Sept. 10, 1935. E. VROOM 2,014,215

SIGNALING SYSTEM

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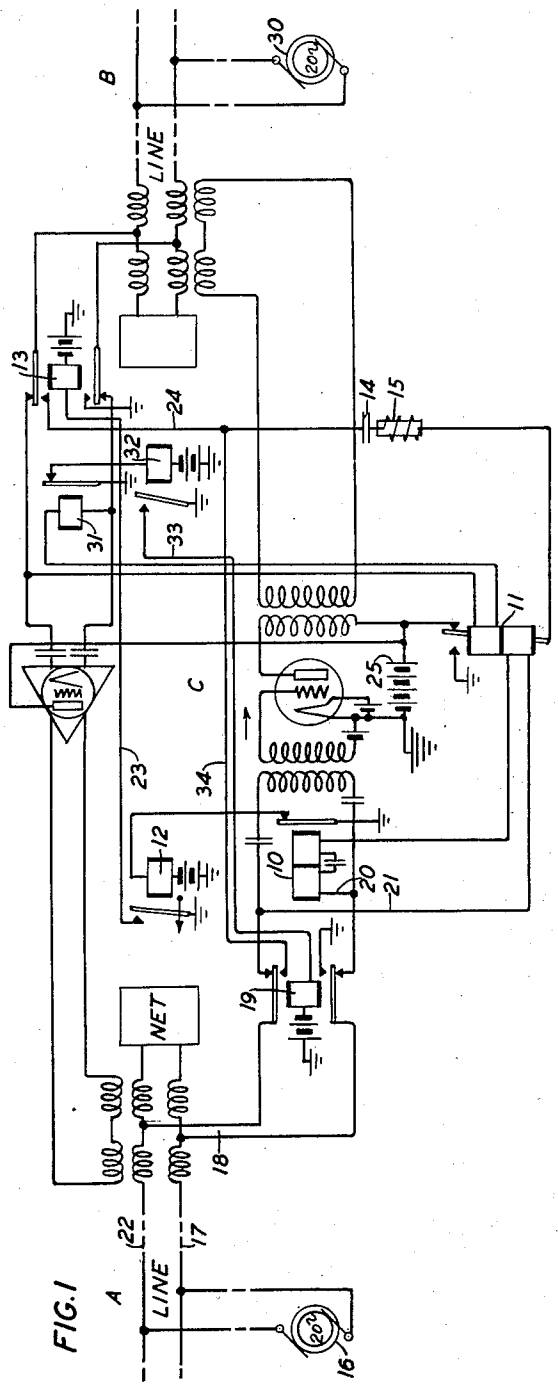

FIG. 1

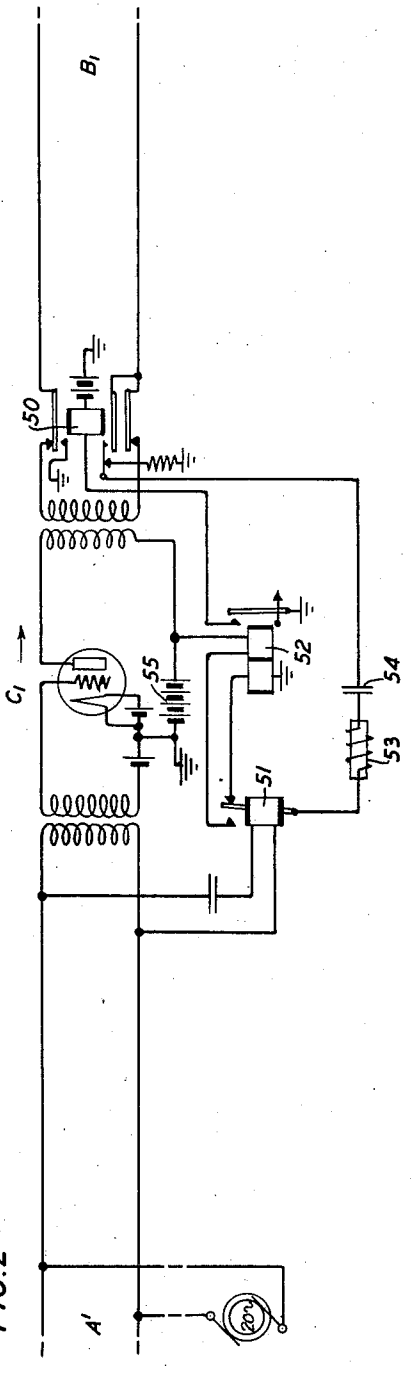

FIG. 2

INVENTOR
E. VROOM
BY
A. G. Hingman
ATTORNEY

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SIGNALING SYSTEM

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

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8 Claims. (Cl. 179—170)

This invention relates to signaling systems and more particularly to signaling equipment for telephone repeater stations.

It is common practice in the art of telephony to provide long telephone lines with intermediate repeater stations for the purpose of amplifying speech currents transmitted over such lines. These repeater stations are also provided with switching equipment which functions upon the application of signaling currents, as distinguished from speech currents, to one line section to disconnect the other line section from the repeater and associate it with a source of signaling current, usually in the nature of an alternating current generator. This application of a fresh source of signaling current at the repeater station to an outgoing line section upon the application of signaling current to the incoming line section at a remote point is generally referred to as relayed ringing or signaling.

Usually these repeater stations accommodate a plurality of telephone lines, so that it has been found practicable to equip such stations with an alternating current generator which may be employed as the source of relayed signaling current for all the lines accommodated at the repeater station. However, there are instances where it is necessary to provide repeater equipment for a single line. In such instances it has not been found economical to equip such repeater stations with an alternating current generator for the purpose of serving but one line.

It is accordingly, the object of this invention to provide a system of relayed signaling which obviates the need for a separate source of signaling current at a repeater station and which results in economies where no such source of signaling current is available.

This object is attained in accordance with a feature of the invention by utilizing the repeater power supply at a repeater station as the source of relayed signaling current.

A further feature of the invention resides in the use of a polarized relay which is common to both incoming and outgoing sections of a telephone line and which functions, upon the application of signaling current to one of the line sections, to cause the transmission, over the other line section, of signaling current of the desired frequency from the repeater power supply.

These and other features of the invention will be readily understood from the following detailed description made with reference to the accompanying drawing, in which:

Fig. 1 shows the relayed signaling arrangement of this invention applied to an intermediate two-wire repeater; and

Fig. 2 shows a modification of the relayed signaling arrangement shown in Fig. 1.

Referring to Fig. 1, there are shown two line sections A and B, the line A being normally associated with the input terminals of the vacuum tube type repeater C (shown in full) and the line B being normally associated with the input terminals of repeater D (shown in schematic). The repeater C amplifies speech currents passing from line A to line B whereas the repeater D is designed to amplify speech currents passing from line B to line A.

Bridged across the input of repeater or amplifier C is a line relay 10 whose windings are connected in series with one of the windings of polarized relay 11, which is common to both line sections A and B. In its normal or unoperated condition, relay 10 maintains an energizing circuit for slow-to-release relay 12 which controls the operating circuit for relay 13. Relay 11 operates in synchronism with the signaling current applied to one of the line sections A or B, to alternately connect battery and ground through a resonant circuit, comprising condenser 14 and impedance coil 15, to the other line section.

To more clearly set forth the operation of applicant's invention, it will be assumed that 20-cycle signaling current from the source 16, associated with the line section A, has been applied to the conductors of this line in any well known manner. Applicant has chosen the 20-cycle frequency merely for purposes of illustration, it being understood that any other frequency which relay 11 is capable of following satisfactorily may be employed.

A path for the current from source 16 may be traced from one side of generator 16, line conductor 17, conductor 18, lower armature and back contact of relay 19, conductor 20, windings of relay 10, lower winding of relay 11, conductor 21, back contact and upper armature of relay 19, line conductor 22, back to the other side of generator 16. Relay 10 operates in this circuit and opens the normal energizing circuit of relay 12 which relay releases its armature closing an obvious circuit for relay 13 by way of conductor 23.

Relay 13 operated, transfers the outgoing line section B of the telephone line from the amplifier output to the signaling current lead 24.

Relay 11 operates in synchronism with the applied 20-cycle frequency current of source 16 and at its armature and contacts alternately connects ground and battery to the lead 24 by way of the resonant circuit comprising elements 14 and 15. It will be noted that the power used in this case is furnished by battery 25 which normally supplies current to the plate circuits of the repeaters or amplifiers C and D.

The alternate connection and disconnection of battery and ground to conductor 24 causes an alternating current of a frequency corresponding to the frequency of the applied source 16 to

be transmitted over the line section B by way of the armatures and front contacts of relay 13.

Signals originating on line B are relayed to line A in a similar manner. Relays 11 and 31 respond to the 20-cycle frequency current of source 30, the former being energized, in this case, by way of its upper winding. Relay 31 causes relay 32 to restore its armature whereupon relay 19 operates to disconnect the line A from the input terminals of amplifier C and connect it to the signaling current lead 34. Relay 11 operates at the frequency of the incoming signaling current to alternately connect battery 25 and ground to the lead 34 by way of the resonant circuit 15, 14. The alternating current generated in this manner is transmitted over the line A by way of the front contacts and armatures of relay 19.

It is evident from the foregoing description that applicant has devised a simple, economical relayed signaling arrangement whereby the direct current plate supply of the repeater is utilized for the purpose of obtaining an alternating current of the desired frequency for signaling purposes, thus obviating the need for an alternating current generator or other similar supply at the repeater station.

Reference is now made to Fig. 2 which discloses a modification of applicant's invention.

The line section A' is shown connected to the input of amplifier C', the output of which is connected to the line section B' by way of the outer armatures and back contacts of relay 50.

Polar relay 51 operates in synchronism with the frequency of the signaling current applied to line section A' and alternately connects battery 55 and ground to its front and back contacts which are in series with the lower and upper windings of relay 52. These operations of relay 52 cause condenser 54 in the resonant circuit to alternately charge through the lower winding of relay 52 and discharge through the upper winding of this relay. Relay 52 is slow to release and its windings are so poled that the charging and discharging of the condenser 54 produce magnetic flux in the relay core in but one direction. This relay accordingly operates and remains operated as long as the signaling current is on the line.

At its armature and front contact relay 52 establishes an obvious circuit for relay 50 in which it operates. Relay 50 in operating, performs the same functions as does relay 13 of Fig. 1 whereupon the alternating current set up by the alternate charging and discharging of the condenser 54 is transmitted over the line section B'.

Fig. 2 shows a one-way signaling arrangement. For two-way operation, two of these circuits are required.

The alternating current generated in both of the cases hereinbefore described is of sufficient strength to be transmitted to the distant ends of lines B or B', or to the next intermediate repeater point, and to operate the usual signaling relays.

What is claimed is:

1. In combination, a line circuit, a repeater associated with said line circuit for amplifying voice currents on said line circuit, a power supply for said repeater, a source of current other than voice current, and means responsive to the application of current from said source to said line for alternately connecting and disconnecting said power supply to and from said line circuit.

2. In combination, a line circuit, a repeater associated with said line circuit for amplifying voice currents on said line circuit, a direct current power supply for said erpeater, a source of alternating current, and means responsive to the application of current from said source to said line circuit for interrupting said power supply at the frequency of said alternating current source and connecting it to said line circuit.

3. In combination, a line circuit, a repeater associated with said line circuit for amplifying voice currents on said line circuit, a power supply for said repeater, a source of alternating current, a circuit resonant at the frequency of said alternating current source, and means responsive to the application of current from said source to said line circuit for repeatedly connecting said power supply to said line circuit by way of said resonant circuit.

4. In combination, a line circuit, a repeater assoicated with said line circuit for amplifying voice currents on said line circuit, a power supply for said repeater, a source of alternating current, and a polarized, relay responsive to current from said source for repeatedly connecting said power supply to said line circuit.

5. In combination, a line section, a second line section, a repeater intermediate said line sections for amplifying voice currents originating on one of said line sections, a power supply for said repeater, a source of alternating current for each of said line sections, and a switching device common to said line sections and responsive to current from the source associated with either of said line sections for alternately connecting and disconnecting said power supply to and from the other of said line sections.

6. In combination, a line section, a second line section, a repeater intermediate said line sections for amplifying voice currents originating on one of said line sections, a power supply for said repeater, a source of alternating current for each of said line sections and a polarized relay responsive to current from the source associated with one of said line sections for alternately connecting and disconnecting said power supply to and from the other of said line sections.

7. In combination, a line, a second line, a vacuum tube type repeater having input and output terminals connected to said lines and adapted to amplify current of one type on said lines, a plate current supply for said repeater, a source of signaling current, means responsive to current from said source incoming over said first line for disconnecting said second line from the output terminals of said repeater, and other means responsive to current from said source for alternately connecting and disconnecting said plate current supply to said second line at a frequency corresponding to the frequency of the incoming signaling current.

8. In combination, a line circuit, a repeater for amplifying voice currents on said line circuit, a power supply for said repeater, a source of signaling current other than voice currents, and means responsive to current from said source for translating current from said power supply into current of a frequency corresponding to the frequency of said signaling current and applying it to said line circuit.

EDWARD VROOM.