

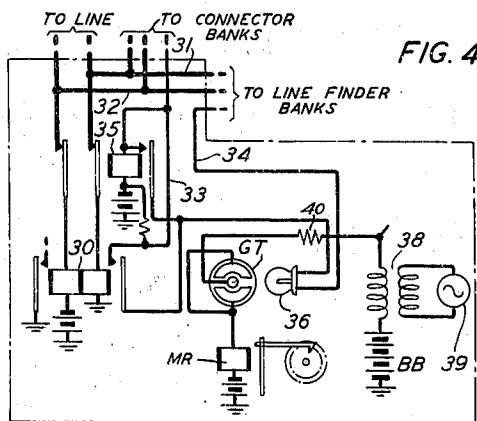
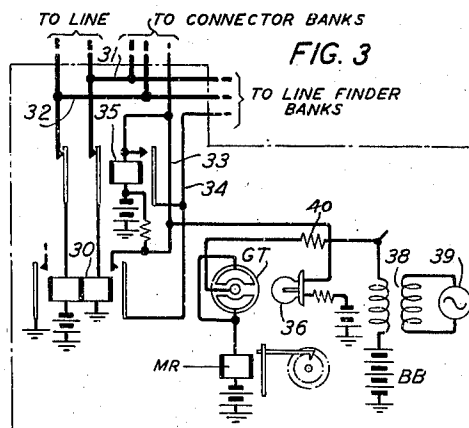
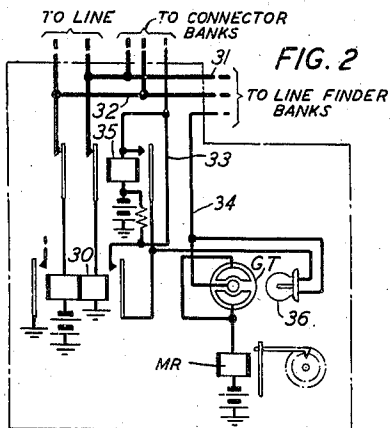
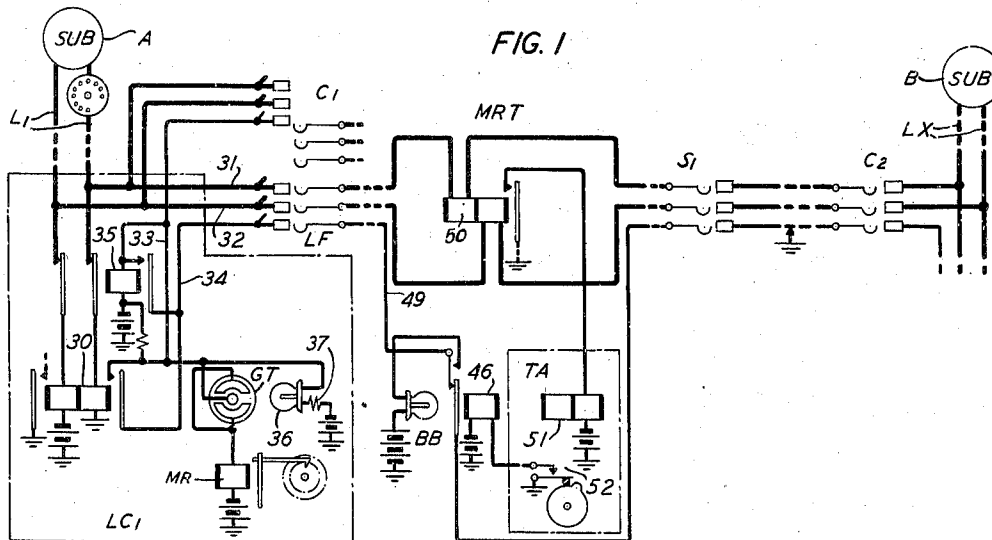
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TELEPHONE SYSTEM

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2,251,346

TELEPHONE SYSTEM

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10 Claims. (Cl. 179—7.1)

This invention relates to telephone systems and particularly to measured service systems.

It is the object of the invention to enable the operation of a calling subscriber's message register when the call is answered and thereafter the periodical reoperation of the register during the time the talking connection is maintained between the calling and called subscriber's stations.

The invention is an arrangement in a telephone system for operating a calling subscriber's message register by the application of a booster battery potential to the line conductor to which the line cut-off relay is connected. According to one feature of the invention the message register is connected to this line conductor through a gas-filled tube, the energization of the tube being controlled by a lamp or other energy radiating element. The lamp may be connected either in parallel or in series with the line cut-off relay. The application of booster battery potential to said conductor is effective to hold the line cut-off relay and energize the lamp; the radiation from the lamp being effective, in combination with the application of booster battery potential, to ionize the gas in the tube; whereupon the message register is operated in series with the tube.

According to another feature the message register is connected in series with a battery and a gas-filled tube, the breakdown of the tube and operation of the register being effected upon application of a booster battery potential to the line conductor to which the line cut-off relay is connected by the energization of a lamp adjacent the gas-filled tube, the radiation of energy from the lamp being effective to ionize the gas in the tube and thus close the register operating circuit. The lamp may be connected either in parallel or in series with the line cut-off relay. The meter operating circuit includes a transformer winding through which an alternating potential of a low frequency, such as 60 cycles is impressed across the tube to effect its permanent deenergization upon disconnection of the booster battery potential from the line conductor.

The invention will be further explained by describing the system and circuit arrangements in which the features of the invention are embodied, such a system being shown schematically in the drawing which forms a part of this invention. The invention is not limited in its application to the particular system or arrangements shown in the drawing but is generally

applicable to measured service communication systems.

Referring to the drawing:

Fig. 1 represents a telephone system which comprises subscribers' stations A and B, lines L1 and Lx, line circuit LC1, line finder LF, selector S1, a message rate trunk circuit MRT connecting the line finder LF to the selector S1, and connectors C1 and C2.

Each of Figs. 2, 3 and 4 shows a modification of the line circuit LC1 of Fig. 1.

The subscribers' stations are of the common battery type which include a dial or impulse sender for controlling the operation of selector and connector switches through which connections with called subscribers are established. Two batteries are shown, the one without designation being the usual central office battery. The other battery is used as a booster battery and is marked BB.

The line finder switch LF, selector switch S1 and connector switches C1 and C2 are of the well known two-motion step-by-step type. Reference may be had to pages 53 to 65 inclusive of "Automatic Telephony," 2nd edition by Smith and Campbell for a description of the structure of said switches and their operation when used as selectors and connectors. Reference may be had to the patent to R. L. Stokely, No. 1,799,654 of April 7, 1931, for a description of the operation of a two-motion step-by-step line finder.

The line circuit LC1 shown in Fig. 1 comprises a line relay 30, a line cut-off relay 35, a message register MR connected through a gas-filled tube GT to conductor 33 in parallel with the line cut-off relay 35 and in parallel with a lamp 36 adjacent the gas-filled tube GT. The operation of the line relay 30 upon initiation of a call at station A is effective, as described in the aforementioned patent to R. L. Stokely, to start an idle line finder LF, the cut-off relay 35 being operated, by the application of ground potential to conductor 34, as soon as the calling line is connected by a line finder LF to the associated message rate trunk circuit MRT and first selector S1. Relay 35 locks to conductor 34 and connects conductor 34 to the lamp 36 and anode element of tube GT. The current through the lamp 36 is limited by a resistor 37 to prevent the lighting of the lamp upon connection of ground potential to conductor 34.

The message rate trunk circuit MRT comprises a supervisory relay 50 which is operated by a reversal of the current, when the called subscriber answers, to start a timing mechanism

TA which measures off unit intervals of time during which the talking connection between the calling and called stations is maintained.

The selector S1 associated with the line finder LF is operatively controlled by the impulses created by the dialing of the first digit of a called subscriber's number to select a corresponding group of terminals and an unguarded set of terminals therein leading to a succeeding switch through which the desired connection may be established. Succeeding digits dialed by the calling subscriber affect the operation of intermediate selectors, if any, and a connector C2 to complete the connection with the called line. The connection is maintained under the control of the calling station by the connection of ground potential in the connector C2 to the test terminal in the bank of selector S1. The selector S1, line finder LF and cut-off relay 35 are all held operated by this ground potential in usual manner. The connector C2 is arranged to ring the called station; and, when the call is answered, the connector reverses the current through the windings of the supervisory relay 50 to effect its operation. Relay 50 closes a circuit for operating the start magnet 51 of timing mechanism TA, which mechanism may be individual to the trunk circuit MRT or common to a plurality of such trunk circuits. As soon as the timing mechanism moves out of normal position to start the timing of an interval for which one operation of the calling subscriber's message register is required, contact 52 closes a circuit for operating relay 46. Relay 46 disconnects the holding ground potential from conductor 49 and closes a circuit from booster battery BB, through the front contact of relay 45, conductor 49, lower brush of line finder LF, conductor 34, front contact of relay 35, conductor 33, and through lamp 36 in parallel with the cut-off relay 35. The lamp 36 is thereby lighted, the radiation of energy from the lamp through the gas in tube GT and application of booster battery potential being effective to break down tube GT and operate the message register MR. When relay 46 releases, the holding ground potential is again applied to conductor 49 in place of booster battery potential, thereby deenergizing the lamp 36, tube GT and register MR. Each succeeding closure of timing contact 52, while the talking circuit is maintained, effects the reoperation of relay 46 and register MR.

The line circuit shown in Fig. 2 is similar to that shown in Fig. 1 except that the lamp 36 is connected in series with the winding of the line cut-off relay 35 instead of in parallel with this relay.

The line circuits shown in Figs. 3 and 4 are similar to the line circuit shown in Figs. 1 and 2 except that the circuit for operating and message register does not include the line conductors 33 and 34 but includes a resistor 40, a winding of a transformer 38, and the booster battery BB. Upon application of booster battery potential to conductor 34 in place of ground potential, the lamp 36 is energized to cause ionization of the gas in, and breakdown of, tube GT; whereupon a circuit is closed from booster battery through the left winding of transformer 38, resistor 37, and the winding of the register MR to operate the register. The tube GT is extinguished by each opposing half cycle of alternating potential applied by source 39 through transformer 38; but as long as lamp 36 is lighted, the tube GT is again energized during the other

half cycle. Each of the message registers is designed to be slow in releasing so that it will not release upon deenergization of tube GT during the opposing half cycle of alternating potential from source 39. If necessary, a condenser can be connected in parallel with each of the registers to prevent release of the register until after lamp 36 is extinguished. When ground potential is again applied to conductor 49, in place of booster battery potential, the cut-off relay 35 is held operated but the lamp 36 is partially deenergized. Upon deenergization of lamp 36, the tube GT is deenergized and register MR released by the impression of an opposing half cycle of a low alternating potential, such as 60 cycles, through transformer 38 in series with the booster battery BB.

Although the arrangements above described contemplate a single operation of a calling subscriber's message register for each conversation unit, the arrangement may be one in which the register is operated once or a plurality of times when a call is answered or for each unit of conversation, the number of operations depending on the zone within which the called station is located with respect to the calling station.

What is claimed is:

1. In a telephone system, a line circuit comprising a control conductor, a line cut-off relay, a gas-filled tube, a lamp adapted to radiate energy to ionize the gas in said tube, means connecting said relay and said lamp in parallel to said conductor, and a message register, said register connected in series with the tube for operation upon breakdown of the tube, means for applying ground potential to said conductor to operate said relay, said lamp being insufficiently energized upon application of ground potential to said conductor to effect breakdown of the tube, and means for applying booster battery potential in place of ground potential to said conductor to hold said relay and to fully energize said lamp to effect breakdown of the tube.

2. In a telephone system, a line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said relay, said lamp and the anode of said tube to said conductor, and a message register connected to the cathode of said tube for operation upon breakdown of said tube, said relay being operatively energized by the application of ground or booster battery potential to said conductor, said lamp being insufficiently energized by the application of ground potential and sufficiently energized by the application of booster battery potential to said conductor to radiate light through the gas in said tube to reduce the potential difference required across its elements to effect breakdown, thereby to effect breakdown of the tube and operation of the register responsive to application of booster battery potential to said conductor.

3. In a telephone system, a line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said relay, said lamp and the anode of said tube in parallel to said conductor, and a message register connected to the cathode of said tube for operation upon breakdown of said tube, said relay being operatively energized by the application of ground or booster battery potential to said conductor, said lamp being insufficiently energized by the application of ground potential and sufficiently energized by the application of booster battery potential to said

conductor to radiate light through the gas in said tube to reduce the potential difference required across its elements to effect breakdown, thereby to effect breakdown of the tube and operation of the register responsive to application of booster battery potential to said conductor.

4. In a telephone system, a line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said relay and said lamp in series to said conductor, the anode of said tube being connected to said conductor, and a message register connected to the cathode of said tube for operation upon breakdown of said tube, said relay being operatively energized by the application of ground or booster battery potential to said conductor, said lamp being insufficiently energized by the application of ground potential and sufficiently energized by the application of booster battery potential to said conductor to radiate light through the gas in said tube to reduce the potential difference required across its elements to effect breakdown, thereby to effect breakdown of the tube and operation of the register responsive to application of booster battery potential to said conductor.

5. In a telephone system, a line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said lamp and relay to said conductor, said relay being operatively energized responsive to the application of ground or booster battery potential to said conductor, said lamp being insufficiently energized by the application of ground potential and sufficiently energized by the application of booster battery potential to said conductor to radiate light through the gas in said tube, a message register and battery connected in series with the elements of said tube, breakdown of the tube and operation of the register being effected by the lighting of said lamp.

6. In a telephone system, a line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said lamp and relay in parallel to said conductor, said relay being operatively energized responsive to the application of ground or booster battery potential to said conductor, said lamp being insufficiently energized by the application of ground potential and sufficiently energized by the application of booster battery potential to said conductor to radiate light through the gas in said tube, a message register and battery connected in series with the elements of said tube, breakdown of the tube and operation of the register being effected by the lighting of said lamp.

7. In a telephone system, a line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said lamp and relay in series with said conductor, said relay being operatively energized responsive to the application of ground or booster battery potential to said conductor, said lamp being insufficiently energized by the application of ground potential and sufficiently energized by the application of booster battery potential to said conductor to radiate light

through the gas in said tube, a message register and battery connected in series with the elements of said tube, breakdown of the tube and operation of the register being effected by the lighting of said lamp.

8. In a telephone system, a calling subscriber's station, line and line circuit, said line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said relay, lamp and the anode of said tube to said conductor, and a message register connected to the cathode of said tube for operation upon breakdown of the tube, a called line and station, means including a message rate trunk circuit connecting said calling and called stations for conversation, means applying ground potential to said conductor to operate said relay, the current through said lamp due to the application of ground potential to said conductor being ineffective to light said lamp, means associated with said trunk circuit for measuring off intervals of time while said connection is maintained, each such interval constituting a message unit for which one operation of the calling subscriber's register is required, means effective at the beginning of an interval for applying booster battery potential to said conductor in place of ground potential thereby to hold said relay and light said lamp, the energy thereupon radiated by said lamp being effective to ionize the gas in said tube and thus effect the operation of said register.

9. In a telephone system, a line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said relay and lamp in parallel to said conductor, and a message register, a source of potential connected in series with said register and said tube, said tube being normally deenergized, means for applying ground potential to said conductor to operate said relay without lighting said lamp, means for applying a potential to said conductor to hold said relay and light said lamp, the energy radiated by said lamp being effective to break down the tube and operate said register, and means comprising a transformer for superimposing an alternating potential on said breakdown potential to extinguish the tube when said lamp is extinguished.

10. In a telephone system, a line circuit comprising a line cut-off relay, a control conductor, a gas-filled tube, a lamp adjacent said tube, means connecting said relay and lamp in series with said conductor, and a message register, a source of potential connected in series with said register and said tube, said tube being normally deenergized, means for applying ground potential to said conductor to operate said relay without lighting said lamp, means for applying a potential to said conductor to hold said relay and light said lamp, the energy radiated by said lamp being effective to break down the tube and operate said register, and means comprising a transformer for superimposing an alternating potential on said breakdown potential to extinguish the tube when said lamp is extinguished.

EDWARD VROOM.