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TELEPHONE EXCHANGE SYSTEM

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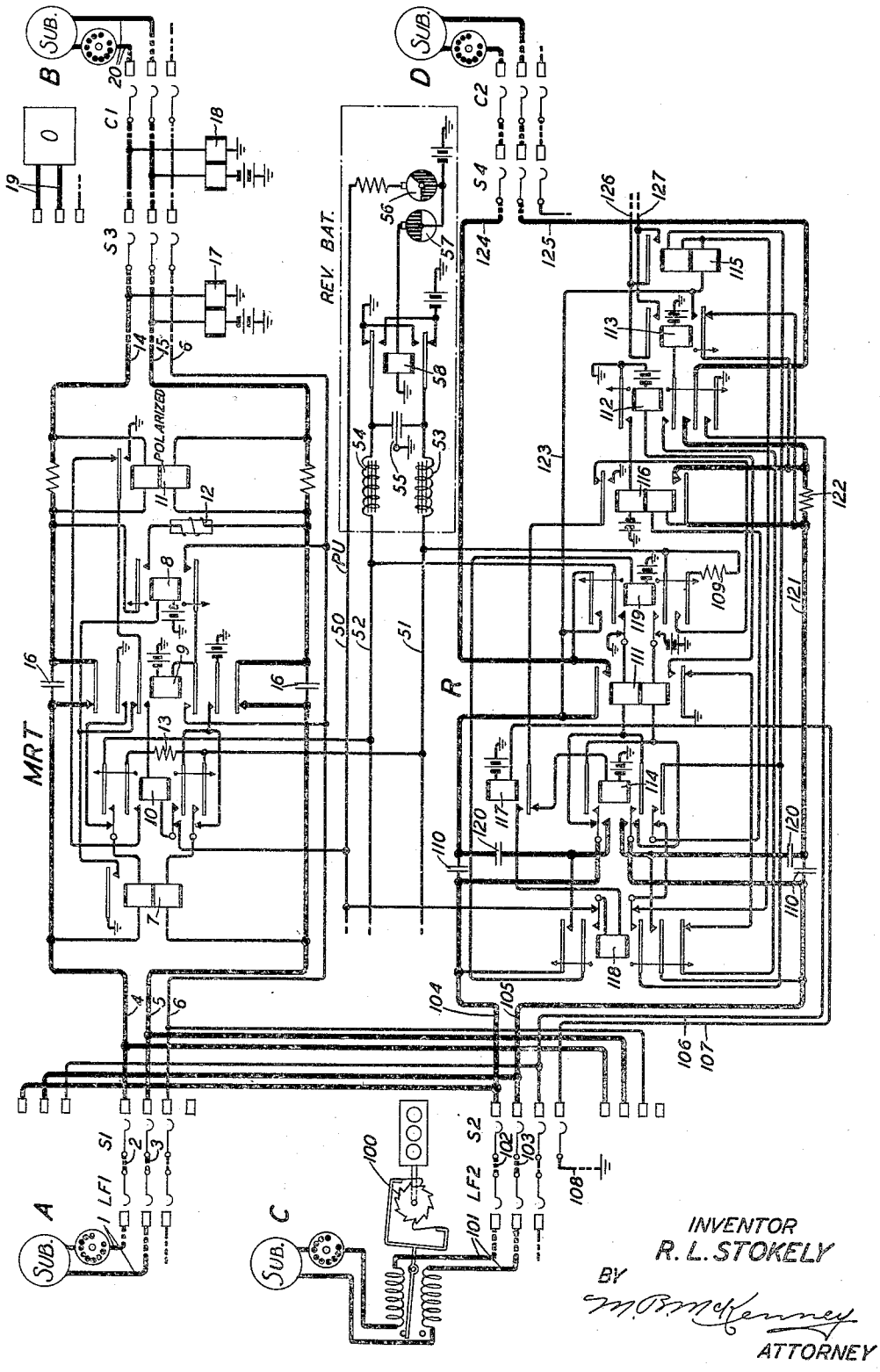

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TELEPHONE EXCHANGE SYSTEM

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This invention relates to telephone exchange systems and more particularly to systems arranged for message rate service.

An object of this invention is to secure a high quality of speech transmission in telephone systems having message registers located at the subscribers' stations. Other objects are to minimize the amount of equipment required and to simplify the circuit arrangements in such a system.

In telephone systems having message rate subscribers, it may be desirable or necessary to locate the message registers at the stations of these subscribers. One of the methods for controlling the operation of the message register at a calling station after the called subscriber has answered is to connect a periodically reversed source of talking current to the calling line. This results in repeated operations of the message register as long as the connection is maintained. In the patent to Bascom 1,679,396 issued August 7, 1928, this method of charging the calling subscriber is applied to a manual telephone system.

In step-by-step systems, it is usual to connect the talking battery for the calling station through the windings of the line relay of the connector circuit employed in establishing a connection. When the message registers are located at the subscribers' stations, the periodically reversed talking battery must be substituted for this battery at the connector. A bridge must be connected across the conductors leading to the connector and the voice currents over the calling line must be repeated to the conductors extending toward the called subscriber.

According to this invention, the repeater circuit employed on interoffice calls to repeat dial impulses over an outgoing trunk and a message register trunk circuit inserted in the same relative position in a local office connection, are each arranged to control the operaton of the calling subscriber's message register, the register being operated by periodically reversing the current over the calling line.

A feature of this invention is a repeater circuit arranged so as to distinguish between calls from message rate and flat rate subscribers' lines. On calls from flat rate lines, the reversal of current over the interoffice trunk consequent upon the response of the subscriber at the called station, is effective to cause the usual reversal of current over the calling line, the latter reversal serving no useful purpose in connection with this invention. On calls from message rate lines, the reversal of current over the interoffice trunk is effective to connect a periodically reversed source of current to the talking conductors extending toward the calling line, each reversal of current being effective to operate the message register at the calling station.

Another feature of the invention is a trunk circuit arranged so that dial pulses need not be repeated on local connections, the pulsing loop being directly extended over the talking conductors of this trunk circuit. Upon the response of the subscriber at the called station, as evidenced by the usual reversal of current over the talking conductors of the trunk, the pulsing loop is opened and the talking circuit is established through condensers which link the incoming and outgoing ends of these conductors. A high impedance bridge is connected across the conductors extending toward the called station to prevent release of the connection and the periodically reversed talking battery is connected to the conductors extending toward the calling station.

On calls to an operator the talking current for the calling station is usually supplied from the operator's cord circuit and if the message register trunk circuit were arranged to repeat dial pulses it would be necessary to provide additional means for eliminating the repeater mechanism so as to improve transmission on a call to an operator which does not require operation of the message register. But when the trunk circuit is arranged in accordance with this invention, the calling line is extended directly to a source of talking current at the operator's position without providing specific means for accomplishing this purpose.

The drawing represents schematically a telephone system having trunk and repeater circuits arranged in accordance with this

invention. The station designated A represents a flat-rate subscriber's station and the station designated C represents a message-rate subscriber's station; these stations are represented as calling stations. The stations designated B and D represent called stations, the station B being in the same local office with stations A and C. LF1 and LF2 represent line-finder switches having access to groups of lines including the lines to which stations A and C are connected; S1, S2, S3 and S4 represent selectors; and C1 and C2 represent connectors having access to groups of lines including the lines to which stations B and D are connected. MRT represents a trunk circuit employed in completing local calls and R represents a repeater circuit employed in completing interoffice connections. An operator's position is represented by the enclosure designated O. The selector S3 has access to trunks some of which terminate at and connect to connector switches such as C1; and others of these trunks such as trunk 19 terminate at the operator's position O.

Calls originated at stations A and C may be assumed to terminate at stations C or D or at the operator's position O. A connection between stations A and B extends through the line-finder LF1, first selector S1 the message register trunk circuit MRT, the second selector S3, and the connector C1; a connection between stations C and B extends through the line-finder LF2, selector S2, trunk circuit MRT, selector S3, and connector C1; a connection between stations C and D extends through line-finder LF2, selector S2, repeater R, selector S4, and connector C2; a connection between stations A and D extends through line-finder LF1, selector S1, repeater R, selector S4, and connector C2; and a connection from station C to the operator's position O extends through the line-finder LF2, selector S2, message-register trunk MRT, selector S3 and trunk 19. The system might be such as to require additional selector switches in the train employed in establishing these connections, the trunk circuit MRT being located in the same relative position in a local connection as that occupied by the repeater R in an inter-office connection in all cases.

The stations A, B, C, and D are of the usual type employed in automatic telephone systems, each being equipped with a dial. In addition there is a metering device 100 at station C for registering the amount of service for which the subscriber is to be charged. This metering device has windings connected in series with the line, and periodical reversals of current over the line are effective to actuate the registering mechanism. The meter may be similar to that described in the patent to E. D. Mead No. 1,762,731, dated June 10, 1930.

The line-finder, selector, and connector switches are of the well known step-by-step type but the invention is applicable to automatic systems generally irrespective of the type of switches employed in completing connections. Those portions of the line-finder, selector, and connector circuits which are not necessary to a complete disclosure of this invention have been omitted; portions thus omitted are represented diagrammatically by broken lines such as those connecting to the brushes of the various switches. For detailed descriptions of the operation of step-by-step selector and connector switches, reference may be had to pages 53 to 65 inclusive of the 2nd edition of "Automatic Telephony" by Smith and Campbell, published in 1921. For a detailed description of the operation of a step-by-step line-finder switch reference may be had to United States Patent No. 1,711,682 issued to H. Hovland May 7, 1929; the brushes which represent the line-finders LF1 and LF2 may be either one of the two sets of brushes as described in the Patent 1,711,682. It should be noted that selector S2, which is associated with message-register lines is provided with one more brush than the selector S1 which is associated with flat-rate lines. This additional brush is required for operating a control relay in the repeater circuit on interoffice calls, the repeater operation being varied in accordance with whether the calling line is a flat-rate or a message-rate line. The difference in operation will be fully explained in the detailed descriptions of connections involving the use of the repeater.

The message register trunk MRT and the outgoing repeater R are each arranged to transfer the calling line from the usual talking battery supply to a periodically reversed talking battery supply, the circuit for controlling the reversals being designated REV.BAT. This reversing circuit includes a reversing relay 58 which is under the control of interrupter 57, relay 58 being alternately operated for a unit period of conversation and then released for a like period. The transfer from the usual talking battery supply is dependent upon the operation of a supervisory relay (relay 11 in trunk circuit MRT or relay 116 in repeater R) in response to the usual reversal of current from the connector circuit when the called subscriber answers. The impedance coils 53 and 54 and the electrolytic condenser 55 are provided to prevent a click when the battery supply leads are reversed. In addition the pick-up interrupter 56 is provided for preventing the transfer of a calling line to the supply conductors 51 and 52 at a time when relay 58 is operated for in such a case the reversal would be instantaneous and the impedance coils 53 and 54 and the condenser 55 would be ineffective to prevent a click in the calling subscriber's receiver. The interrupter 56 is so

designed and its segment so located that battery is connected over pick-up conductor 50 during the interval that relay 58 is normal except for the last two seconds of this interval. This pick-up battery is effective to operate the transfer relay 10 in the trunk or the pick-up relay 118 in the repeater providing the supervisory relay has been operated by the answer of the called subscriber. Should the supervisory relay operate within 2 seconds prior to the operation of relay 58 the transfer relay cannot operate; and therefore a temporary operation of the supervisory relay due to a busy-back signal or other temporary reversal of current will be ineffective to cause the transfer of the calling line to the supply conductors 51 and 52.

In the system disclosed in the drawing the trunk circuit MRT is used in establishing calls originated at both flat-rate and message-rate stations. But since reversals of talking current are unnecessary on calls originated at flat-rate stations the preferred arrangement is to segregate the message-rate stations, using trunks such as MRT only on calls originated at these stations. In this preferred arrangement the repeater R will be used on all interoffice calls, but on a call originated at a flat-rate station the calling subscriber's line is not transferred to the periodically reversed source of talking current and the talking current is maintained in one direction during the coversation.

Consider first a call from station A to station B. When the receiver is removed from the receiver hook at station A a line-finder such as LF1 hunts for and seizes the terminals of line 1 thereby extending the line to the selector S1. In response to the dialing of the number of the called station the switches S1, S3, and C1 operate to complete the connection to station B. The dial impulses for controlling the selector S3 and the connector C1 are transmitted over conductors 4, 5, 14 and 15 of trunk MRT, the talking condensers 16 being shunted by the outer contacts of relay 9. As each selector is seized it connects ground to the sleeve conductor, in the usual manner, to prevent the release of the preceding switches; and with the connection extended to connector C1, the holding ground connected to sleeve conductor 6, is maintained at this switch until the connection is released by the calling subscriber.

Since the features of this invention come into play only on completed calls we will assume that the called station is idle, that ringing current is transmitted to signal the subscriber at this station, and that the receiver is removed to answer the call.

When the called station answers, the current over conductors 14 and 15 of trunk MRT is reversed in the usual manner by the operation of the connector C1, thereby causing the operation of polarized relay 11; at this time the circuit for the talking current over the calling line may be traced from battery, through one winding of the line relay 18 and the tip conductor of connector circuit C1, the tip brush and conductor of selector S3, conductor 14, upper winding of relay 11, outer upper back contact of relay 9, conductor 4, tip conductor 2 and brushes of selector S1 and line-finder LF1, over line 1 and through the subscriber's instrument, ring conductor 3 and brushes of line-finder LF1 and selector S1, conductor 5, outer lower back contact of relay 9, lower winding of relay 11, conductor 15, ring conductor and brush of selector S3, ring conductor of connector C1, and through the other winding of the line relay 18 to ground.

In operating, relay 11 closes a circuit for operating relay 8. Relay 8 closes a circuit from the winding of relay 9 to ground on the sleeve conductor 6. Relay 9 operates and locks through its inner lower front contact to the same ground. The operation of relay 9 interrupts the flow of direct current over conductors 4 and 5 from the battery and ground supply in the connector circuit C1 but the line relay 18 of connector circuit C1 is held operated since the operation of relay 8 bridged the retard coil 12 across conductors 14 and 15 leading to selector S3. The operation of relay 9 closes a circuit for maintaining a flow of talking current over the calling line in the same direction as that of the current which caused the operation of relay 11; this circuit may be traced from battery at the middle lower contacts of relay 9, outer lower back contact of relay 10, lower winding of relay 7, conductor 5, ring conductor 3 and brushes of selector S1 and line-finder LF1, over the calling subscriber's loop, tip conductor 2 and brushes of line-finder LF1 and selector S1, conductor 4, upper winding of relay 7, upper back contact of relay 10, to ground at the outer upper front contact of relay 9. Relay 7 operates thereby closing a circuit for holding relay 8 operated; although the operation of relay 9 opened the circuit for operating relay 8, relay 8 is slow in releasing so that the bridge across conductors 14 and 15 leading to selector S3 will not be opened long enough to cause the release of the connection.

The operation of relay 9 is also effective to connect the ground at the front contact of relay 11, through the winding and inner lower back contact of relay 10, over conductor 50 to the pick-up lead PU of the battery supply circuit REV.BAT. As soon as this lead is connected to battery at interrupter 56, relay 10 operates; and relay 10 locks through the front contact of its inner lower continuity spring to battery at the lower front contact of relay 9. With relay 10 operated, the connection from the calling station is transferred, through the front con-

tacts of the outer continuity springs of relay 10, from the battery and ground at the contacts of relay 9, over conductors 51 and 52, to battery and ground at the back contacts of relay 58. The talking current over conductors 4 and 5 and over the calling line is thereafter periodically reversed, but these reversals are ineffective on this particular call since the subscriber at station A is a flat-rate subscriber.

When the receiver is replaced at station A relay 7 releases, thereby causing the release of relay 8. Relay 8 opens the bridge across the conductors 14 and 15 leading to selector S3, thereby causing the release of the line relay 18 of connector C1 so that the holding ground is disconnected from sleeve conductor 6. Relay 9 releases thereby causing the release of relay 10. The connector switch C1, selector switches S3 and S1, and the line-finder switch LF1 are all restored to normal in the usual manner.

If the message-rate subscriber at station C were calling station B, the connection would extend through line-finder LF2, selector S2, message-register trunk circuit MRT, selector S3, and connector C1. In this case the reversals of current over the calling line after the called subscriber answers are effective to operate the meter 100 and thus charge the subscriber at station C for each unit period of conversation. Should the called subscriber move the receiver hook up and down, relay 11 is alternately released and reoperated by the reversals of current from the connector C1; but false charging on account of these reversals does not result, since relay 10 is slow-in-releasing.

If the called subscriber replaces the receiver before the connection is released by the calling subscriber relay 11 is permanently released to prevent further charging. In this case relay 10 releases immediately if relay 58 in the REV.BAT. circuit is normal. But if relay 58 is operated, relay 10 is held operated in a circuit which may be traced from battery at the outer lower front contact of relay 9, inner lower front contact and winding of relay 10, inner upper front contact of relay 9, back contact of relay 11, inner upper front contact of relay 10, resistance 13, supply conductor 51, coil 53, lower front contact of relay 58, to ground; when relay 58 releases relay 10 releases, thereby restoring the connection from line 1 to battery and ground at the contacts of relay 9.

When the calling subscriber replaces the receiver at station C, the line circuit is opened thereby preventing further operation of the meter 100 and releasing relay 7. Relay 8 is thereby released to open the bridge across conductors 14 and 15 and thus release the line relay of the conductor C1. If not already released, due to the reversal of current from the connector when the receiver is replaced at the called station, relay 11 releases when relay 8 opens the bridge. The release of the line relay of the connector causes the holding ground to be disconnected from the sleeve conductor. With the holding ground disconnected, relay 9 releases thereby causing the release of relay 10.

If the subscriber at C is calling the operator at O, the trunk circuit MRT permits dial impulses to be transmitted directly to the selector S3 for extending the line to the trunk 19. Since the answer of the operator does not cause the reversal of current over conductors 14 and 15, relay 11 does not operate and as a result the calling station is supplied with talking current from the operator's position in the usual manner without providing additional equipment in the message-register trunk to prevent the transfer of the calling station to the periodically reversed source of talking battery REV.BAT. and without additional equipment having been provided to permit dial pulses for establishing the connection to be directly transmitted through the trunk circuit MRT.

Consider now calls involving the use of the repeater circuit R. Assume station C to be calling station D, and that the line 101 has been extended through the line-finder LF2 and selector S2 to the repeater circuit R. The selector S2 connects ground at 108 through its lowermost brush, over conductor 107, to operate control relay 117 since the station C is a message-rate station. Relay 117 partially closes the pick-up circuit for operating relay 118 after the called subscriber has answered.

With the line 101 extended to the repeater R, the line relay 111 of the repeater is operated in a circuit which may be traced from battery and ground at the inner back contacts of relay 119, windings of relay 111, inner back contacts of relay 114, conductors 104 and 105, tip and ring conductors and brushes of selector S2 and line-finder LF2, and over line 101 and through the subscriber's instrument at station C. Relay 111 closes a circuit for operating relay 112 and relay 112 closes a bridge across conductors 124 and 125 leading to selector S4; this bridge may be traced from conductor 124, through the upper front contact of relay 111, lower winding of relay 115, inner lower back contact of relay 118, outer lower back contact of relay 114, lower winding of relay 116, lower back contact of relay 113, and through the middle lower front contact of relay 112, to conductor 125. The line relay (not shown) of selector S4 is thereby operated in the usual manner; and relay 115 is also operated to connect conductor 126 of the all trunks busy register circuit (not shown) to conductor 127 of the same circuit. Relay 112 also connects a holding ground to sleeve conductor 106, to prevent

the release of the line-finder LF2 and the selector S2, and connects ground to the upper winding of relay 116. Relay 116 does not operate at this time since the current through its lower winding tends to neutralize the effect of the current through its upper winding.

When the subscriber at station C dials the remaining digits of the called station's number relay 111 responds to each train of impulses so as to interrupt the bridge across conductors 124 and 125 and thus repeat the impulses to selector S4 and connector C2. Relay 112 is slow in releasing and remains operated during the transmission of each train of impulses. Upon receipt of the first impulse in each train, the release of relay 111 causes the operation of relay 113. Relay 113 is a slow-to-release relay and it remains operated until all of the impulses in each train have been received. In operating, relay 113 short-circuits the lower windings of relays 115 and 116 and closes another connection between conductors 126 and 127 so that the release of relay 115 during the transmission of impulses will not falsely indicate that this trunk is idle. When relay 113 releases at the end of each train of impulses, resistance 122 is effective to prevent the sending of an additional false pulse to the line relay of the selector S4 or connector C2. With relay 113 released, relay 115 is reoperated by the current through its lower winding.

In response to the impulses transmitted over conductors 124 and 125, the selector S4 and connector C2 extend the connection to the calling line. When the receiver is removed at the called station to answer the call, the current over conductors 14 and 15 is reversed in the usual manner, thereby causing the operation of relay 116 since the current through its lower winding is now aiding the current through the upper winding. Relay 116 short-circuits resistance 122 and closes a circuit for operating the pick-up relay 118; this circuit may be traced from ground at the upper front contact of relay 116, front contact of relay 117, winding and upper back contact of relay 118, over pick-up lead 50 to the pick-up interrupter 56. When interrupter 56 connects battery to lead 50, pick-up relay 118 operates and closes a circuit for locking itself operated and for operating relay 119; this circuit may be traced from battery through the winding of relay 119, inner upper continuity front contact and winding of relay 118, front contact of relay 117, to ground at the upper front contact of relay 116. Relay 118 also connects condensers 120 in parallel with condensers 110 and connects the upper winding of relay 115 in series with its lower winding to increase the impedance of the bridge across the conductors 124 and 125; transmission of the talking current between stations C and D is thereby improved.

In operating, relay 119 transfers the windings of line relay 111 from battery and ground at its inner back contacts to conductors 51 and 52 leading to the reversing circuit REV. BAT. The current over conductors 104 and 105 and over the calling line is thereafter periodically reversed to operate the meter 100 for each unit period of conversation as long as the talking connection is maintained. Relay 119 also prepares a circuit for preventing the immediate release of relays 118 and 119 in case the called subscriber replaces the receiver and relay 116 releases during the time that relay 58 is operated and the current over line 101 is in the reversed direction; assuming relay 116 to have released and relay 58 to be operated this circuit may be traced from battery through the winding of relay 119, inner upper continuity front contact and winding of relay 118, front contact of relay 117, back contact of relay 116, outer lower front contact of relay 119, resistance 109, over conductor 51, coil 53, lower front contact of relay 58, to ground. Relays 118 and 119 are slow in releasing so that the momentary release of relay 116, on account of reversals of current created by the called subscriber if he alternately moves the receiver hook up and down, will not be effective to falsely operate the meter 100. Relay 119 also short-circuits the pulse repeating contacts of relay 111 so that the momentary release of relay 111 each time the current through its windings is reversed will not cause the opening of the bridge across conductors 124 and 125.

If the receiver is replaced at the called station before the connection is released by the calling subscriber relay 116 releases. As soon thereafter as relay 58 is released relays 118 and 119 release thereby transferring the connection from the calling line from conductors 51 and 52 to battery and ground at the inner back contacts of relay 119 so as to prevent further operation of the meter 100.

When the receiver is replaced at the calling station no further operation of the meter 100 can take place irrespective of whether the receiver has been replaced at the called station. Relay 111 releases, thereby causing the release of relay 112. The release of relay 112 opens the bridge across conductors 124 and 125 thereby releasing the line relay (not shown) of the connector C2; the selector is restored to normal in the usual manner and, if the receiver has also been replaced at the called station, the connector C2 is restored to normal. The release of 112 also causes the release of relay 116 and disconnects the holding ground from sleeve conductor 106, thereby causing the selector S2 and line-finder LF2 to be restored to normal. Relay 117 releases when the brushes of selector S2 are moved away from the terminals associated with the repeater R; and relays 118 and 119 release as soon as relay 117 releases if not

already released on account of the release of relay 58.

If station A is calling station D the control relay 117 is not operated; since the selector S1 is associated only with flat-rate subscriber's lines the control conductor 107 is not multipled to a terminal in the bank of selector S1. In this case when relay 116 is operated in consequence of the answer of the called subscriber relay 114 operates instead of relay 118. The calling station A continues, therefore, to be supplied with talking current from the battery and ground at the inner back contacts of relay 119 but the direction of the current is reversed by the operation of relay 114. The operation of relay 114 is also effective to connect the upper winding of relay 115 in series with its lower winding in the bridge across conductors 124 and 125 and to connect condensers 120 in parallel with condensers 110. The operation of the repeater R is otherwise the same as that described on a call from station C to station D.

Although this invention is disclosed in a particular system and in specific trunk and repeater circuits, it is understood that the invention may be applied to any system in which the meter for registering the charge for a call is located at the subscriber's station and is operated by periodically reversing the current over the talking conductors of the line.

What is claimed is:

1. In a telephone system, subscriber's lines, a calling station, a called station, an impulse sender at said calling station, a message register for said calling station, a trunk circuit for controlling the operation of said register, means for extending the line of said calling station to said trunk circuit, means including a connector switch for completing the connection between said stations, a pulsing loop including said impulse sender and the talking conductors of said trunk circuit for controlling the operation of said switch, and means associated with said trunk circuit effective upon the response of the subscriber at said called station for periodically reversing the current over the line of said calling station as long as said connection is maintained.

2. In a telephone system, message rate and flat rate subscribers' lines, a calling station, a called station, an impulse sender at said calling station, a message register for each of said message rate subscribers' lines, a trunk, means for extending the line of said calling station to said trunk, a repeater circuit associated with said trunk for repeating pulses originated by the operation of said impulse sender, means associated with said repeater circuit effective upon the response of the subscriber at said called station for reversing the current over the line of said calling station, said reversed current being continuously maintained until the connection is released if said calling station is on a flat rate line, and means associated with said repeater circuit effective upon the response of the subscriber at said called station for periodically reversing the current over the line of said calling station as long as the connection is maintained if said calling station is on a message rate line.

3. In a telephone system, subscribers' lines, a calling station, a called station, an impulse sender at said calling station, a message-register for said calling station, a trunk circuit for controlling the operation of said register, means for extending the line of said calling station to said trunk circuit, means including a connector switch for completing the connection between said stations, a line relay for said connector switch, a pulsing loop including said line relay and said impulse sender and the talking conductors of said trunk circuit for controlling the operation of said switch, and means associated with said trunk circuit effective upon the response of the subscriber at said called station for periodically reversing the current over the line of said calling station as long as said connection is maintained.

4. In a telephone system, subscribers' lines, a calling station on one of said lines equipped with a dial for use in making a call, a service meter for said calling station arranged to respond to reversals of current over the line of said station, other subscribers' stations, an operator's position, means including a trunk and a selector for extending the calling line to another of said stations or to said operator's position, an impulse relay for said selector, a dialing circuit which includes the windings of said relay and the line conductors of said trunk and the interrupter contacts of said dial, a source of periodically reversed talking current, switching means associated with said trunk and effective upon the answer of a call to one of said other stations for connecting said source to the line of said calling station, said switching means being ineffective to connect said source to the line of said calling station on a call to said operator's position.

5. In a telephone system, subscribers' lines, a calling station, a dial at said station, a meter for registering the service to be charged to said calling station and arranged to be operated by reversals of current over the line of said calling station, a called station, means including a trunk and a connector switch for extending a connection from said calling station to said called station, a line relay for said connector, a circuit including said dial and extending from said station over the line conductors of said trunk to the windings of said line relay for controlling the operation of said connector, a periodically reversed source of talking current, a retardation coil, means associated with said connector for reversing the current over the line conductors

of said trunk to said calling station when the subscriber at said called station answers the call, and means associated with said trunk and effective upon reversal of the current from said connector for opening said circuit from said calling station to said line relay and for bridging said retardation coil across the windings of said line relay and for connecting said periodically reversed source of talking current to the line of said calling station.

6. In a telephone system, subscribers' lines, a calling station, a dial at said station, a meter associated with the line of said station for operating in response to a reversal of current over said line, a called station, a trunk and an automatic switch for establishing a connection between said stations, talking condensers connected between the incoming and outgoing ends of the line conductors of said trunk, means for short-circuiting said condensers during the transmission of impulses from said dial to said automatic switch, a retardation coil, a source of periodically reversed talking current, and means effective in consequence of the answer of the called subscriber for opening the short-circuit around said condensers, for bridging said retardation coil across the line conductors leading to said automatic switch, and for connecting said source of periodically reversed talking current to the line of said calling station.

7. In a telephone system, subscribers' lines, a flat-rate subscriber's station, a message-rate subscriber's station, a meter associated with the line of said message-rate station for operation in response to a reversal of current over said line, a called station, a trunk and an automatic switch for establishing a connection between either of said flat-rate and message-rate stations and said called station, means effective in consequence of the answer of the called subscriber for reversing the current over the calling line, said reversed current being continuously maintained if the call originated at said flat-rate station, means effective in consequence of the answer of the called subscriber for periodically reversing the current over the calling line as long as the connection is maintained if the call originated at said message-rate station, and means associated with said trunk for distinguishing between calls originated at said flat-rate and said message-rate stations.

8. In a telephone system, message-rate and flat-rate subscribers' lines, a message register for each of said message-rate lines, means including a repeater for establishing a connection between a calling and a called line, means associated with said repeater for indicating whether said calling line is a flat-rate or a message-rate line, and means effective only if said calling line is a message-rate line for periodically reversing the current over said calling line to operate the message-register of said line for each unit period during which said connection is maintained.

9. In a telephone system, message-rate and flat-rate subscribers' lines, a message-register for each of said message-rate lines operable by a reversal of current over the line with which it is associated, a called line, means including a trunk for extending a connection from a calling line to said called line, means associated with said trunk for indicating whether said calling line is a message-rate or a flat-rate line, and means controlled by said indicating means and rendered effective in consequence of the answer of the called subscriber for periodically reversing the current over said calling line as long as said connection is maintained.

10. In a telephone system, subscribers' lines of two classes, means including a trunk for extending a connection from a calling line to a called line, means associated with said trunk for indicating the class to which said calling line belongs, and means controlled by said indicating means and rendered effective in consequence of the answer of the called subscriber for periodically reversing the current over said calling line as long as said connection is maintained.

11. In a telephone system, message-rate and flat-rate subscribers' lines, a called line, means including a trunk and an automatic switch for extending a connection from a calling line to said called line, means associated with said trunk for indicating whether said calling line is a message-rate or a flat-rate line, and means controlled by said indicating means and rendered effective in consequence of the answer of the called subscriber for reversing the current over said calling line and maintaining the direction of this current as long as said connection is maintained.

In witness whereof, I hereunto subscribe my name this 29 day of May, 1930.

RAY L. STOKELY.