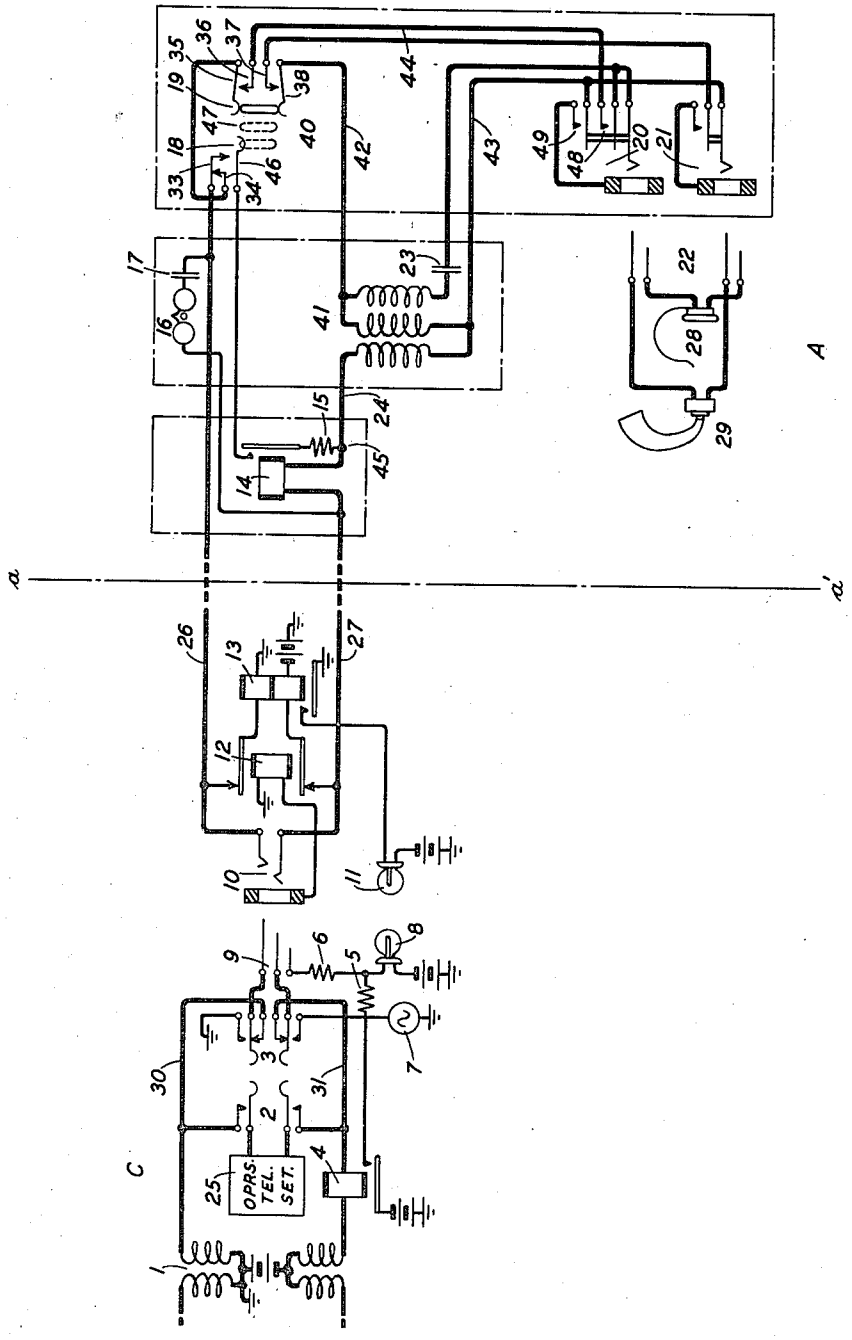
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TELEPHONE SUBSCRIBER'S SUBSTATION

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INVENTOR
J. M. LABAUGH

BY

ATTORNEY

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TELEPHONE SUBSCRIBER'S SUBSTATION

James Monroe Labaugh, Paterson, N. J., assignor to American Telephone and Telegraph Company, a corporation of New York

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This invention relates to telephone systems and more particularly to arrangements at subscribers' stations wherein the subscriber is supplied with an operator's chest transmitter and head receiver in place of the usual desk stand or handset type of instrument.

In such an arrangement means equivalent to the hook switch furnished with desk or handset instruments is necessary and consequently a key equipment in a convenient box or mounting is usually supplied whereby, when the subscriber is called in the usual manner, he can by operating the key connect his telephone set to the line and answer the call.

One of the advantages of the operator's type telephone set resides in the fact that it is usually furnished with a cord and plug whereby the set can be quickly disconnected from the line thus enabling the user to leave his desk without removing the transmitter and receiver from his person. With such arrangements in case the subscriber, after answering a call, should disconnect his telephone by removing the plug of his set from the telephone jack, which for convenience may be located in the key box, the line from the central office would be opened and a premature disconnect signal given to the central office operator.

An object of the invention, therefore, is to permit the subscriber to hold the central office connection while his telephone set is disconnected from the line.

A feature of the invention whereby the foregoing object is attained resides in the provision of a relay connected in series with the line at the subscriber's station which will be operated when a conversational condition exists between the central office and subscriber and by the provision of switching contacts on the subscriber's key together with circuit connections so arranged that, when the key is operated in a predetermined direction, a bridge circuit, including the operated contacts and winding of the relay, is connected across the line to simulate the normal bridge resistance across the line when the subscriber's telephone set is connected thereto.

In such an arrangement, wherein the holding bridge is completed over contacts and the winding of a relay serially connected in the line, in case the subscriber should neglect to restore his holding key for any reason, disconnection by the operator at the central office will release the relay thereby removing the holding bridge and placing the station in condition for another call.

The invention will be understood from the following description when read in connection with the accompanying drawing which illustrates a telephone line extending from a central office to a subscriber's station equipped with an operator's telephone set and arranged for holding.

The section of the drawing shown to the left of the vertical dotted line *aa'* schematically shows the central office apparatus and wiring of a subscriber line circuit terminating before an operator in jack 10 and lamp 11 together with a conventional cord circuit C arranged to be connected with said line circuit. The section of the drawing to the right of the aforesaid dotted line *aa'* illustrates a subscriber station with connections for common battery talking and signaling and arranged in accordance with this invention which shows a conventional subscriber set consisting of a ringer, induction coil, and condensers with which a breast type transmitter and head band telephone are adapted to be connected by means of a plug and jacks.

Although not shown by the drawing this invention, however, is also adapted for use with a subscriber station arranged for local battery talking and common battery signaling. This arrangement is desirable in case of certain subscriber lines over which it is impracticable to furnish transmitter current for the subscriber station from the central office, either because of line resistance or because of some limitation in battery supply at the central office. In this case a circuit arrangement may be provided for energizing the transmitter with current from a local battery, and instead of using the transmitter as part of the line bridge circuit, as hereinafter described, a retardation coil bridge may be used.

A detailed description of the operation of the arrangement shown in the drawing will now be given.

Let it be assumed that a calling subscriber, not shown, has been connected with the answering end, not shown, of the cord circuit C and a conversational connection has been established between the operator and calling subscriber by the actuation of the usual talking key 2, effecting a connection with the operator's telephone circuit 25. Let it be further assumed that the calling subscriber has requested that he be connected with the subscriber A whose station apparatus is shown at the right of the drawing. The operator, after making the usual busy test and finding the line free, then inserts the calling plug 9 of the cord circuit C into jack 10 of the called line. A circuit may now be traced from grounded battery through supervisory lamp 8, resistance 6,

sleeve conductors of plug 9 and jack 10 to ground through the winding of cut-off relay 12. Relay 12 operates opening its normally closed contacts and disconnecting the windings of line relay 13 from the tip and ring conductors, 26 and 27, respectively. Also, in the circuit above traced said supervisory lamp 8 is lighted.

The operator now operates the ringing key 3 which disconnects the tip and ring conductors of aforementioned plug 9 from the conductors 30 and 31, respectively, and connects said tip and ring conductors respectively, to ground and to a source 7 of grounded alternating current, of the frequency usually employed for ringing. A circuit may now be traced from said source 7 of ringing current through the two lower springs of key 3 over the ring conductors of plug 9 and jack 10 and conductor 27, thence through ringer 16 and condenser 17, over conductor 26 and tip conductors of jack 10 and plug 9 to ground through the two upper springs of key 3. In response to ringer 16 subscriber A inserts plug 22 into jacks 20 and 21, if not so connected at this time, and operates key 40 to position 47 which is the talking position. This causes springs 35 and 36, and 37 and 38 to close. A circuit may now be traced through transmitter 29 as follows. From ground at the center point of the repeating coil 1 of cord circuit C, hereinbefore mentioned, through upper right-hand winding of repeating coil 1, over conductor 30 and through the upper normally closed contacts of key 3 (assuming that the key is now normal, the operator having ceased ringing) over tip conductors of plug 9 and jack 10, conductor 26 through springs 33 and 34, 35 and 36 of key K, over conductor 44 through contacts 48 and over tip conductor of jack 20, upper tip conductor of plug 22, through transmitter 29, over lower tip conductor of plug 22 and tip conductor of jack 21, conductor 43, through left-hand winding of induction coil 41, over conductor 24 through winding of relay 14, over conductor 27, ring conductors of jack 10 and plug 9, contacts of key 3, conductor 31, through winding of relay 4 and lower right-hand winding of repeating coil to grounded battery. As a result of closing this circuit, relay 4 operates and connects resistance 5 to grounded battery, thereby shunting with said resistance 5 the supervisory lamp 8, hereinbefore mentioned. Resistance 5 is sufficiently low in value to shunt effectively and to extinguish lamp 8, thereby indicating to the operator that subscriber "A" has answered. In addition to the circuit above traced through transmitter 29, a circuit through receiver 28 was also closed when the subscriber A inserted plug 23 into jacks 20 and 21 as hereinbefore described. This circuit may be traced from the junction of the left-hand and center windings of induction coil 41, over conductor 43 through upper local contacts 49 and over sleeve conductor of jack 20, over upper sleeve conductor of plug 22 through receiver 28, over lower sleeve conductor of plug 22 and through sleeve conductor and local contact of jack 21, springs 37 and 38 of key 40, over conductor 42 and through center winding of induction coil 41 to point of beginning.

Another circuit from the junction point of the center and right-hand windings of induction coil 41 may be traced through the right-hand winding of induction coil 41, condenser 23, lower local contact 48 of jack 20 over conductor 44 and thence by a path previously traced through springs of key 40 to the tip conductor of the line. From the description above given it will be seen that the left-hand winding of induction coil 41 functions as the primary winding of the transmission circuit, while the secondary winding consists of the center and left-hand windings in series with condenser 23, receiver 28 being connected in multiple with the center winding. The circuit is now ready for conversation. If subscriber "A" should now have occasion or desire to leave the station location without releasing the connection and at the same time without removing the transmitter and headband receiver from his person, he may do so and still hold the line, by first operating key 40 to its holding position 18. A holding circuit may now be traced which includes a part of the circuit previously traced through transmitter 29. From junction point 45 on conductor 24 a circuit may be followed through resistance 15, contacts of relay 14 (which was previously operated on current through transmitter 29) springs 46 and 33 of key 40 to conductor 26 and thence to ground through the circuit previously traced in connection with transmitter 29. Relay 14, accordingly, is held operated through resistance 15 and holds supervisory relay 4 operated, maintaining the connection at the central office. Resistance 15 is designed so that the necessary current flows to maintain this holding condition and prevent the release of relay 14 when key 40 is changed from its operated position 47 to its holding position 18. Springs 33, 34 and 46 are continuity springs and are arranged so that spring 46 makes contact with spring 33 before spring 34 breaks from spring 33, thereby assuring that the holding path for relay 14 through resistance 15 is established before the operating path through transmitter 29 is broken. When subscriber "A" returns to the station location and reinserts plug 22 into jack 20 and 21, the circuit of transmitter 29 previously traced is open at springs 34 and 33. In order to resume conversation, subscriber A must now restore key 40 to its talking position 47. This reestablishes the transmitter circuit through springs 34 and 33, and opens the holding circuit at springs 33 and 46, without interrupting the flow of current through relay 14. However, it may so happen that subscriber A having left the station location may forget that the central office connection is being held. To avoid the undesirable results of this situation, is one of the principal objects of this invention and this is accomplished as follows: The central office operator on observing that the connection is being held unusually long and on challenging with the talking key 2 and obtaining no response, removes plug 9 of cord circuit C from jack 10 releasing relays 4 and 12. Relay 14 is also released removing holding bridge 15. The operator may now recall subscriber A, causing the operation of ringer 16 as previously described, or leave the circuit ready for a subsequent call, either incoming or outgoing. If subscriber A is recalled, on returning to the station key 40 is operated from holding position 18 to talking position 47, restoring thereby the conversational condition of the circuit previously described. On concluding the conversation key 40 is restored to right-hand or normal position 19. This opens at springs 35 and 36, the circuit previously traced through the transmitter, and causes the release of supervisory relay 4, which was also included in said circuit. Relay 4 in releasing removes resistance 5 from its shunt connection around supervisory lamp 8, which lights to indicate that subscriber A has disconnected. The operator now removes plug 9 from jack 10

which releases cut-off relay 12 restoring the central office apparatus to normal.

In the description given above the invention has been described for a call proceeding from the central office toward the subscriber. Now the functioning of the invention will be described for a call originating with the subscriber.

To originate a call the plug 22 must be inserted in jacks 20 and 21 and key 40 operated to the talking position 47. This establishes a circuit which causes the operation of line relay 13. This circuit may be traced from ground through the upper winding of relay 13, upper contacts of cut-off relay 12 to conductor 26, thence through the transmitter circuit previously traced to conductor 27, lower contacts of relay 12 and lower winding of relay 13 to grounded battery. The operation of relay 13 closes an obvious circuit through line lamp 11, which lights as a signal to the central office operator that the line of subscriber "A" is calling. The operator answers by inserting the plug of the answering end (not shown) of the cord circuit C into line jack 10. This causes the functioning of a supervisory relay and supervisory lamp, in said answering end of cord circuit C, in a manner similar to that previously described for the calling end of the cord circuit. Similarly, relay 12 operates and disconnects the windings of relay 13 from conductors 26 and 27 as previously described. Relay 13 accordingly, releases and opens the circuit through line lamp 11, which is extingushed. A conversational connection now being established with the operator the subscriber requests that a connection be made with the telephone of the called subscriber. With the connection established key 40 may be used in a manner similar to that previously described for a call originating with the central office. That is, by operating key 40 to holding position 18, the line may be held when plug 22 is removed from jacks 20 and 21. In like manner at the end of the conversation key 40 is restored to its normal position 19, opening the circuit through the transmitter 29 and restoring all apparatus to normal.

What is claimed is:

1. In a common battery telephone system, a central office, a subscriber's station equipment including a transmitter, a line therebetween, means to connect said transmitter across the line, a relay in series with the line and adapted to operate and partially close a holding bridge across the line when a connection is made to the line at the central office and the transmitter is connected across the line at the subscriber's station, said holding bridge including the winding of said relay, and other means under control of the subscriber for completing said holding bridge and thereafter disconnecting said transmitter from the line.

2. In a common battery telephone system, a subscriber's line, a subscriber's station equipment including a transmitter terminating one end of said line, a relay in series with said line and operated when direct current of a predetermined strength is flowing therein to partially close a bridge circuit, including the winding of said relay, across said line independent of said transmitter, and switching means under control of the subscriber for completing said bridge circuit.

3. In a common battery telephone system, a subscriber's line, a subscriber's station equipment including a transmitter adapted to be connected across the line, a relay in series with the line and operated when said transmitter is connected across the line and the line is seized at the central office, to partially close an auxiliary bridge circuit, including the winding of said relay, across said line independent of said transmitter and switching means controlled by the subscriber for completing said auxiliary bridge.

4. In a common battery telephone system, a subscriber's line, a subscriber's station equipment including a transmitter adapted to be connected to the line, a relay in series with the line and operated when said transmitter is connected to the line and the line is seized at the central office to partially close an auxiliary bridge circuit including the winding of said relay across said line independent of said transmitter, and subscriber controlled switching means for completing said auxiliary bridge and thereafter disconnecting said transmitter from the line.

5. In a common battery telephone system, a subscriber's line, a subscriber's station associated therewith, a relay in series with said line and operated when direct current of a predetermined strength is flowing therein to partially close a bridge circuit, including the winding of said relay, across said line, and a multi-position key adapted, when operated in one position, to connect the transmitter circuit of said station across said line and when operated in another position to first complete said bridge circuit and thereafter disconnect said transmitter circuit from the line.

6. In a common battery telephone system, a subscriber's line, a subscriber's station equipment associated therewith including a transmitter and receiver, plug and jack means for associating said transmitter and receiver with the other station equipment, a relay in series with said line and operated when direct current of a predetermined strength is flowing therein to partially close a bridge circuit, including the winding of said relay, across the line, and switching means under control of the subscriber for completing said bridge circuit whereby said transmitter and receiver may be dissociated from the station equipment and line without causing a disconnect signal to be given the central office.

7. In a common battery telephone system, a subscriber's line, a subscriber's station associated therewith, switching means for bridging the transmitter circuit of said station across said line, a relay in series with said line and operated when a connection is established with the line at the central office and the transmitter circuit is connected to the line at the station to partially close an auxiliary bridge circuit including the winding of said relay across said line, and other switching means adapted to complete said auxiliary bridge circuit and thereafter disconnect said transmitter circuit.

8. In a common battery telephone system, a subscriber's line, a subscriber's station associated therewith, switching means for bridging the transmitter circuit of said station across said line, a relay in series with said line operated when the line is seized at the central office and the transmitter circuit is connected thereto to partially close an auxiliary bridge circuit including the winding of said relay across said line, and other switching means adapted to open said transmitter bridge, said other switching means being further adapted to complete said auxiliary bridge circuit before said transmitter bridge is opened.

9. In a common battery telephone system, a subscriber's line, and associated station equipment including a transmitter, subscriber controlled means for connecting said transmitter to

the line, a relay in series with the line responsive to seizure of the line at the central office and connection of said transmitter thereto to prepare an auxiliary holding circuit, including the winding of said relay, for connection across said line and other subscriber controlled means for completing said auxiliary holding circuit and for thereafter disconnecting said transmitter from the line.

10. In a common battery telephone system, a subscriber's line and associated station equipment, a relay in series with the line adapted to be operated when the line is seized at the central office and the subscriber's transmitter is connected at the station, and means controlled by the subscriber for establishing a holding bridge across the line independent of the transmitter, said bridge including an operated contact and winding of said relay.

11. In a common battery telephone system, a central office, a subscriber's station equipment including an operating bridge, a line therebetween, means to connect said operating bridge across the line, a relay in series with the line and adapted to operate and partially close a holding bridge across the line when a connection is made to the line at the central office and the operating bridge is connected across the line at the subscriber's station, said holding bridge including the winding of said relay, and other means under control of the subscriber for completing said holding bridge and thereafter disconnecting said operating bridge from the line.

12. In a common battery telephone system, a subscriber's line, a subscriber's station equipment including an operating bridge terminating one end of said line, a relay in series with said line and operated when direct current of a predetermined strength is flowing therein to partially close a holding bridge circuit, including the winding of said relay, across said line independent of said operating bridge, and switching means under control of the subscriber for completing said holding bridge circuit.

13. In a common battery telephone system, a subscriber's line, a subscriber's station equipment including an operating bridge adapted to be connected across the line, a relay in series with the line and operated when said operating bridge is connected across the line and the line is seized at the central office to partially close an auxiliary bridge circuit, including the winding of said relay, across said line independent of said operating bridge and switching means controlled by the subscriber for completing said auxiliary bridge.

14. In a common battery telephone system, a subscriber's line, a subscriber's station equipment including an operating bridge adapted to be connected to the line, a relay in series with the line and operated when said operating bridge is connected to the line and the line is seized at the central office to partially close an auxiliary bridge circuit including the winding of said relay, across said line independent of said operating bridge, and subscriber controlled switching means for completing said auxiliary bridge and thereafter disconnecting said operating bridge from the line.

15. In a common battery telephone system, a subscriber's line and associated station equipment, a relay in series with the line adapted to be operated when the line is seized at the central office and an operating bridge is connected at the station, means controlled by the subscriber for establishing a holding bridge across the line independent of said operating bridge, said holding bridge including the winding of said relay, and means adapted to effect the disconnection of said holding bridge, said means being under joint control of both the central office and the subscriber's station.

16. In a common battery telephone system, a subscriber's line and associated telephone equipment, a relay in series with the line adapted to be operated when the line is seized at the central office, and a resistance bridge is connected across the line at the station, means controlled by the subscriber for establishing a holding bridge across the line independent of said resistance bridge, said holding bridge being arranged so as to be disconnected when the current therethrough is interrupted at either the central office or at the subscriber's station.

JAMES MONROE LABAUGH.