

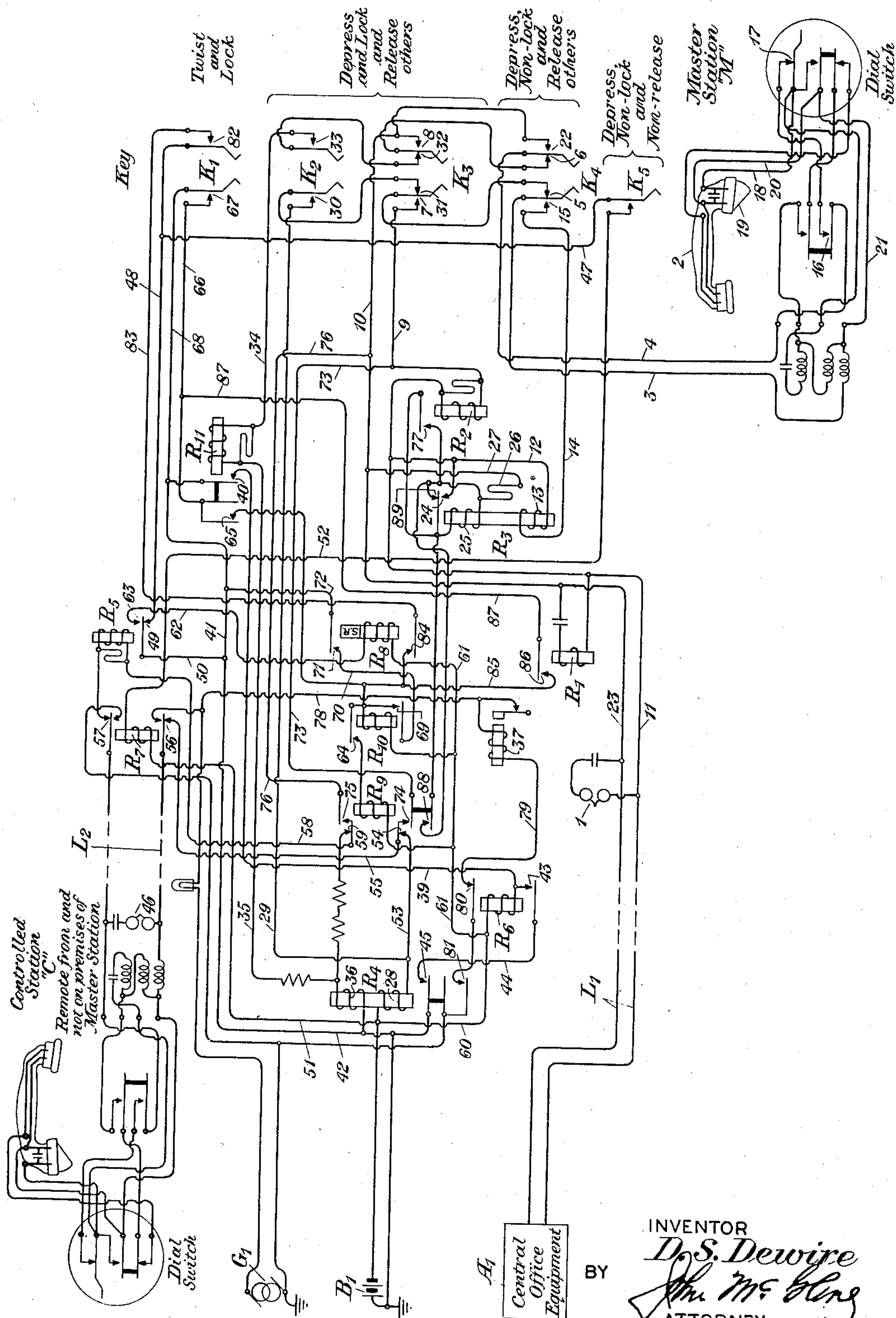
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TELEPHONE SUBSCRIBER'S STATION

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TELEPHONE SUBSCRIBER'S STATION

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This invention relates to telephony and particularly to a system for providing an off-premise extension station service, characterized by means to connect the extension station to the central office line that extends from the main station to the central office, the said connecting means being controlled by a pulsing switch at the extension station.

Where a telephone subscriber has two places of business in the same city and desires to maintain telephone communication between those places without talking through a central office connection, such service has heretofore been provided by a tie line between the telephone stations at the two places. One of those stations is connected directly to the central office, and acts as the master station to establish various connections for the distant station. When the distant station desires to be connected with another telephone subscriber the call is transmitted to the central office through the intermediation of the operator at the master station. Thereafter that operator holds the central office line at the master station and then, after signaling the controlled station, transfers the central office line to the said controlled station.

The circuits employed to furnish the type of service above described have numerous limitations that render the operation of such circuits unsatisfactory. The systems of the prior art require the use of a hand generator for signaling between the master station and the controlled station (and vice versa) which, in turn, require the use of a separate bell at the master station in addition to that required for signaling from the central office. Furthermore, the method employed to signal the controlled station requires the use of a short-circuited hand generator at the master station which is difficult to operate and results in complaints from subscribers. Another difficulty resides in the fact that the master station is compelled to monitor the connection between the distant station and the central office in order to effect the disconnection of the circuit when the subscriber at the controlled station replaces his receiver upon the switchhook at the termination of the conversation. Another undesirable feature is the necessity for a control key and a local battery supply at the controlled station. Finally, the system employed has relatively low loop resistance limits, which is a deterrent to its extensive use.

In the circuit in which the present invention is embodied, the distant station calls the master

station by operating a buzzer located at the latter station, and the master station calls the distant station by applying ringing current to the tie line by operating a push button at the master station, thereby eliminating the need for hand generators at each of those stations. A feature of considerable importance resides in the method and means for switching the connection of the central office line from the master station to the controlled station in this improved circuit. That connection is effected in certain cases by transmitting an impulse from a pulsing switch at the controlled station which, by the actuation of certain relays, effectively connects the tie line to the central office line at the master station after the transfer key has been operated. Thereafter, the disconnection of those lines is automatic upon the restoration of the receiver at the controlled station to its switchhook. Another feature of importance lies in the fact that there are no loop resistance limitations in this improved circuit because dial impulse repeaters may be employed either between the central office and the master station or between the master and controlled stations to provide satisfactory supervision and to maintain the desired grade of transmission.

Other objects and advantages of this invention will be apparent from the following description when read in connection with the attached drawing that shows one form of embodiment of the invention.

The central office may be either of the automatic type, or of the manual type in which connections between various subscriber stations are established by an operator. The master station may or may not be equipped with a dial, depending upon the type of central office. The controlled station must always be equipped with a dial or other pulsing switch designed to send out an open circuit impulse of predetermined time interval. For the purpose of description, we will assume an automatic telephone system.

In the drawing, A₁ represents a central office having therein the usual automatic equipment for establishing connections between various subscriber stations and for ringing other subscribers' lines. The office A₁ is connected by the central office line L₁ to the master station M having thereat a dial substation set, a plurality of keys and a plurality of relays by means of which the functions of this invention are accomplished. There is also provided a source of direct current B₁ which may be either a local battery or a connection to the central office battery. Also there

is provided a source of ringing current G_1 which may be either a local source or a connection to the central office ringing supply. Extending from the location of the master station is a tie line L_2 which serves to connect a controlled dial station C, at a distant point, to the circuit at the master station M. In the drawing the receivers at both stations are represented as being upon their switchhooks, it being understood that upon their removal the contacts of the respective switches, now shown open, will be closed. The nature of this invention will be understood from the following description of the mode of operation of the circuit to provide communication between the central office and the master station, also to provide intercommunication between the master and the controlled stations and to provide the connection between the controlled station and the central office A_1 .

The manner in which communication is established between the office A_1 and the master station M is as follows: Ringing current transmitted from A_1 will operate the ringer 1 at the master station, and will also operate the relay R_1 which, however, in this instance performs no useful function. The attendant at station M depresses the key K_3 which locks and connects the handset 2 at station M with the conductors of the line L_1 , the connection including conductors 3 and 4, contacts 5 and 6 of key K_1 , contacts 7 and 8 of key K_3 , winding of relay R_2 and conductors 9 and 10 which are connected to the line L_1 . Relay R_2 operates, closing contact 77 which short-circuits winding 25 of relay R_3 in parallel with contact 69 of relay R_3 . If the attendant desires to hold the call coming in on the line L_1 , she depresses key K_4 , which is a non-locking key. That serves to operate relay R_3 , the current for such operation flowing from the central office over conductor 11 of line L_1 , thence over a circuit that includes conductor 12, winding 13 of relay R_3 conductor 14, contact 15 of key K_4 , conductors 3, 21 and 20, transmitter 19, conductor 18, contacts 17 and 16, conductor 4, contact 22 of key K_4 and conductor 10 to the other side 23 of the line L_1 . Key K_3 then releases by the operation of key K_4 and allows the release of relay R_2 . Both short-circuiting paths around winding 25 of relay R_3 are now open. Relay R_3 will be operated and will be locked across the line L_1 by a circuit extending from conductor 11 through conductor 12, contact 24, winding 25, resistance 26 and conductor 27 to the other side 23 of the line L_1 . The attendant will release the key K_4 , thereby de-energizing winding 13.

Let it be assumed that the call that came from the central office was intended for the distant controlled station C. The attendant at the master station operates the holding relay R_3 to connect it across the conductors of line L_1 in the manner described hereinbefore. The attendant at the master station thereupon depresses the intercommunicating key K_2 which causes the operation of relays R_{11} and R_4 , the operation being effected by current over a circuit that extends from the battery B_1 , winding 28 of relay R_4 , conductor 29, contact 30 of key K_2 , contact 31 of key K_3 , contact 5 of key K_4 , thence over conductor 3 and through the contacts of the switches and through the transmitter and dial of station M, thence over conductor 4, contact 6 of key K_4 , contact 32 of key K_3 , contact 33 of key K_2 , thence over conductor 34, winding of relay R_{11} , conductor 35, winding 36 of relay R_4 to ground. The operation of relay R_4 closes a cir-

cuit for the operation of the buzzer 37 but does not effect its operation. Likewise the operation of relay R_{11} prepares an operating circuit for relay R_6 which circuit may be traced from the battery B_1 , conductor 60, winding of relay R_6 , conductor 39, contact 40 of relay R_{11} , and conductors 41 and 42 to ground. Relay R_6 locks over a circuit that includes contact 43, conductor 44, contact 45 of relay R_4 . The operation of relay R_6 opens the circuit through the buzzer 37. The attendant at the master station then depresses the ringing key K_5 which applies ringing current from the source G_1 to the line L_2 to operate the bell 46 at that station. The circuit by which this ringing current is applied to L_2 may be traced from one side of key K_5 to conductor 47, thence over conductor 48, through contact 49 of relay R_5 , thence over conductors 50 and 42 to one side of battery B_1 , thence over conductor 51 to the winding of relay R_7 , thence over conductor 52 to the other side of the key K_5 . Relay R_7 operates and over its inner contacts ringing current from the generator G_1 flows to the conductors of the line L_2 across which, at the distant station, the ringer 46 is connected. The attendant then releases key K_5 , thereby releasing relay R_7 and disconnecting ringing current from line L_2 .

Upon hearing the bell, the attendant at the controlled station C removes her handset from the switchhook. This causes the operation of relay R_5 by current that flows from battery B_1 , through winding 28 of relay R_4 , thence over conductor 53 and through contact 54 of relay R_9 , thence over conductor 55 and contact 56 of relay R_7 , thence over the lower conductor of the line L_2 to and through the substation C, thence over the upper conductor L_2 and through contact 57 of relay R_7 , the winding of relay R_5 , conductor 58, contact 59 of relay R_9 and winding 36 of relay R_4 to ground. The operation of relay R_5 in turn causes the operation of relay R_8 by current that flows over a circuit that extends from the battery B_1 over conductors 60 and 61 to the winding of relay R_8 , thence over conductor 62 to contact 63 of relay R_5 , thence over conductors 50 and 42 to ground. The operation of relay R_5 opens contact 49 and thereby prevents operation of relay R_7 and application of ringing current to line L_2 by inadvertent operation of key K_5 while the station C handset is removed from the switchhook. The attendant at the master station announces the call to the attendant at the controlled station and thereupon operates the transfer key K_1 . This serves to operate relay R_{10} by closing a circuit that extends from the battery B_1 over conductors 60 and 61, the winding of relay R_{10} , contact 65 of relay R_{11} , conductor 66, contact 67 of key K_1 , conductors 68, 41 and 42 to ground. Relay R_{10} is thereupon locked through a circuit that extends from contact 69 of that relay over conductor 70, contact 71 of relay R_3 , conductor 72, thence over conductors 41 and 42 to ground. The operation of relay R_{10} closes a circuit for the operation of relay R_9 , which circuit extends from the battery B_1 over conductors 60 and 61, the winding of relay R_9 , contact 64 of relay R_{10} and thence to ground over both the operating and locking paths for relay R_{10} . This serves to connect the central office line L_1 to the line L_2 extending to the controlled station. That connection may be traced from conductor 11 of line L_1 to the winding of relay R_2 and thence over a circuit that includes conductor 73, contact 74 of relay R_9 , conductor 55, contact 56 of relay R_7 and the lower

conductor of line L₂ to the circuit of the controlled station C. From that station the circuit may be traced over the upper conductor L₂, through contact 57 of relay R₇, the winding of relay R₅, conductor 58, contact 75 of relay R₉, conductor 76 and conductor 23 of the line L₁. The operation of relay R₉ closes its contact 88 thereby short-circuiting the winding of the holding relay R₃, releasing that relay and removing it from its position across the line L₁. Relay R₂ may or may not operate at this time, depending upon the resistance of line L₂. The operation of the relay R₉ not only connects the tie line L₂ directly with the line L₁ but also disconnects therefrom the circuit by means of which the line L₂ was connected to the master station. The attendant at the master station restores her transfer key K₁ to its normal position. She also replaces her handset on the hook, or she may depress her talking key K₃ to monitor the connection, if such action is desirable. The depression of key K₃ releases key K₂. Either action by the attendant results in the release of relays R₁₁, R₄ and R₆.

The transfer of a call from the master station to the controlled station may also be effected by direct ringing. The attendant at the master station operates the transfer key K₁ which remains locked in spite of subsequent operation of keys K₂ and K₃. The attendant then operates the ringing key K₅ which in turn operates relay R₇ and applies ringing current to the line L₂. By transmitting impulses of ringing current according to an adopted code, the attendant at the controlled station C understands that a call from the office A₁ is to be picked up. The attendant at station C thereupon removes her handset from the switchhook which, as described hereinbefore, causes the operation of relay R₅ and that in turn opens the circuit of relay R₇. The operation of relay R₅ in turn causes the operation of relay R₈, which prepares both operating and locking circuits for relay R₁₀. Relay R₄ is also operated over a circuit that extends from the battery B₁, winding 28 of relay R₄, conductor 53, contact 54 of relay R₉, conductor 55, contact 56 of relay R₇, the lower conductor of line L₂, thence through the substation circuit at C and over the upper conductor of line L₂, through contact 57 of relay R₇, winding of relay R₅, conductor 58, contact 59 of relay R₉ and winding 36 of relay R₄ to ground. The operation of relay R₄ closes a circuit that extends from generator G₁ over conductor 78, the winding of buzzer 37, conductor 79, contact 80 of relay R₆, contact 81 of relay R₄ to the grounded side of the generator G₁. That causes the operation of the buzzer 37. The attendant at the C station then dials "1" which transmits over the line L₂ an open impulse of fixed duration of approximately .06 second. That opening of the circuit at the C station releases relay R₅ which closes a circuit from ground over conductors 42 and 50, contact 49 of relay R₅, conductor 48, contact 82 of key K₁, conductor 83, contact 84 of relay R₈, the winding of relay R₁₀ and conductors 61 and 60 to battery. Relay R₈ is of the slow-release type so that its contacts do not open during the interval in which the circuit of its winding is opened at contact 63 of relay R₅. Relay R₁₀ operates, locks itself and effects the operation of relay R₉ in the manner hereinbefore described, which connects the conductors of line L₁ to the conductors of line L₂ and disconnects line L₂ from the apparatus of the master station. Upon the operation of relay R₉

relay R₄ is released and that in turn disconnects the buzzer. The reclosing of the line at the controlled station C, upon the completion of the transmission of the impulse, operates relay R₅ which recloses the circuit of relay R₈ and keeps this relay and also relays R₁₀ and R₉ energized. Upon the completion of the conversation between office A₁ and the controlled station C the operator at that station will replace her handset and the connection between line L₂ and L₁ will be opened upon the deenergization of the relays.

An outgoing call from the controlled station to the central office A₁ is normally established through the agency of the attendant at the master station. This may be accomplished by having the attendant at the master station obtain the desired central office number before connecting the controlled station to the central office line, or by immediately establishing this connection and allowing the controlled station attendant to obtain the central office number. If the first method is followed, the attendant at the controlled station establishes an intercommunicating call to the master station. The attendant at the controlled station removes her receiver from the hook which causes the operation of relays R₄ and R₅. Relay R₄, when operated, closes the circuit to operate the buzzer 37 and also prepares a locking circuit for relay R₆. The operation of relay R₅ opens the circuit of relay R₇ and thereby prevents inadvertent application of ringing current to line L₂ toward the controlled station C. The operation of relay R₅ also operates relay R₈ and prepares the locking circuit for relay R₁₀ which, as will later be seen, establishes the through connection between the line L₂, extending to the controlled station, and the line L₁ extending to the central office A₁.

The operation of the buzzer 37 attracts the attention of the attendant at the master station who thereupon operates the intercommunicating key K₂ and receives information from the attendant at the controlled station as to the call desired to be made with the central office. The operator at the master station thereupon operates key K₃, obtains the desired central office connection, holds this connection by operating key K₄ and returns to line L₂ by operating key K₂ in the manner hereinbefore described. The connection between the line L₁ and the line L₂ is thereupon made by the operation of the transfer key K₁.

Upon the establishment of the connection between station C and office A₁ the attendant at the master station restores key K₁ to its normal position and replaces her receiver on the hook. Thereupon relays R₁₁, R₄ and R₆ release. Upon the completion of the conversation, the attendant at the controlled station replaces her receiver on the hook and relays R₅, R₈, R₉, R₁₀ and R₂ will release.

The second method suggested above, namely that by which the central office call is placed directly with the central office by the controlled station attendant, is as follows: The attendant at the controlled station establishes an intercommunicating call to the master station as hereinbefore described. The master station attendant, having operated key K₂ and determined that the controlled station attendant desires to place a central office call, operates key K₁, which causes line L₁ to be connected to line L₂. The attendant at the master station then restores key K₁ to its normal position and replaces her handset on the hook, whereupon relays R₁₁, R₄

and R₆ release. Upon completion of the conversation, the attendant at the controlled station replaces her handset on the hook and relays R₅, R₈, R₉, R₁₀ and R₂ release.

In the event that it is desired to give service between the controlled station and the central office A₁ at a time when the attendant is not at the master station, for example, service at night, the transfer key K₁ is left in its operated position.

The procedure for a call from the central office is then as follows: Ringing current transmitted from the central office A₁ will operate the ringer 1 and also the relay R₁. The operation of relay R₁ in turn operates relay R₁₀ by causing the flow of current from the battery B₁ through a circuit that includes conductors 60 and 61, winding of relay R₁₀, contact 86 of relay R₁, conductors 87 and 66, contact 67 of key K₁, conductors 68, 41 and 42 to ground. The operation of relay R₁₀ closes a circuit for the operation of relay R₉, which circuit extends from the battery B₁ over conductors 60 and 61, the winding of relay R₉, contact 64 of relay R₁₀ and thence to ground over the previously described operating path for relay R₁₀. The operation of relay R₉ closes the circuit between the conductors of the line L₁ and those of line L₂, the connection being established through contacts 74 and 75 of relay R₉. The ringing current from the central office will then also operate the ringer 46 at the controlled station. If the attendant at the controlled station removes her receiver from the hook during the ringing interval, relay R₅ will operate, which will lock relay R₉ in the same manner as has previously been described and will thereby hold the connection between the lines L₁ and L₂. If the operator at the controlled station removes her receiver from the hook during the silent interval, she may establish a connection between the controlled station and the central office by dialing "1" exactly as hereinbefore described. Upon the completion of the call the operator at the controlled station replaces her receiver upon the hook which causes the release of the relays hereinbefore stated to be operated and those relays will be restored to their normal condition.

The procedure for a call from the controlled station to the central office is as follows: The attendant at the controlled station removes her receiver from the hook, which causes operation of the buzzer at the master station as hereinbefore described. By dialing "1," the controlled station attendant causes line L₂ to be connected to line L₁ to the central office A₁, and disconnects the master station buzzer. Upon completion of conversation and replacing of the controlled station receiver on the hook, all operated relays restore to their normal condition.

It will be seen from the above description that the controlled station attendant, by removing her receiver from the hook, may signal the master station at any time, regardless of the position of the transfer key K₁.

While this invention has been described as embodied in a particular form and arrangement of parts, it is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a telephone system, the combination with a central office, of a master subscriber's telephone station connected to said central office by a central office line, a controlled telephone

station connected to said master station by a tie line, and switching means at said master station controlled by a pulsing switch at said controlled station to automatically connect said tie line to said central office line.

2. In a telephone system, the combination with a central office of a master subscriber's telephone station, a central office line connecting said office to the said master station, a controlled telephone station, a tie line connecting said controlled station to said master station, means at said master station to apply a code ringing signal to said tie line to call the controlled station, and switching means at said master station and responsive to an impulse sent out by a pulsing switch at said controlled station to automatically connect said tie line to the said central office line.

3. In a telephone system including a central office, a master subscriber's station and a second subscriber's station controlled by said master station, the combination with a central office having thereat telephone apparatus of a master subscriber's station having a telephone set thereat, a central office line extending between said master station and said central office, a controlled subscriber's station having a telephone set thereat including a pulsing switch, a tie line extending between said master and said controlled stations, a relay at the master station responsive to the removal of the receiver from the hook at the controlled station, a second relay, having a slow-release characteristic, energized by the operation of the first mentioned relay, a transfer key also located at the master station, a third relay to establish a connection between the conductors of the said central office line and the said tie line, the said first relay being deenergized by the opening of the tie line during the transmission from the controlled station of an impulse from a pulsing switch, and causing the energization of the said third relay by closing a circuit through the contacts of said transfer key and a contact of said second relay which remains closed due to the slow-release characteristic of the second relay, whereby the said central office line and said tie line will be effectively closed through the contacts of said third relay.

4. In a telephone system the combination with a central office, of a master subscriber's station, a controlled subscriber's station, each of said stations having a telephone thereat, a central office line extending from the master station to the central office, a tie line extending from the said master station to the said controlled station, a relay normally in series with the said tie line and energized by the removal of the telephone receiver from its hook at the controlled station, a second relay having a slow-release characteristic normally energized by the operation of the said first-mentioned relay, a pulsing switch at the said controlled telephone adapted to open the said tie line and to release the said first-mentioned relay for a prefixed interval of time, a third relay adapted to be energized and locked by the operation of the said slow-release relay, and a fourth relay controlled by the said third relay to connect the said tie line to the said central office line.

5. In a telephone system the combination with a central office, of a master subscriber's station and a controlled subscriber's station, each having a telephone thereat, a central office line extending from the master station to the central office,

a tie line extending from the master station to the controlled station, a ringer at the master station responsive to the signaling current from the central office, means at that station to signal the controlled station when the central office desires communication with the latter station, means for holding the call at the master station by bridging a suitable impedance coil across the central office line, a transfer key at the master station having means associated therewith to effect the operation of a relay to connect the said tie line to the said central office line and, in turn, to remove the impedance coil from the said central office line to establish an unimpeded circuit between the central office and the controlled station.

6. In a telephone system the combination with a central office, of a master subscriber's station, a controlled subscriber's station, a central office line extending from the master station to the central office, a tie line extending from the said master station to the said controlled station, a ringer at the master station responsive to signaling current from the central office, a holding coil at the master station comprising a suitable impedance coil adapted to be bridged across the central office line, a transfer key to effectively connect the master telephone to the tie line, a ringing key to transmit a signal to the said controlled station to advise the attendant of an incoming call from the central office, a relay at the master station operated by the removal of the receiver from its hook at the controlled station, a second relay of the slow-release type at the master station operated by the first-mentioned relay, a pulsing switch at the controlled station to effect the release of the said first-mentioned relay for a prefixed interval of time, during which interval the said slow-release relay remains operated, a third relay operated by the joint action of said first relay and said slow-release relay to connect the conductors of the said tie line and the said central office line.

7. A telephone system including a central office, a master station, and a controlled station remote from the said master station, a central office line extending between the central office and the master station, a tie line extending between the master station and the controlled station characterized by the use of a slow-release relay at the master station and a pulsing switch at the extension station to automatically effect the direct connection between the central office line and the tie line.

8. In a telephone system the combination with a master telephone set of a controlled telephone set remote from the master set, a tie line extending from the said controlled set to the said master set but normally disconnected therefrom, a telephone central office having a line extending therefrom to the master station but normally disconnected therefrom, switching means

at the master station to effectively connect the master telephone to the central office line, a second switching means to disconnect the master telephone and to connect a holding coil across the said line, switching means to connect the said master telephone to the said controlled telephone, means to signal the said controlled station and a pulsing switch at the controlled station to effect the direct connection of the said tie line to the said central office line.

9. In a telephone system, the combination with a central office, of a master station having a telephone thereat, a controlled station also having a telephone thereat, a line extending from the central office to the master station, a tie line extending from the master station to the controlled station, a ringer connected to the tie line at the controlled station, means at the master station adapted to apply ringing current to the said tie line, and means controlled by the switchhook of the controlled station to prevent the application of the current to the tie line after the receiver has been removed from the switchhook at the controlled station.

10. In a telephone system, the combination with a central office, of a master station having a telephone thereat, a controlled station also having a telephone and a pulsing device thereat, a line extending from the central office to the master station, a tie line extending from the master station to the controlled station, the said tie line having a relay connected thereto operated by the removal of the receiver from the switchhook at the controlled station, a slow release relay actuated by the operation of the relay connected to the tie line and timed to remain operated during the transmission of the impulse corresponding to the digit 1, a key switch at the master station, switching means controlled by the said slow release relay and operable upon the sending of an impulse corresponding to the digit 1, during the time which the said switching means is closed, to connect the said tie line to the said line extending to the central office.

11. A telephone system including a central office, a master station, and a controlled station remote from the said master station, a central office line extending between the central office and the master station, a tie line extending between the master station and the controlled station, switching means at the said master station to effect the connection of the tie line to the said line extending to the central office, the said switching means being characterized by a slow release relay at the master station, and a pulsing switch at the extension station to automatically operate said switching means to effect the direct connection of the tie line to the said central office line.

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