the key 105 through printer contact 101, winding of relay 107 to battery 2 on the lower contact of key 105, thereby operating relay 107. Relay 107, in turn, actuates the printer magnet 100 from ground on its make contact. The motor may then be started and the printer tested locally while the loop is arranged so that the operator can ring.

The station circuit may be returned to normal by operating stop key 103. The operation of key 103 will open the locking circuit for relay 108, thereby releasing 108, and opening up the current supply circuit for the motor which will release. Relay 109 will also fall back upon the release of relay 108.

Various modifications may be made in this invention to suit different circuit arrangements without departing from the scope of this invention.

What is claimed is:

1. A subscriber's printer station circuit of the type which employs a ringer responsive to ringing current incoming to said station circuit for attracting the attention of the attendant including a special key connecting said printer set to a local circuit whereby the printer set may be tested locally while the circuit is arranged so that ringing current received over the line can actuate the ringer.

2. A subscriber's telegraph station circuit comprising a source of current supply, a printer, motor driving means for said printer, a relay, normally open contacts for said relay, one side of the winding of said relay being connected to one side of said source of current supply, the other side of the winding of said relay being connected to a start key and to a first contact of said relay, a second contact for said relay being arranged to make connection with said first contact when said relay is operated, said second contact being connected to the other side of said source of current supply, a stop key serially connected in series with said second contact, said relay being adapted to oper-

ate upon the actuation of said start key and to lock up over said first and second contacts and adapted to release upon the actuation of said stop key and additional contacts for said relay to connect said source of current supply to operate said motor upon the operation of said relay.

3. In combination in a subscriber's station circuit, a printer, motor driving means for said printer, a transmission line, a polar relay serially connected in said line and adapted when operated by current of a predetermined polarity over said line to actuate said motor driving means, and relay means responsive to the operation of said polar relay for maintaining the actuation of said motor driving means, said relay means being adapted to lock up over one of its contacts, and means for releasing said locked-up relay means independently of the position of said polar relay.

4. In combination in a station circuit, a transmission line having a first wire and a second wire, a bell ringer associated with the first wire of said line, a printer set responsive to signal impulses received over said line, means to enable said printer to be tested locally, a key normally arranged to connect said first wire of said line through said bell ringer to ground and arranged to connect said second wire of said line through said printer set to ground, said key being arranged when operated to again associate said first and second wires with ground, to disconnect said printer set from said transmission line and to connect said printer to a local circuit to enable said printer to be tested locally.

5. A printer station circuit of the type which employs an indicator responsive to a signal incoming to said station for attracting the attention of the attendant, including means whereby the printer set may be tested locally while the circuit is arranged so that said indicator will be actuated by an incoming signal received over the line.

6. A substation for printing telegraphy comprising a printing telegraph equipment having a driving device connectible to a source of power, a pair of conductors outgoing from said substation, a ringing device operable by periodic fluctuating current flowing over at least one of said pair of conductors for calling the operator at said substation, a contact for connecting said driving device to said source, a relay operable by suitable current flowing in one of said conductors to close said contact, and other devices controlled by the closure of said contact to disconnect said ringing device from operative relation to either of said pair of conductors.

7. A substation for printing telegraphy comprising a printing telegraph equipment having a driving device connectible to a source of power, a pair of conductors outgoing from said substation, a ringing device operable by periodic fluctuating current flowing over at least one of said pair of conductors for calling the operator at said substation, a contact for connecting said driving device to said source, a relay operable by suitable current flowing in one of said conductors to close said contact, means at a point distant to said substation for controlling the flow of said suitable current over said one of said conductors, and other devices controlled by the closure of said contact to disconnect said ringing device from operative relation to either of said pair of conductors.

CUTHBERT C. LANE.