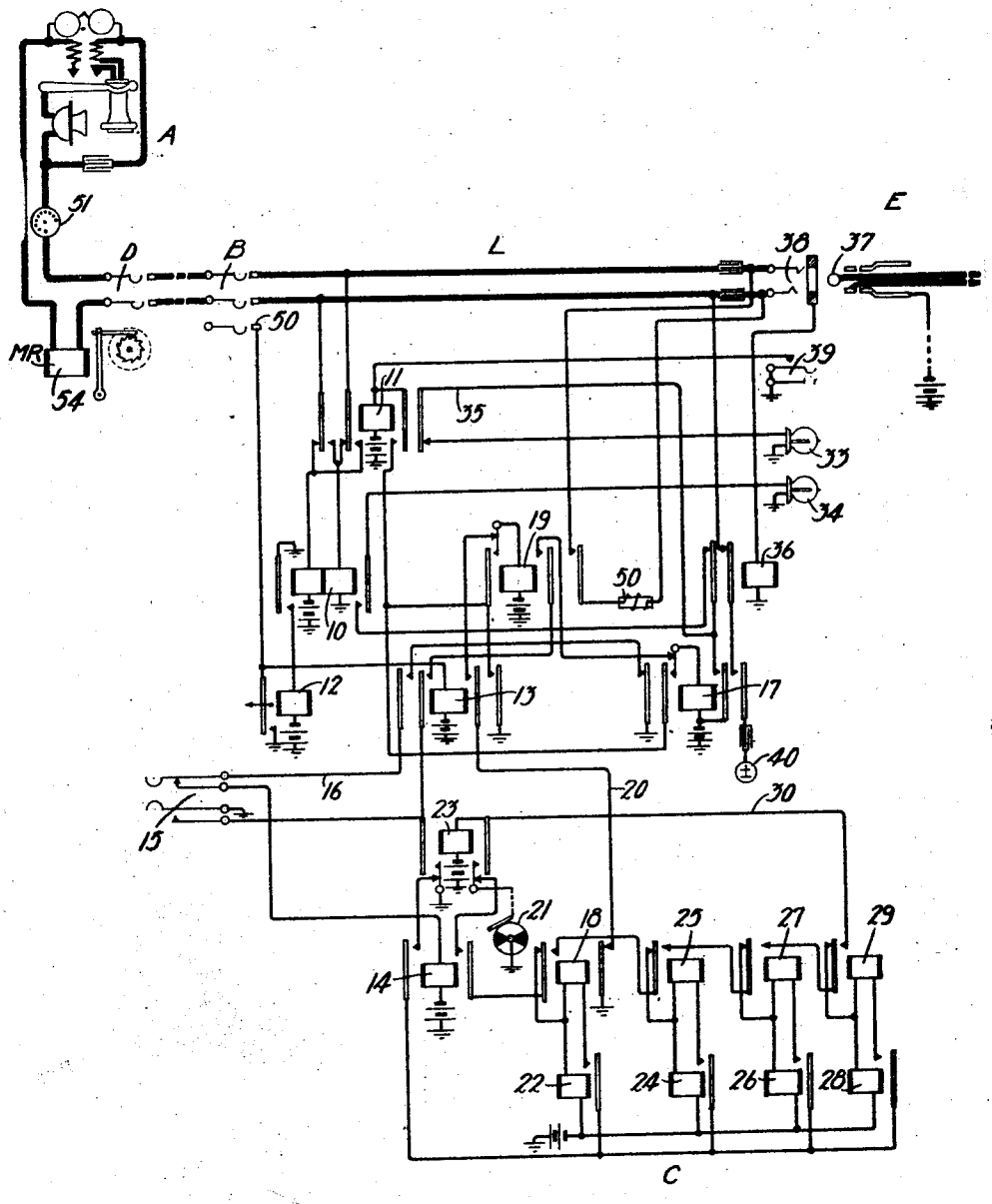
Oct. 27, 1925. 1,558,872

E. C. HELWIG

TELEPHONE SYSTEM

Filed March 3, 1923



Inventor:
Eugene C. Helwig,
by Edwards Atty.

Patented Oct. 27, 1925. 1,558,872

UNITED STATES PATENT OFFICE.

EUGENE C. HELWIG, OF HACKENSACK, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

Application filed March 3, 1923. Serial No. 622,494.

To all whom it may concern:

Be it known that I, EUGENE C. HELWIG, a citizen of the United States, residing at Hackensack, in the county of Bergen, State of New Jersey, have invented certain new and useful Improvements in Telephone System, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone systems and more particularly to link circuits employed in interconnecting automatic and manual switching exchanges.

In such systems, as mentioned above, wherein a subscriber at a machine switching substation may be telephonically associated with a subscriber, such as a rural subscriber, whose line terminates at a manual switching exchange, it has been found desirable to eliminate the effects of dialing the full number of digits individual to a called subscriber's line, by a calling subscriber, when the dialing of the complete number is not essential to the establishment of the connection.

In order to lessen the confusion of machine switching subscribers, it is customary to assign numbers to the manual switching lines, of a character similar to those assigned to the machine switching subscribers. It follows, therefore, that in calling a subscriber, such as a rural subscriber, whose line terminates in a manual switching exchange, a machine switching subscriber would proceed to signal the called party in the same manner as would be employed in signaling another machine switching subscriber, that is, remove the receiver and dial the complete set of digits individual to the line desired. It is generally necessary for a machine switching subscriber in reaching a rural exchange to remove the receiver and dial only the first digit or the first and second digits of the number assigned to the rural subscriber because for such calls connector switches need not be employed, but since the calling subscriber is ignorant of this fact and dials the complete set of digits, means must be provided whereby the impulses effected by dialing the remaining digits are rendered ineffective in producing disturbance on the line or in tying up unnecessary equipment.

Let it be assumed that a machine switching subscriber desires a connection with a rural subscriber, it being understood that part of the connection is to be set up manually by a rural operator. On removing the receiver at the calling station and dialing a complete set of digits, the line switch and selector employed in completing the connection would function in a manner well known in the art. A signal at the rural operator's position would be actuated before all the digits had been dialed. The rural operator, observing the signal, would plug into the jack associated with the trunk corresponding to the actuated signal, and actuate her listening key to connect her headset with the calling line, whereupon the impulses being sent out by the calling subscriber in dialing the remaining digits would produce a series of disagreeable and annoying clicks in the operator's ears.

It is, therefore, an object of this invention to relieve a manual operator of the disagreeable effects produced by dialing impulses not essential to the establishment of machine switching-manual connections.

Another object of the invention is to provide a simple, efficient and easily maintained system for absorbing or cancelling certain digits dialed by a machine switching subscriber, but not essential to the establishment of the desired connection.

In accordance with features of this invention, the above and other objects of this invention are attained by providing the link circuits which interconnect automatic and manual switching exchanges with a timing arrangement wherein a relay chain is adapted to delay the actuation of a signaling device at a manual operator's position until a calling machine switching subscriber has dialed a complete set of digits.

A further feature of the invention resides in the provision of manually operable means for disassociating the timing arrangement from a seized trunk to effect the immediate operation of the trunk signal.

The above and other objects of this invention will be readily discernible from the following description made with reference to the accompanying drawing which shows the preferred embodiment of the invention.

It will be assumed that a subscriber at the machine switching station A desires to signal a rural operator at the manual switching exchange E.

The subscriber at substation A, upon removing the receiver from the switchhook and dialing the first digit of the desired number causes the operation of the line switch and selector schematically represented by D and B respectively which, as is well known in the art, continue to operate until the terminals of the line A rest on an idle trunk which terminates at the manual switching exchange E. To simplify the description, it will be assumed that the brushes of selector B have engaged the terminals of the trunk circuit L.

When the selector B seizes the trunk L, a circuit is established which may be traced from grounded battery, left-hand winding of relay 10, back contact and outer left-hand armature of relay 11, ring conductor of the trunk L, ring contacts of selector B and line switch D, the line loop of substation A, tip contacts of the line switch D and selector B, tip conductor of trunk L, inner left-hand armature and back contact of relay 11 to ground through the right-hand winding of relay 10. Relay 10 in operating establishes an obvious circuit for slow-releasing relay 12 which in operating places a holding ground on the test terminal 50.

The ground placed on the armature of relay 12 effects a circuit for relay 13 which may be traced from grounded battery through the winding of relay 13 to ground over the armature and front contact of relay 12. Relay 13, in attracting its outer left-hand armature, establishes a circuit for relay 14 extending from grounded battery, winding of relay 14, upper normal contacts of the emergency key 15, conductor 16, outer left-hand armature and front contact of relay 13 to ground over the back contact and outer left-hand armature of relay 17. If the timing circuit C is idle, as will be assumed in this case, a ground on the right-hand armature of relay 18 completes the circuit for pick-up relay 19 which may be traced from grounded battery, through the winding of pick-up relay 19, make-before-break contacts of relay 19, front contact and inner right-hand armature of relay 13, conductor 20 to ground over the back contact and right-hand armature of relay 18. Relay 19 operates in this circuit and in attracting its left-hand armature locks up over an obvious circuit controlled by relay 13. In this manner, the pick-up relay 19 is maintained operated irrespective of the non-operated condition of relay 18 which is actuated as soon as the timing circuit C is set in operation by the actuation of relay 14, a circuit for which has previously been traced. In attracting its outer right-hand armature, relay 19 bridges the talking conductors of the trunk circuit L with the retardation coil 50 which provides supervision to the manual switching operator in a manner well known in the art. Relay 19, in attracting its inner right-hand armature, also prepares a circuit for the relay 17, which circuit is completed as soon as relay 23 operates, which will hereinafter be described.

When the relay 14 operates, as heretofore described, the interrupter 21 is connected in circuit with relay 22 which operates on the first ground pulse received from the interrupter 21 over a circuit which may be traced from grounded battery, winding of relay 22, back contact and left-hand armature of relay 18, right-hand armature and front contact of relay 14, right-hand make-before-break contacts of relay 23 to ground through the interrupter 21. Relay 22, in operating, establishes a series circuit for itself and relay 18, which may be traced from grounded battery, windings of relay 22 and 18, front contact and armature of relay 22, left-hand armature and front contact of relay 14 to ground over the left-hand make-before-break contacts of relay 23. By virtue of this circuit, relays 22 and 18 remain operated after ground is removed from the original circuit by the continued rotation of interrupter 21.

The next ground pulse from interrupter 21 effects the operation of relay 24 over a circuit extending from grounded battery, winding of relay 24, back contact and armature of relay 25, front contact and left-hand armature of relay 18, right-hand armature and front contact of relay 14, right-hand make-before-break contacts of relay 23 to ground over the interrupter 21. Relay 24 operates in a manner similar to that described in connection with relay 22, establishing a locking circuit for itself and relay 25 under the control of relay 23.

The operation of relays 26 and 27, and 28 and 29 is effected in a manner similar to that described in connection with relays 24 and 25 and their operating circuits need not be traced.

When relay 29, which is the last relay in the chain circuit, operates, a circuit is established which may be traced from grounded battery, winding of relay 23, conductor 30, front contacts and armatures of relays 29, 27, 25 and 18 respectively, right-hand armature and front contact of relay 14, right-hand make-before-break contacts of relay 23 to ground over the interrupter 21. Relay 23 operates in this circuit and opens the locking circuit of all the counting relays in the timing circuit C. Relay 23, in attracting its left-hand armature, completes the circuit prepared by relay 19 for relay 17, the latter relay operating in the circuit which may be traced from grounded battery, winding of relay 17, make-before-break contacts of relay 17, front contact and inner

right-hand armature of relay 19, front contact and inner left-hand armature of relay 13 to ground over the left-hand armature and front contact of relay 23.

The delayed signal relay 17, in operating, causes the illumination of charge lamp 33 and trunk lamp 34. The circuit for lamp 33 may be traced from grounded battery, inner right-hand armature and front contact of relay 17, conductor 35, outer right-hand armature and back contact of relay 11 to ground, through the filament of lamp 33. Lamp 34 lights in a circuit extending from grounded battery, inner right-hand armature and front contact of relay 17, outer armature and back contact of cut-off relay 36, front contact and right-hand armature of relay 10 to ground through the filament of lamp 34. In attracting its outer right-hand armature, relay 17 connects the ringing induction source 40 to the ring conductor of the trunk. Current from this source traverses the line loop of substationA and produces a distinctive sound in the receiver thereof to notify the calling subscriber that the called station is being signalled. Relay 17, in attracting its outer left-hand armature, removes ground from the winding of relay 14, thereby causing this relay to release and return the timing circuit C to normal.

The illumination of lamp 34 informs the rural operator at E that a call is awaiting her attention and she inserts plug 37, associated with her cord circuit, into jack 38 associated with the trunk L.

When the rural operator inserts plug 37 into jack 38, a circuit for sleeve relay 36 is established which may be traced from grounded battery, sleeve contacts of plug 37 and jack 38 to ground through the winding of relay 36. Relay 36 in operating attracts its inner and outer armatures and respectively removes the current source 40 from the line and interrupts the circuit for trunk lamp 34. Having plugged into the trunk L, the rural operator may actuate her talking key, not shown, and learn from the calling subscriber the number of the called subscriber's line and then proceed to complete the connection.

Owing to the fact that the locking circuit for relay 11 is controlled by relay 13 which is in turn controlled by relay 10 which is controlled by the calling party, it is impossible for a second calling subscriber to initiate a call prior to the removal of the plug 37 from the jack 38 and subsequent to the replacement of the receiver on the switchhook at station A and be charged for the same without getting the attention of the rural operator. If such a condition should arise, as soon as the subscriber at station A places the receiver on the switchhook, relay 11 is deenergized, (key 39 being in its normal position), as will be described in detail hereinafter, thereby returning battery and ground to the tip and ring conductors of line L, so that should a second subscriber seize the terminals of trunk L the call registering device would not operate. In like manner, the second seizure of the trunk L under the aforementioned conditions would effect the illumination of lamp 33 since the timing device, comprising the counting relays, which control the lamp 33 is under the control of the calling subscriber and not under control of the operator.

If the call is of such a nature that a charge must be made, the operator depresses the charge key 39, whereupon a circuit is established from grounded battery, winding of relay 11 to ground, through the alternate contacts of key 39. Relay 11 operates in this circuit and in attracting its two left-hand armatures reverses battery and ground on the calling subscriber's line. If, as is assumed here, the call originated at a machine switching subscriber's station, the reversal of battery and ground on the line would cause the operation of the message register 54 in the manner well known in the art. Should the call emanate from a coin box station, the reversal of battery and ground would cause the operation of a polarized relay to effect the deposit of the coin in the collect receptacle, as is well known in the art.

In attracting its outer right-hand armature, relay 11 interrupts the circuit for the charge lamp 33 which thereupon becomes extinguished. Relay 11, in attracting its inner right-hand armature, establishes a locking circuit for itself which includes the grounded outer hight-hand armature and front contact of relay 13. By virtue of this locking circuit, should the operator in error remove plug 37 from jack 38 and reoperate key 39, there would be no second operation of the registering device to falsely register a second call.

If the call is of such a nature that there is no additional charge, the key 39 would not be actuated and relay 11, therefore, would not operate so that the charge lamp 33 would remain lighted whether or not plug 37 was inserted into jack 38. The lamp 33 may, therefore, act as a disconnect signal when the calling subscriber hangs up at the conclusion of the conversation. When the receiver is replaced on the switchhook at the substation A, relays 10, 11, 12, 13 and 19, deenergize, the last causing relay 17 to deenergize, whereupon the circuit for charge lamp 33 extending from grounded battery, inner right-hand armature and front contact of relay 17, conductor 35, outer right-hand armature and back contact of relay 11 to ground through the filament of lamp 33, is opened at the front contact and inner right-hand armature of relay 17. The lamp 33

thereupon is extinguished notifying the rural operator of the conclusion of the conversation. The rural operator also gets a disconnect signal from the called line in a manner well known in the art.

Upon receipt of the disconnect signal, the rural operator removes plug 37 from jack 38 and when the receiver is replaced on the switchhook at station A, all the trunk circuit apparatus is restored to normal.

If the rural operator has experienced any trouble with the trunk circuit L and more particularly should it be found advisable for other reasons to bring in the trunk lamp 34 as soon as the trunk is seized, she would operate the emergency key 15. When the trunk L is seized and relays 10, 13 and 19 operate in a manner heretofore described, the actuation of key 15 establishes a circuit for relay 17 which extends from grounded battery, winding and make-before-break contacts of relay 17, front contact and inner right-hand armature of relay 19, front contact and inner left-hand armature of relay 13 to ground over the lower alternate contacts of key 15. Relay 17, in operating, establishes a circuit hereinbefore traced for trunk lamp 34.

It is to be noted that should the calling subscriber at substation A be slow in operating the dial 51 and the lamp 34 be lighted before the calling subscriber has finished dialing, relay 10 would be alternately energized and deenergized according as the circuit therefor is interrupted by the operation of the dial 51, so that the trunk lamp 34, the circuit for which is controlled by relay 10, would flicker, notifying the rural operator that the calling subscriber has not yet finished dialing, whereupon she would delay the insertion of plug 37 into jack 38 until the trunk lamp 34 glows steadily.

What is claimed is:

1. In a telephone system, a subscriber's station, an impulse sender, a link circuit adapted to be connected with said station, a signal associated with said link circuit, an automatic switch controlled by said sender for seizing said link circuit, and a chain of pairs of relays operable responsive to the seizure of said link circuit and independent of further actuation of said impulse sender for effecting the operation of said signal at a predetermined length of time after the link circuit is seized.

2. In a telephone system, a subscriber's station, a dial therefor, a link circuit adapted to be connected with said station, a signal associated with said link circuit, a manual switch associated with said link circuit for effecting the immediate operation of said signal subsequent to the removal of the receiver and the actuation of the dial at said station, and means effective in delaying the operation of said signal for a predetermined length of time after the removal of the receiver and the actuation of said dial at said station.

3. In a telephone system, a subscriber's station, a dial therefor, a link circuit adapted to be connected with said station, a signal associated with said link circuit, signal delaying means responsive to the removal of the receiver and the actuation of said dial at said station for delaying the operation of said signal a predetermined length of time, and means for nullifying the effect of said signal delaying means and effecting the immediate operation of said signal.

4. In a telephone system, a subscriber's station, a link circuit adapted to be connected with said station, a signal associated with said link circuit, means at said station for transmitting impulses over said link circuit which are adapted to intermittently actuate said signal, and means responsive to the removal of the receiver at said station and the actuation of said first means for rendering said signal unresponsive to the aforesaid impulses and effecting a steady indication thereof.

5. In a telephone system, a machine switching substation, a dial therefor, a manual operator's position, a link circuit interconnecting said substation and said position, said link circuit adapted to conduct current impulses transmitted from said substation to said position by the actuation of said dial, a signal at said position adapted to be actuated upon removal of the receiver at said substation and the actuation of said dial, and means including a chain of counting relays for delaying the actuation of said signal until the aforementioned impulses have been dissipated.

6. In a telephone system, a substation, a dial therefor, a switching exchange, a link circuit interconnecting said substation and said exchange, a signal at said exchange, a relay controlling the operation of said signal, means for causing the immediate response of said relay to the removal of the receiver at said substation and the actuation of said dial, and means effective, when said first means is unoperated, in delaying the operation of said relay, whereby the actuation of said signal is delayed for a predetermined length of time after the removal of the receiver at said substation and the actuation of said dial.

7. In a telephone exchange system, a calling and a called station, a signal at the called station, means comprising a trunk line for interconnecting said stations, an impulse device for transmiting variable sets of impulses, an automatic switch controlled by one set of impulses from said device for connecting the calling station to the trunk line, means associated with said trunk line for absorbing variable sets of the remaining sets

of impulses transmitted by said device, and means operative thereafter to actuate said signal.

8. In a telephone exchange system, a calling and a called station, a signal at the called station, means comprising a trunk line for interconnecting said stations, an impulse sender for transmitting variable sets of impulses, an automatic switch actuated by one set of impulses for connecting the calling station to the trunk line, a relay in said trunk circuit actuated in response to the remaining sets of impulses, and means including a chain of counting relays controlled by said relay for delaying the actuation of said signal until all the impulses of the remaining sets have been transmitted.

9. In a telephone exchange system, a calling and a called station, a signal at the called station, means comprising a trunk line for interconnecting said stations, an impulse sender for transmitting variable sets of impulses, an automatic switch actuated by one set of impulses for connecting the calling station to the trunk line, a relay in said trunk circuit actuated in response to the remaining sets of impulses, and a chain of relays and an interrupter for delaying the actuation of said signal until all the impulses of the remaining sets have been transmitted.

10. In a telephone exchange system, an operator's position, a plurality of trunk lines terminating at said position, a signal for each of said trunks, a calling station, an impulse device thereat for transmitting a plurality of sets of impulses, an automatic switch controlled by the impulses of one set for extending the calling line to one of said trunks, means associated with said trunk for absorbing the remaining sets of impulses, and means common to said plurality of trunks for delaying the lighting of the signal associated with the selected trunk.

11. In a telephone exchange system, a calling and a called station, a signal at the called station, a plurality of trunk circuits, an impulse sender for transmitting variable sets of impulses, an automatic switch actuated by one of said sets of impulses for connecting the calling station to one of the trunk circuits, a relay in the selected trunk circuit actuated in response to the remaining sets of impulses, and a chain of relays and an interrupter common to said plurality of trunk circuits for delaying the lighting of the signal associated with the selected trunk.

In witness whereof, I hereunto subscribe my name this 2nd day of March A. D., 1923.

EUGENE C. HELWIG.