

June 15, 1943.

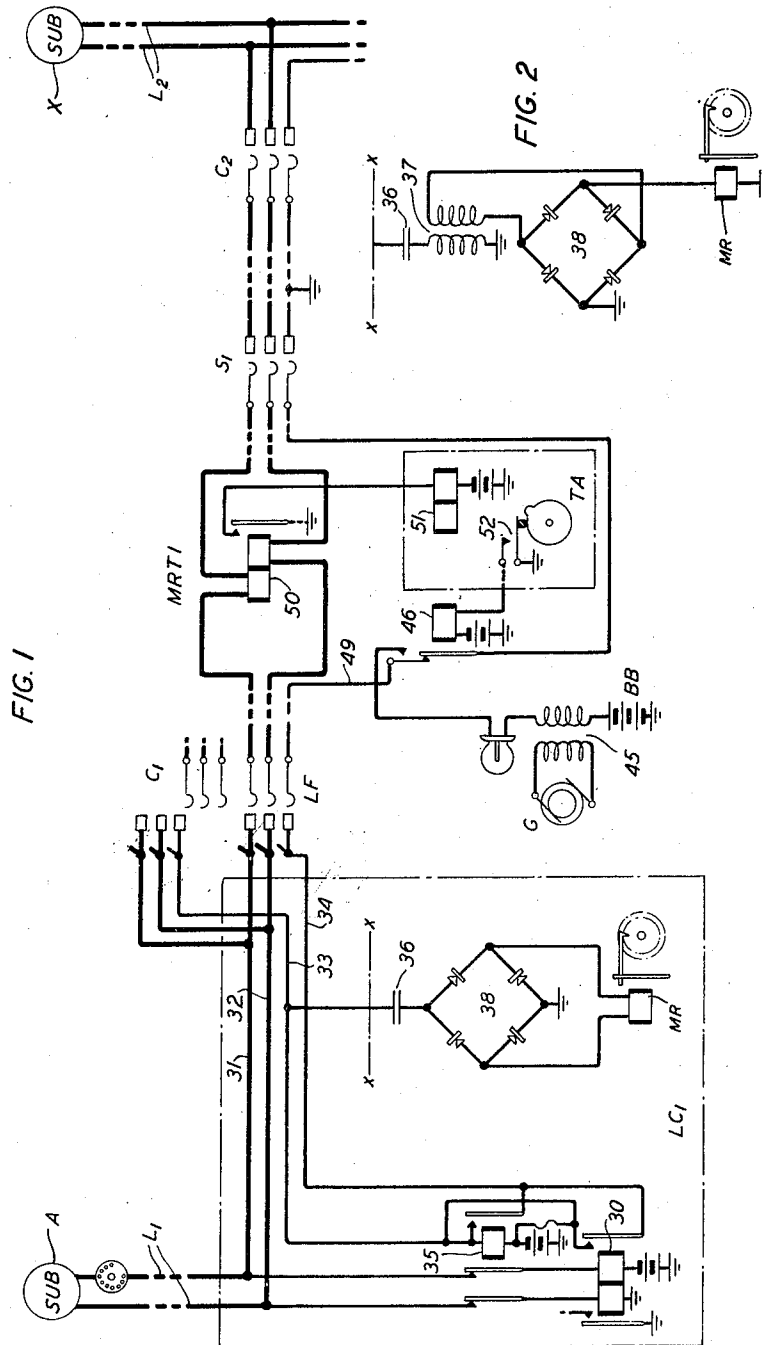
E. VROOM

2,321,714

TELEPHONE SYSTEM

Filed Sept. 28, 1940

2 Sheets-Sheet 1



INVENTOR
E. VROOM

BY

R. O. Corvill

ATTORNEY

June 15, 1943.

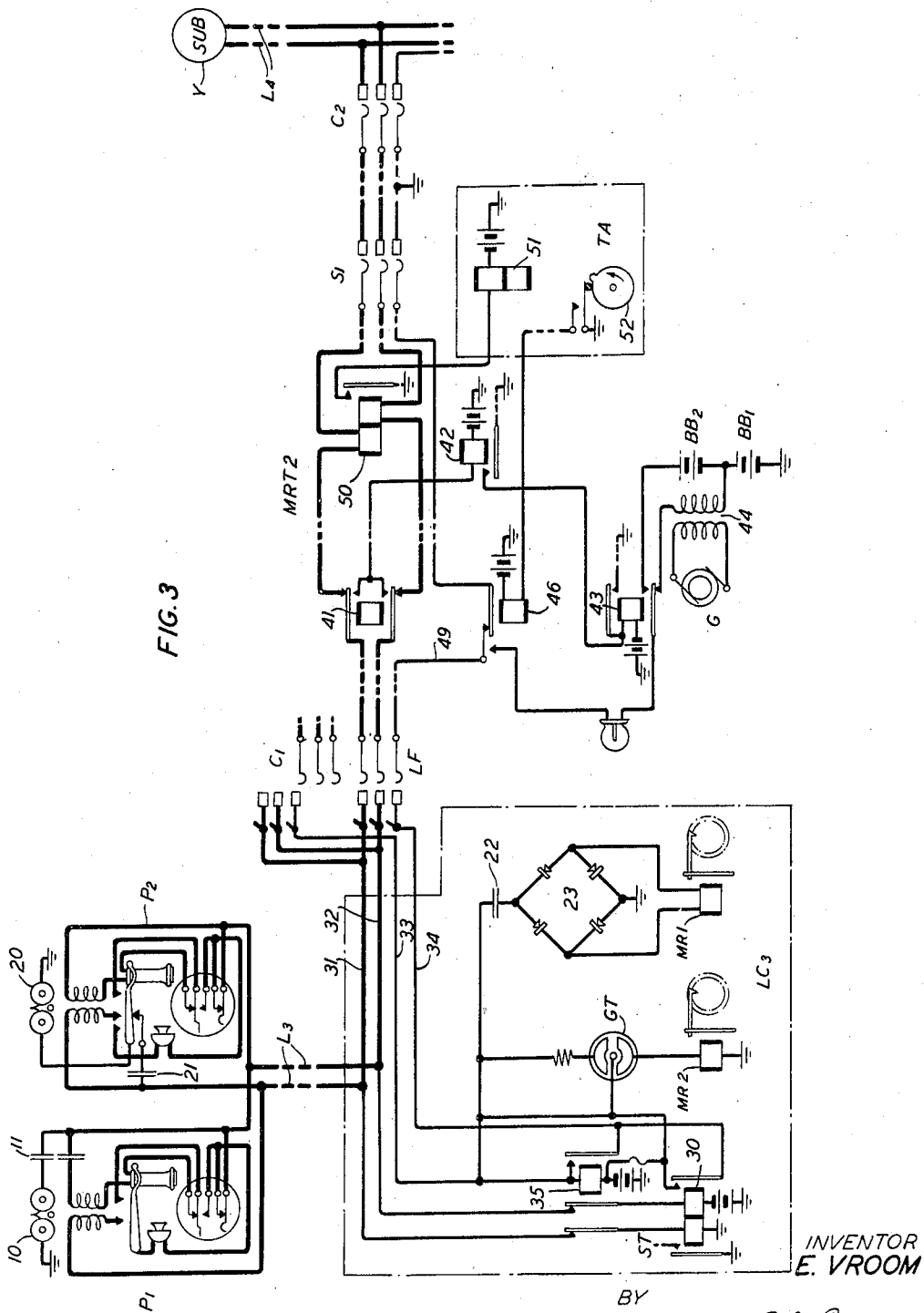
E. VROOM

2,321,714

TELEPHONE SYSTEM

Filed Sept. 28, 1940

2 Sheets-Sheet 2



INVENTOR
E. VROOM

E. VROOM

BY

R. O. Covell

ATTORNEY

UNITED STATES PATENT OFFICE

2,321,714

TELEPHONE SYSTEM

Edward Vroom, Ossining, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application September 28, 1940, Serial No. 358,821

6 Claims. (Cl. 179—8.5)

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.

A feature of the invention is an arrangement in a measured service telephone system for operating the message register of a calling line by the application of an alternating potential to the line conductor to which the line cut-off relay and message register are connected, the register being connected to this conductor in series with a rectifier and condenser, the alternating potential being superimposed on a booster battery potential which maintains the energization of the line cut-off relay while the register is being operated. The register is operated initially upon answer of the called subscriber and thereafter periodically while the talking connection is maintained between the calling and called stations.

Another feature of the invention is an arrangement in a measured service telephone system for selectively operating either one of the two registers of a party line. One of the registers is operated by the application of alternating potential to the line conductor to which the registers and the line cut-off relay are connected, said one register being connected to this conductor in series with a rectifier and condenser, the alternating potential being superimposed on a booster battery potential which maintains the operative energization of the line cut-off relay while this register is being operated. The other register is connected to the line conductor through a gas-filled tube, the alternating and booster battery potentials applied to operate the one register and hold the line cut-off relay being ineffective to break down the tube. To operate this other register, a booster battery of a higher potential is connected to the conductor to break down the tube, operate the register and hold the line cut-off relay.

The invention will be further explained by describing a system and circuit arrangement in which the features of the invention are embodied, one such system being shown schematically in the drawings which form a part of this specification. The invention is not limited in its application to the particular system or arrangements shown in the drawings but is generally applicable to measured service communication systems.

Referring to the drawings:

Fig. 1 represents a telephone system which comprises subscribers' stations A and X, lines L1 and L2, line circuit LC1, line finder LF, selector S1, a message rate trunk circuit MRT1 connecting the line finder LF to the selector S1, and connectors C1 and C2;

Fig. 2 shows a modification of the line circuit LC1 made on the line x-x of Fig. 1; and

Fig. 3 represents a telephone system which comprises subscribers' stations P1, P2 and Y, lines L3 and L4, line circuit LC3, line finder LF, selector S1, message rate trunk circuit MRT2 connecting line finder LF to selector S1, and connectors C1 and C2.

The subscribers' stations are each of the common battery type which includes a dial or other impulse sender for controlling the operation of selector and connector switches through which connections with called subscribers' stations are established. The lines L1 and L2 in Fig. 1 and L4 in Fig. 3 are connected to a single station, but the line L3 in Fig. 3 is a party line connected to two stations P1 and P2. The station P1 differs from the station P2 in that there is no connection of ground potential to the conductors of the associated line upon removal of the receiver at station P1; whereas removal of the receiver at station P2 connects both conductors of the associated line to ground through the ringer 20. This difference enables identification of the calling station on each call initiated over the party line L3, as hereinafter explained.

The line-finder switches LF, selector switches S1, and connector switches C1 and C2 are of the well-known two-motion step-by-step type. Reference may be had to "Automatic Telephony" 2nd edition by Smith and Campbell, pages 53 to 65, for a description of the structure of such 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 comprises a line relay 30, a line cut-off relay 35 and a message register MR connected by a full wave rectifier 38, through a condenser 36, to the line conductor 33 in parallel with the line cut-off relay 35. 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 in search for the calling line, the cut-off relay 35 being operated as soon as the calling line L1 is connected by a line finder LF to an associated message rate trunk MRT1

and first selector S1. Relay 35 locks in the usual manner to holding ground potential connected, through the test brush of the line finder, to conductor 34. Relay 35 also connects conductor 34, through conductor 33, to one side of the condenser 36. The message rate trunk circuit MRT1 includes a supervisory relay 50 which operates when the call is answered by the called subscriber, timing means TA which measures off intervals of time for each of which the calling subscriber's register should be operated once.

The selector S1 is operatively controlled by the impulses created by the first digit of the called subscriber's number to select a corresponding group of terminals, and to select 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 effect 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 the 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 all being held operated by this ground potential in the 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 polarized supervisory relay 50 of the message rate trunk circuit to effect the operation of this relay. Relay 50 closes a circuit for operating the start magnet 51 of the timing mechanism TA, which mechanism may be individual to a trunk MRT1 or common to a plurality of trunks. 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 connection from booster battery BB through the right winding of transformer 45, conductor 49, lower brush of line finder LF, conductor 34 and front contact of relay 35 to conductor 33, the booster battery potential being effective to hold relay 35. A 60-cycle alternating potential from generator G, superimposed on the booster battery potential by the windings of transformer 45, causes a current through condenser 36 and the full wave rectifier 38 to operate message register MR. When relay 46 releases, ground potential is reconnected to conductor 49 to hold relay 35. Each succeeding closure of the timing contact 52, while the talking circuit is maintained, effects a reoperation of relay 46 and the register MR.

The line circuit LC1 may be modified as shown in Fig. 2 in which the alternating potential impressed on conductor 33 is applied to the rectifier 38 by a transformer 37.

Referring now to the system shown in Fig. 3 the line circuit LC3 is similar to the line circuit LC1 except that two message registers are provided, one register MR1 being connected through a gas-filled tube GT to the conductor 33; the other register MR2 being connected through a rectifier 23 and condenser 22 to this conductor. The message rate trunk circuit MRT2 is similar to the trunk circuit MRT1 in that it includes a supervisory relay 50 and a timing means TA for measuring off intervals of time during which a talking connection is maintained between the

calling and called stations. This trunk circuit further includes a means comprising a control relay 41 and test relay 42 for identifying the station at which the call is being made. Relay 41 is operated immediately after the dialing of the first digit of the called subscriber's number to connect relay 42 to the calling line as described in the patent to H. Hovland, No. 1,823,688 of September 15, 1931. In the case of a call initiated at station P1, relay 42 does not operate; but in the case of a call initiated at station P2, relay 42 operates in series with the ringer 20, thereby closing a circuit for operating relay 43. Relay 43 locks and remains operated until the connection is released at station P2. When the call is answered, the operation of relay 50 closes the circuit for operating the start magnet 51 of the timing mechanism TA. The contact 52 is thereupon actuated to close a circuit for operating relay 46. Relay 46 disconnects holding ground potential from conductor 49 and closes a circuit for operating the calling subscriber's register. If the call is from station P1, and relay 43 is not operated, the register operating circuit is traced from ground through booster battery BB1, the left winding of transformer 44, back contact of relay 43, front contact of relay 46, conductor 49, lower brush of line finder LF, conductor 34, front contact of relay 35, to conductor 33. The booster battery thus connected to conductor 33 holds relay 35 operated; while the alternating potential, superimposed on the booster battery potential through the windings of transformer 44, cause a current through condenser 22 and rectifier 23 which operatively energizes the message register MR1. If, however, the call is from station P2, relay 43 is operated and the meter operating circuit is traced from ground, through booster battery BB1 in series with booster battery BB2, lower front contact of relay 43, front contact of relay 46, conductor 49, lower brush of line finder LF, conductor 34, front contact of relay 45 to conductor 33. Relay 35 is thereby held operated and the potential impressed across the control elements of tube GT is sufficient to cause breakdown of this tube and operation of register MR2. When relay 46 releases, ground potential is reconnected to conductor 49 to hold relay 45. Each succeeding closure of timing contact 52, while the talking circuit is maintained, effects the reoperation of relay 46 and the calling subscriber's register.

Although the arrangements above described contemplate a single operation of a calling subscriber's register for a message unit, the invention is applicable to arrangements in which the register is operated either once or a plurality of times depending upon the relative locations of the calling and called stations.

What is claimed is:

1. In a telephone system, a line circuit comprising a control conductor, a line cut-off relay, means connecting said relay to said conductor, a message register, a condenser, a rectifier, and means comprising said condenser connecting said register and rectifier to said conductor, grounded sources of direct current including a booster battery, and a source of alternating current, said relay being operatively energized upon application of either ground or booster battery potential to said conductor and said register being operatively energized upon application of an alternating potential to said conductor.

2. In a telephone system and line circuit ac-

cording to claim 1, another register, another booster battery, and a gas-filled tube connecting said other register to said conductor, said tube and other register being operatively energized upon application of a booster battery potential of high enough value to said conductor.

3. In a telephone system, a line circuit comprising a control conductor, a line cut-off relay, means connecting said relay to said conductor, a message register, a condenser, a rectifier, and means comprising said condenser connecting said register and rectifier to said conductor, grounded sources of direct current including a booster battery, a source of alternating current, means for applying ground potential to said conductor to operate said relay, and means for applying a booster battery potential to said conductor in place of said ground potential and for superimposing thereon an alternating potential for operating said register, the application of booster battery potential to said conductor being effective to maintain the energization of said relay.

4. In a telephone system according to claim 3, another register, a gas-filled tube connecting said other register to said conductor, the impression of said booster battery and alternating potentials being ineffective to energize said tube and other register, another booster battery and means for applying to said conductor, in place of said ground potential, a booster battery potential of high enough voltage to effect breakdown of said tube and operation of said other register.

5. In a telephone system, a subscriber's station and line, a line circuit for said line, said circuit comprising a control conductor, a line cut-off relay, means connecting said relay to said conductor, a condenser, a rectifier, a message register and means comprising said condenser connecting said register and rectifier to said conductor, another subscriber's station and line, means comprising a message rate trunk circuit connecting said stations for conversation, grounded sources of direct current including a booster battery, a source of alternating current, means connecting ground potential to said conductor to operate and hold said relay, means in said trunk circuit for

measuring intervals of time while a talking connection is maintained between said stations, each of said intervals constituting a message unit for which one operation of said register is required, and means effective at the beginning of an interval for connecting to said conductor, in place of said ground potential, a booster battery potential for holding said relay operated and for simultaneously connecting an alternating potential to said conductor to operate said register.

6. In a telephone system, a party line, two subscribers' stations connected to said line, a line circuit for said line comprising a control conductor, a line cut-off relay, means connecting said relay to said conductor, a condenser, a rectifier, a first message register, means comprising said condenser connecting said register and rectifier to said conductor, a gas-filled tube, a second register, and means comprising said tube connecting said other register to said conductor, another subscriber's station and line, means comprising a message rate trunk circuit connecting a calling one of the stations on said party line with said other station, grounded sources of direct current including booster batteries, a source of alternating current, means connecting ground potential to said conductor to operate and hold said relay, means in said trunk circuit for identifying the calling station on said party line, means in said trunk circuit for measuring intervals of time while a talking connection is maintained between the calling and called stations, each of said intervals constituting a message unit for which one operation of the calling subscriber's register is required, and means effective at the beginning of an interval for selectively connecting to said conductor, in place of ground potential, a booster battery potential of high enough value to effect energization of said gas-filled tube and said second register or a booster battery potential of insufficient value to effect breakdown of said tube together with an alternating potential for operating said first register, said relay being held operated by either of said booster battery potentials.

EDWARD VROOM.