May 31, 1932. W. H. EDWARDS 1,860,459

SIGNALING ARRANGEMENT FOR TWO-PARTY TELEPHONE LINES

Filed June 27, 1931

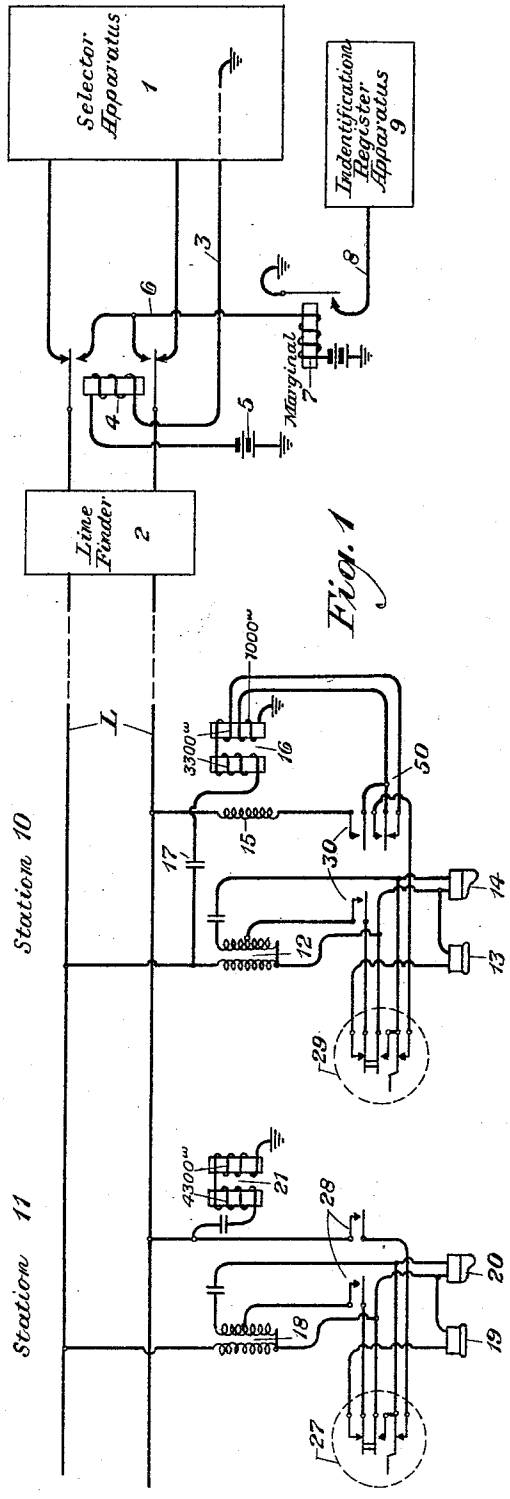


Fig. 1

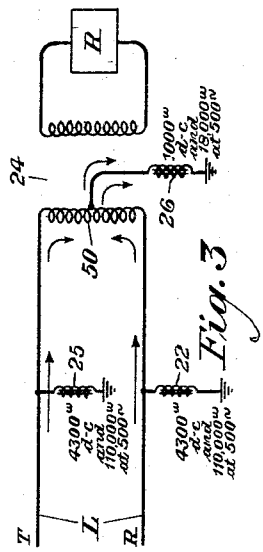


Fig. 3

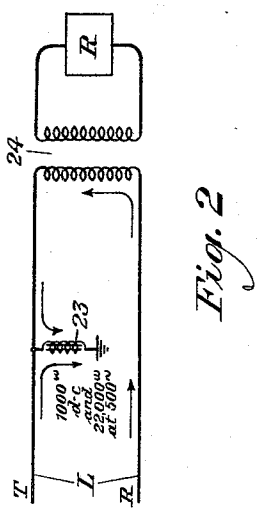


Fig. 2

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UNITED STATES PATENT OFFICE

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SIGNALING ARRANGEMENT FOR TWO PARTY TELEPHONE LINES

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This invention relates to telephone systems and more particularly to improvements in signaling or ringing arrangements associated with the lines of such systems.

The ringing circuit arrangements of the invention are particularly adapted for telephone lines having a plurality of stations connected thereto, such for example as two party dial message rate lines. When the telephone line serves two subscribers' stations with message rate service, or in other words when each station is charged separately for the number of calls therefrom, certain apparatus is provided at the central office for making identification tests when a call comes in from the line to tell which station is calling so that the proper station may be charged with the call. The central office equipment for making this identification test, whereby the proper station may be charged for the outgoing call, is so designed as to require for its operation the presence of a 1000 ohm *d*—*c* resistance ground at the station when the tip party is calling and the absence of this ground when the ring party is calling. It has been the practice to provide this 1000 ohm ground through the ringer apparatus at the station when the tip party is calling. In other words a 1000 ohm *d*—*c* resistance ringer which is approximately 22,000 ohms impedance at 500 cycles would be connected to the tip side of the line and a similar ringer would be connected to the ring side of the line. A condition wherein a ringer of low impedance is connected to one side of the line and there is no party connected to the other side of the line results in an unbalanced condition which might be quite undesirable when the line has inductive exposures which in turn would cause the induced currents to flow through the induction coil at the subscriber's station and cause noise in the receiver thereat. A similar unbalance is present when two or more ringers are connected to one side of the line and a different number connected to the other side.

It is the primary object of the invention to provide ringer circuits at both stations on the line in which any unbalances due to different numbers of ringers on the two sides of the lines will be negligible. It is a further object of the invention to provide ringer circuits so arranged that, when the ring party is calling, both stations will have high impedance ringers of approximately 4300 ohms *d*—*c* resistance and a 500 cycle impedance of approximately 110,000 ohms and, when the tip party is calling, the ringer at that station will have the characteristic of a low impedance 1000 ohm ringer for the purpose of the identification test at the central office but will have its circuit connections so arranged that no inductive interference or noise will result in the receiver at the station. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawings in the Figures 1, 2 and 3 of which the invention is illustrated. Fig. 1 is a circuit diagram embodying a preferred form of the invention. Figs. 2 and 3 are schematic diagrams illustrating the principles of operation of the invention. Similar reference characters have been used to denote like parts in Figs. 2 and 3.

In Fig. 1 is shown a telephone line L to which would be connected the subscribers' stations 10 and 11. The line L illustrates a two party dial message rate circuit. At the central office the line would be associated with line finder apparatus 2 and selector apparatus 1. As such apparatus is well known in the art no further description thereof will be given except that at the end of the first digit in the dialing operation a ground will momentarily be applied to conductor 3 and relay 4 will be operated. This will connect the tip and ring sides of the line to conductor 6 which is connected to the marginal relay 7. The function of relay 7 is to control a circuit 8 leading to register apparatus 9. The relays 4 and 7 and the appartus associated therewith are utilized to make an identification test so that the proper station may be charged for outgoing calls on a line of this type. As has heretofore been pointed out the identification test, or operation of marginal relay 7, depends on the presence of a

1000 ohm ground at the station when the tip party is calling and the absence of this relatively low *d*—*c* resistance ground when the ring party is calling. In other words the marginal relay will operate when the tip party is calling but will not operate when the ring party is calling. In this manner the proper one of the calling parties may be identified and the call charged thereto.

As has been pointed out the presence of a 1000 ohm *d*—*c* resistance ground connected to one side of the line through the ringer, or in other words the connection of a relatively low impedance ringer to the line and ground, might be quite undesirable because of the susceptiveness of station sets with such ringers to inductive noise and because the low impedance ringers are less satisfactory from a ringing standpoint. This susceptiveness will appear more readily from Figs. 2 and 3. When the line L has inductive exposures longitudinal currents might be set up in the tip and ring sides of the line. If a low impedance ringer 23, such as the 1000 ohm *d*—*c* resistance type with the impedance of 22,000 ohms at 500 cycles, is connected to the tip and there is no party connected to the ring side of the line, as shown in Fig. 2, the induced currents would follow the direction shown by the arrows. The two sides of the line would not be balanced and currents would flow through the induction coil 24 to ground through the low impedance 23. This would cause noise in the receiver R. If, as shown in Fig. 3, both ringers connected to the tip and ring are of relatively high impedance as 22 and 25, namely 110,000 ohms at 500 cycles or if a ringer with a low impedance winding as 26 is connected to the midpoint of the induction coil winding then the induced currents as shown by the arrows will have no effect on the secondary of the induction coil 24 and will not affect the receiver R. Likewise, if the ring party is not connected, and the impedance 22 is not present the slightly unbalanced condition created will have a negligible effect from a noise standpoint. The arrangements of the invention present the advantages shown schematically in Fig. 3. In other words when the ring party is calling the ringers are both of high impedance, but when the tip party is calling the ringer is changed so that while its *d*—*c* resistance is only 1000 ohms, its 500 cycle impedance is 18,000 ohms and furthermore it is connected to the midpoint of the subscriber's induction coil so that the receiver will not be affected by noise.

In Fig. 1 is shown in more detail the station ringing apparatus of the invention for obtaining the advantages of high impedance ringers at the stations, and also for meeting the requirement of the identification test circuit for a 1000 ohm ground when the tip party is calling. The ring party is shown as station 11. This station includes the usual induction coil 18, receiver 19, transmitter 20, dial 27, and switch hook contacts 28. Connected to the ring side of the line and ground is the high impedance ringer 21 having an impedance of approximately 4300 ohms for purposes of illustrating the invention. The tip party is shown as station 10. This station includes the induction coil having windings 12 and 15, the receiver 13, the transmitter 14, dial 29 and switch hook contacts 30. The ringer 16 is provided connected through condenser 17 to the tip side of the line. The ringer 16 has a lower right hand winding of approximately 1000 ohms, which together with its other windings, is equal in voice frequency and ringing frequency impedance to the regular high impedance ringer used for the ring party at station 11. The switch contacts 30 of station 10 are so arranged that, when the tip party at station 10 is not talking, the ringer 16 is connected in the same manner as the ringer 21 at station 11, or as a high impedance ringer, thus providing a circuit of low susceptiveness to inductive noise currents. When the tip party at station 10 is talking the lower right hand winding of 100 ohms of ringer 16 is connected in the station set at a point such as 50 between the windings 12 and 15 of the induction coil which is substantially balanced with respect to the tip and ring of the line. With the above arrangements the receivers will not be subjected to inductive noise and the requirement of the 1000 ohm ground for the identification test will be met.

While the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable it is understood that it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A telephone line having two subscribers' stations connected thereto, grounded ringing apparatus of high impedance connected to one side of the line at one of said stations, grounded ringing apparatus of high impedance connected to the other side of the line at the other of said stations, and means at said last mentioned station operative when a call is initiated therefrom for reducing the impedance of the ringer thereat and for so changing its connection to the line that inductive interference will not be caused by such connection.

2. A telephone line having two subscribers' stations connected thereto, grounded ringing apparatus of high impedance connected to one side of the line at one of said stations, grounded ringing apparatus of high impedance connected to the other side of the line at the other of said stations, and means at said last mentioned station operative when

a call is initiated therefrom for reducing the impedance of the ringer thereat and for connecting the ringer to the line at a point in said station set which is substantially balanced with respect to the tip and ring sides of said line.

3. A telephone line having two subscribers' stations connected thereto, grounded ringing apparatus of high impedance connected to one side of the line at one of said stations, grounded ringing apparatus of high impedance connected to the other side of the line at the other of said stations, and means at said last mentioned station operative when a call is initiated therefrom for reducing the impedance of the ringer thereat and for connecting the ringer to the mid or neutral point of the subscribers' induction coil at said station.

4. A telephone line of the two party dial message rate type connecting two subscribers' stations with a central office, marginal identification apparatus at the central office operative when a low impedance ground is connected to the line when one party is calling and non-operative when said low impedance ground is not connected to the line as when the second party is calling, grounded ringing apparatus of high impedance connected to the ring side of the line at the station of said first mentioned partly, grounded ringing apparatus of high impedance connected to the tip side of the line at the station of said first mentioned party, and means operative when said first party calls for reducing the impedance of the grounded ringer thereat and for changing its connection so that the sides of the line will remain substantially balanced.

In testimony whereof, I have signed my name to this specification this 26th day of June, 1931.

WILLIAM H. EDWARDS.