

Nov. 26, 1946.

G. DEAKIN

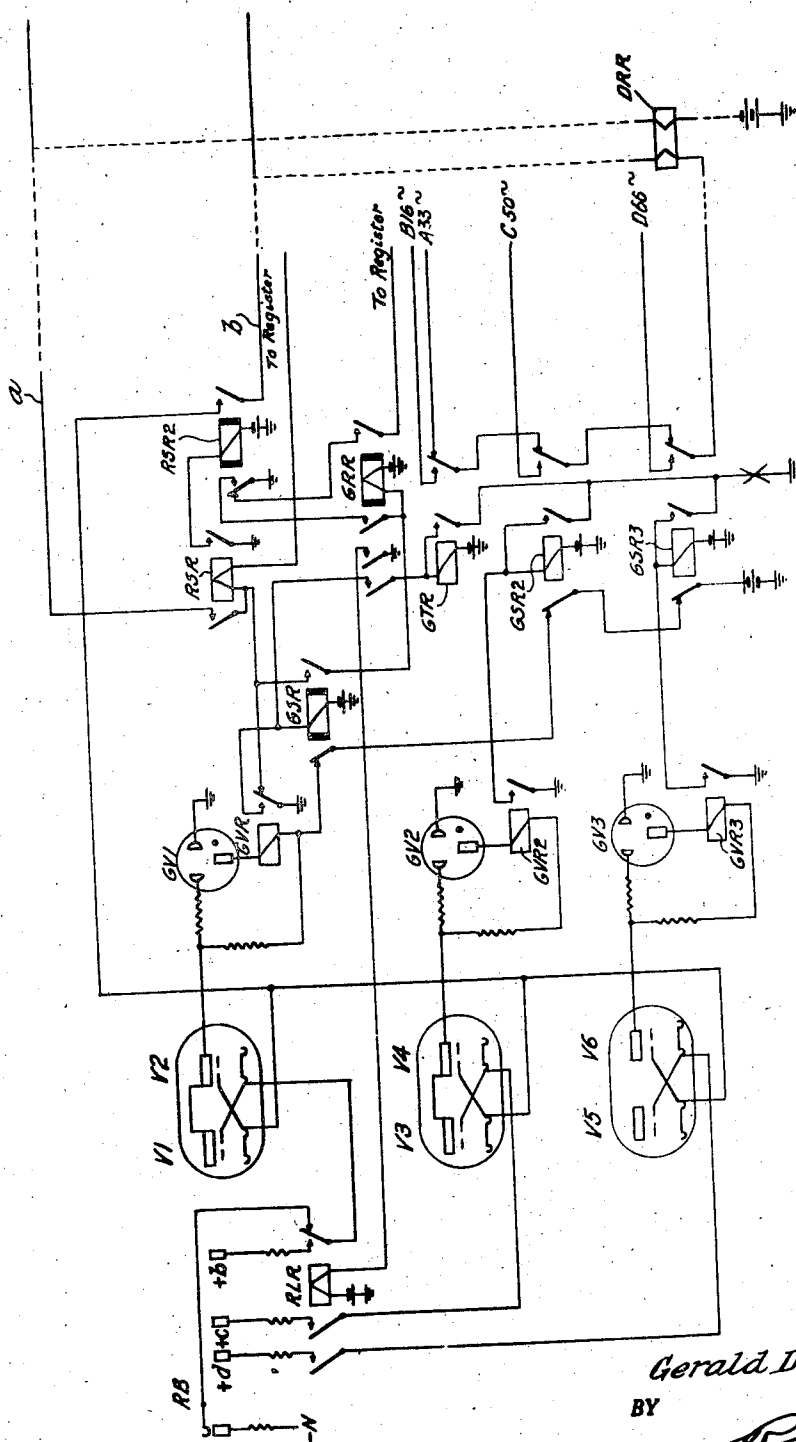
2,411,525

PARTY LINE RINGING SYSTEM

Filed March 2, 1944

2 Sheets-Sheet 1

Fig. 1.



INVENTOR.
Gerald Deakin
BY
R. J. Perry
AGENT

UNITED STATES PATENT OFFICE

2,411,525

PARTY LINE RINGING SYSTEM

Gerald Deakin, New York, N. Y., assignor to International Standard Electric Corporation, New York, N. Y., a corporation of Delaware

Application March 2, 1944, Serial No. 524,735

25 Claims. (Cl. 179-17)

1

This invention relates to new and useful improvements in selective signalling systems and more particularly in party line ringing arrangements for automatic telephone exchange systems.

The object of the invention is to provide electric discharge means, preferably arranged in a register sender for controlling the selection of a characteristic ringing current to signal the called station.

The nature of the invention will more fully appear from the appended claims and the following description of a preferred embodiment. The description will be applied to the drawings, Figs. 1 and 2 of which, when placed side by side, represent as much of an automatic telephone exchange system as is necessary for an understanding of the invention.

The system herein disclosed is of the type described in my co-pending applications, Serial No. 484,184, filed April 23, 1943, now Patent No. 2,380,950, and Serial No. 500,411, filed August 28, 1943, and in the applications and patents referred to therein. Said applications describe a double electronic testing arrangement in which two tests are performed by a gas valve, a first test over a test brush and a second test over one of the talking connection brushes of a selection. Since the simultaneous testing of a line over the terminal with which the first brush cooperates during the short time available therefor is extremely unlikely, in accordance with the present invention the second test over the second brush is used for the purpose of determining the character of the ringing current to be selected and to signal the desired party on the seized line.

The party line illustrated in Fig. 2 has four stations, 1, 2, 3 and 4, each of which has a different number and is accessible over a different set of terminals in the final selector. Preferably, though not necessarily, these numbers are within the same hundred, so as to permit the use of a common line and line relay equipment. Also, certain groups of one hundred lines may be specially wired for four-party line service.

Each line is provided with two-line relays, LR₁, LR₂, and two cut-off relays, COR₁, COR₂. The *a* wire of the party line is multiplied in the main distributing frame to the A terminals of the stations in the final selector and also to a back contact of COR₁. The C terminals of the line are also multiplied together in the main distributing frame and are connected to the winding of COR₁. The *b* wire of the party line is not multiplied in the main distributing frame but is connected to

2

the B terminals over armatures and front contacts of the two cut-off relays, and over a back contact of COR₁ to the winding of LR₁. The B terminal of each station is connected over contacts of COR₂ to a source of characteristic D. C. potential.

The T terminals of stations 2, 3 and 4, are connected to characteristic sources of D. C. potentials over contacts of LR₂, and the T terminal of station No. 1 may be connected to characteristic sources of D. C. potentials over contacts of COR₁ and LR₁.

The number assigned to the party line station and thus the setting of the final selector, has nothing to do with the character of the ringing current selected. Each station has a characteristic -N potential corresponding to the last, or units digit, of the line number. For instance, digit 1 corresponds to a characteristic -N potential of -2 volts; digit 2, -4 volts; digit 3, to -6 volts etc.; digit 0, to -20 volts.

Three of the four stations, 2, 3 and 4, are normally connected over back contacts of COR₂, each with a different tap of a source of characteristic positive potential indicated in Fig. 2 as +*b*, +*c* and +*d*. For instance, for the different units digits these may be +2 volts, +4 volts, etc., up to +20 volts. The *b* wire of the party line is not connected to the B terminals and the B terminal of station No. 1 is connected to an armature of COR₂, which is normally open and thus does not apply an identifying potential to the terminal.

When a four-party line station number is called, then under the control of the register, part of which is illustrated in Fig. 1, a calling subscriber (not shown) controls the establishment of a connection which we shall assume reaches the final selector shown in Fig. 2. Under the control of relays AR and BR and power magnet P, the final selector is operated and tests for the characteristic -N potential of the called line over the T brush, in the manner disclosed in the above-identified co-pending applications. In the register, relays RSR and RSR₂ are energized under the control of a register switch (not shown).

When the final brush B engages a terminal to which the same -N potential is applied as to the brush RB of the register (which was set by the calling subscriber in accordance with the units digit) then triodes V₁ and V₂ permit gas valve GV₁ to strike, whereupon register relays GVR and then GSR are operated. GVR falls off and energizes over its back contact and the front contact

3

of GSR a relay GRR which locks up over a front contact of RSR₂.

GRR operates RLR which places certain predetermined D. C. potentials, identified as +b, +c and +d, on the grids of triodes V₁, V₃ and V₅. The final selector connects the b wire extending from the register over the B terminal of the final selector of the called station to an armature of COR₂ and therethrough to D. C. potentials +b, +c or +d. Assuming, for instance, that station 4 is called, the connection will be from source +d over the b wire to the grids of tubes V₂, V₄ and V₆. When the same potentials are applied to the grids of V₁ and V₂, then the associated gas valve GV₁ operates and causes the operation of the associated relay GVR. As described in said co-pending applications GVR operates GSR which in turn extinguishes GV₁, deenergizes GVR, whereupon GRR operates.

If station 3 is called, then tubes V₃ and V₄ and gas valve GV₂ operate, and if station 2 is called, then V₅, V₆ and GV₃ operate. If there is no potential on the selected B terminal, e. g. if station 1 is called, then none of the valve circuits in the register will operate and, when relay RSR₂ finally makes its back contact, none of the relays GTR, GSR₂ or GSR₃, will be energized and the normal 33-cycle ringing current source A33 will remain connected to the ringing relay over the back contacts of the above-mentioned three relays.

However, if as above stated, station 4 is called, the gas valve GV₁ will again operate and will close an energizing circuit for relay GTR over the front contact of relay GRR which is slow enough to space the interval required for the two operations of GVR. GTR will lock up and connect a 16 cycle ringing current from source B16 over its front contact and outer armature and the back contacts and armatures GSR₂ and GSR₃, to the ringing relays for signalling station 2. Only the marginal ringing trip relay DRR is shown of the complete ringing circuit which is illustrated in my co-pending application, Serial No. 484,184.

Similarly, should stations 3 or 4 be called, the corresponding potentials +c and +d would operate the valves GV₂ or GV₃ and the corresponding 50 or 66 cycle ringing current would be applied from sources C50 or D66 to the called line.

The test for the ringing current is made instantly upon the engagement of the final selector bank terminal by the B brush and before relay COR₂ has had time to be energized by relay COR₁, which is energized over the C brush and a front contact of relay BR in the final from ground in the penultimate selector. Since the tripping of a gas valve requires only a few microseconds, the length of the test contact is of no importance. When COR₂ is energized, the banks of all the party line stations are disconnected from their various characteristic potentials and are connected over the front contacts of the two cut-off relays to the b wire of the party line. Line relay LR₁ is disconnected but line relay LR₂ is energized over a front contact and armature of COR₁. Thus all the -N potentials are disconnected from the four T terminals of this line, making it unselectable by another final selector.

What is claimed is:

1. In a telephone exchange system, a party line comprising a plurality of stations, a final selector including a set of wipers and a plurality of co-operating sets of terminals one for each station on said party line, a magnet for controlling the movement of said wipers over said terminals, a register controller, means under the control of

4

said register controller for controlling said magnet to cause said wipers to engage a set of terminals corresponding to a wanted station on said party line, a source of direct current potentials, means for applying to one of the terminals of each set of terminals a direct current potential characteristic of each party line station, a plurality of sources of ringing current and means in said register controller responsive to said characteristic direct current potentials for applying a selected source of ringing current to said party line.

2. The telephone system according to claim 1, and in which a talking connection is established by the final selector over the terminal to which the characteristic direct current potential is applied.

3. The telephone system according to claim 1, and in which each set of terminals comprises a test terminal, means for applying to the test terminals direct current potentials characteristic of the designation of the associated station, and means in the register responsive to the last-mentioned potential for stopping the final selector wipers on the terminals of the desired station.

4. In a telephone exchange system, a plurality of subscribers' lines including a party line, a final selector having a plurality of sets of talking and test terminals for said lines, a set of wipers and a magnet for controlling the cooperation of the wipers with the terminals, means including a register controller for controlling over one terminal of the called line the operation of the magnet and the seizure of the terminals by the selector, sources of different signaling current, and means including the register and controlled over another terminal of the selected set for applying one of said sources of signaling current to the called line over the wipers and terminals of the selector.

5. In a telephone exchange system, a plurality of subscribers' lines including a party line, a final selector having a plurality of sets of talking and test terminals for said lines, a set of wipers and a magnet for controlling the cooperation of the wipers with the terminals, means including a register controller for controlling over the test terminal of the called line the operation of the magnet and the seizure of the terminals by the selector, sources of different signaling current, and means including the register and controlled over the talking terminal of the selected set for applying one of said sources of signaling current to the called line over the wipers and terminals of the selector.

6. In a telephone exchange system, a plurality of subscribers' lines including a party line, a final selector having a plurality of sets of terminals for said lines and a set of wipers co-operating therewith, means including a register controller for controlling the operation of the selector, sources of different potentials, electron discharge devices in the register, a switching means in the register for applying variable potentials to the discharge devices twice in succession, means depending on the setting of the final selector for applying characteristic potentials to the discharge devices twice in succession, means operable when the potentials first applied to discharge devices have a predetermined relationship to one-another for stopping the wipers on a set of terminals, a plurality of different sources of ringing current, and means controlled by said discharge devices when the two potentials applied thereto the second time bear a predetermined relationship to

5

one-another for connecting one of said sources of ringing current to the called line.

7. In a telephone exchange system, a plurality of subscribers' lines including a party line, a final selector having a plurality of sets of terminals for said lines, a set of wipers and a magnet for controlling the cooperation of the wipers with the terminals, means including a register controller for controlling the operation of the magnet, sources of potentials, a plurality of electron discharge devices in the register, a switching means in the register operable in accordance with the numerical designation of the lines for applying variable potentials of one kind to the first electron discharge device, means in the final selector including a wiper and the cooperating terminal for applying characteristic potentials of the same kind to the electron discharge devices, means including said magnet and operable when the potentials applied to a discharge device have a predetermined relationship to one-another for stopping the wipers on a set of terminals, means in the register operable thereupon for applying a predetermined potential of a different kind to each of said discharge devices, means in the final selector for applying characteristic potentials of said different kind to another one of the terminals of the selected set and therethrough to the discharge devices, a plurality of different sources of ringing current, and means controlled by said discharge devices when the two potentials of the different kind applied thereto bear a predetermined relationship to one-another for connecting one of said sources of ringing current to the called line.

8. In a telephone exchange system, a plurality of subscribers' lines including a party line, a final selector having a plurality of sets of talking and test terminals for said lines, a set of wipers and a magnet for controlling the cooperation of the wipers with the terminals, means including a register controller for controlling the operation of the magnet, sources of direct current potentials, a plurality of electron discharge devices in the register, a switching means in the register operable in accordance with the numerical designation of the lines for applying variable negative potentials to the first electron discharge device, means in the final selector including a terminal and the cooperating wiper for applying characteristic negative potentials to the electron discharge devices, means including said magnet and operable when the negative potentials applied to a discharge device have a predetermined relationship to one-another for stopping the wipers on a set of terminals, means in the register operable thereupon for applying a predetermined positive potential to each of said discharge devices, means in the final selector for applying characteristic positive potentials to another one of the terminals of the selected set and therethrough to the discharge devices, a plurality of different source of ringing current, and means controlled by said discharge devices when the two positive potentials applied thereto bear a predetermined relationship to one-another for connecting one of said sources of ringing current to the called line.

9. In a telephone exchange system, a plurality of subscribers' lines including a party line, a final selector having a plurality of sets of terminals in which said lines terminate, a set of wipers and a magnet for controlling the cooperation of the wipers with the terminals, said wipers and terminal sets including two over which talking con-

6

nections are established and one over which lines are tested, means including a register controller for controlling the operation of the magnet, sources of direct current potentials, a plurality of electron discharge devices in the register, a switching means in the register operable in accordance with the numerical designation of the lines for applying variable negative potentials to the first electron discharge device, means in the final selector including the test wiper and the cooperating terminals for applying characteristic negative potentials to the electron discharge devices, means including said magnet and operable when the negative potentials applied to a discharge device have a predetermined relationship to one-another for stopping the wipers on a set of terminals, means in the register operable thereupon for applying a predetermined positive potential to each of said discharge devices, means in the final selector for applying characteristic positive potentials to one of the terminals included in the talking connection and therethrough to the discharge devices, a plurality of different sources of ringing current, and means controlled by said discharge devices when the two positive potentials applied thereto bear a predetermined relationship to one-another for connecting one of said sources of ringing current to the called line.

10. In a telephone exchange system, a party line having a plurality of stations, a final selector including a set of wipers and a plurality of cooperating sets of terminals one for each station of said party line, a magnet for controlling the movement of said wipers over said terminals, a register controller, means under the control of said register controller for controlling said magnet to cause said wipers to engage a set of terminals corresponding to a wanted station on said party line, a source of potentials, means including a relay individual to said line for applying to one of the terminals of each set of terminals a potential characteristic of each station on the line, a plurality of sources of ringing current, and selective means in said register controller responsive to said characteristic potentials for applying a source of ringing current to said party line.

11. The telephone system according to claim 10, and in which a talking connection is established by the final selector over the terminal to which the characteristic potential is applied.

12. The telephone system according to claim 11, and in which the party line has two line relays and a cut-off relay, the first line relay connected with the line over contacts of the cut-off relay, an energizing circuit for the second line relay controlled in parallel by the first line relay and the cut-off relay, and contacts for one of the line relays controlling the application of the characteristic potentials to the terminals.

13. The telephone system according to claim 10, and in which the party line has two line relays and a cut-off relay, the first line relay connected with the line over contacts of the cut-off relay, an energizing circuit for the second line relay controlled in parallel by the first line relay and the cut-off relay, and contacts for both line relays controlling the application of the characteristic potentials to the terminals.

14. In a telephone exchange system, a final selector switch having a plurality of sets of multiplied terminals, a set of wipers and a magnet for controlling the cooperation of said wipers with said terminals, a plurality of lines connected to said terminals including a subscriber's party

line having a plurality of stations connected in parallel therewith, cut-off and line relays individual to said party line, a source of potentials, different characteristic potentials connected to each of three normally closed contacts of the cut-off relay and therethrough to multiplied terminals of the party line, connections from multiplied terminals of the party line to normally closed contacts of the line relay and therethrough to different characteristic potential sources, a register controller operable in accordance with the numerical designation of a called line and controlling the selection of a set of terminals by the wipers of the final selector, said register including electric discharge means and means for applying potentials thereto depending on the designation of the called line, circuits for applying potentials to the discharge means from the wipers of the final selector, means for variably operating the discharge means depending on the relationship of the potentials applied thereto from the final selector and at the register, sources of ringing currents of different frequencies, and circuits controlled by said discharge means for connecting said sources with the final selector wipers.

15. In a telephone exchange system, a final selector switch having a plurality of sets of terminals, a set of wipers and a magnet for controlling the cooperation of said wipers with said terminals, a plurality of lines connected to said terminals including a subscriber's two-wire party line having a plurality of stations connected in parallel therewith, a cut-off relay and a first and a second line relay individual to said party line, a multiple connection from the first line wire to certain terminals individual to said party line, a connection from the second line wire over a normally closed contact of the cut-off relay to the winding of the first line relay, a connection from the second line wire over normally open contacts of the cut-off relays to another terminal in each set, a source of potentials, a different characteristic potential connected to normally closed contacts of the cut-off relay, a multiple connection between a certain terminal of each set and the winding of the cut-off relay, a connection from a terminal of one of said sets and normally closed contacts of the cut-off and first line relays to a characteristic potential and from a terminal of each of the other sets to a different normally closed contact of the second line relay and therethrough to a different characteristic potential, a connection for applying a characteristic potential over a normally open contact of the first line relay and the last-mentioned normally closed contact of the cut-off relay to a terminal of said one of said sets, an energizing circuit for the second line relay controlled in normally open contacts of the first line relay and the cut-off relay, a register controller operable in accordance with the numerical designation of a called line and controlling the selection of a set of terminals by the wipers of the final selector, said register including electric discharge means and means for applying potentials thereto depending on the designation of the called line, circuits for applying potentials to the discharge means from the wipers of the final selector, means for variably operating the discharge means depending on the relationship of the potentials applied thereto from the final selector and at the register, sources of ringing currents of different frequencies, and circuits controlled

by said discharge means for connecting said sources with the final selector wipers.

16. The telephone exchange system according to claim 14, and in which said register includes three pairs of triodes, a gas valve associated with each pair of triodes, a switch in said register operable in accordance with the units designation of the called station and arranged to apply in its different positions different characteristic negative potentials to the grid of the first triode in the first pair of triodes, a connection from a final wiper to the grids of the second triodes of each of said pairs of triodes, a connection from another final wiper to the grids of the second triode in each pair of triodes, a first relay in the register having a normally closed contact controlling said connection from the register switch to the first pair of triodes and normally open contacts adapted to apply predetermined potentials to the grids of the first triodes of the three pairs of triodes, circuits for operating each gas valve when the same potentials are applied to the grids of the two triodes associated with the valve, a second register relay associated with each gas valve and energized upon the operation thereof, an operating circuit for the magnet of the final selector controlled by the first gas valve, an energizing circuit for the first register relay closed upon the extinguishing of the first gas valve following its first operation, three other relays in said register, circuits for operating the first of the last-mentioned relays by the first, the second by the second and the third by the third gas valve, sources of ringing currents of four different frequencies, and series connections from said sources over contacts of said three relays in the register to the wipers of the final selector.

17. In a telephone exchange system, a final selector switch having a plurality of sets of terminals, each set consisting of four terminals, a set of wipers for said selector and a magnet for controlling the cooperation of said wipers with said terminals, a plurality of lines connected to said terminals including a subscriber's two-wire party line having four stations connected in parallel therewith, cut-off relay means and a first and a second line relay individual to said party line, a multiple connection from the first line wire to the first terminals of four of said sets of terminals individual to said party line, a connection from the second line wire over a normally closed contact of the cut-off relay means to the winding of the first line relay, a connection from the second line wire over normally open contacts of the cut-off relay means to the second terminals in the four sets, a connection from each of the second terminals of the other three of the four sets to normally closed contacts of the cut-off relay means, a source of direct current potentials, a different characteristic positive potential connected to each of three normally closed contacts of the cut-off relay means, a multiple connection between the third terminals of the four sets and the winding of the cut-off relays means, a connection from the fourth terminal of said one of said sets and normally closed contacts of the cut-off and first line relays to a characteristic negative potential, a connection from each of the fourth terminals of each of the three other of said four sets to a different normally closed contact of the second line relay and therethrough to a different characteristic negative potential, a connection for applying a characteristic negative potential over a normally open contact of the first line relay and the last-mentioned normally closed

contact of the cut-off relay means to the fourth terminal of said one of said sets, an energizing circuit for the second line relay controlled in normally open contacts of the first line relay and the cut-off relay means, a register controller operable in accordance with the numerical designation of a called line and controlling the selection of a set of terminals by the wipers of the final selector, said register including discharge tubes having cathode, anode and grid electrodes, a switch in said register operable in accordance with the units designation of the called station and arranged to apply in its different positions different characteristic potentials to one of the electrodes of said tubes, a connection from the final selector wipers to other electrodes of said tubes, said tubes being operable when the potentials applied to their electrodes bear predetermined relationships to one another, an operating circuit for the magnet of the final selector controlled by said tubes, sources of ringing currents of four different frequencies, and connections from said sources to the wipers of the final selector controlled by said tubes.

18. In a telephone exchange system, a party line comprising a plurality of stations, a final selector including a set of wipers and a plurality of co-operating sets of terminals one for each station on said party line, a magnet for controlling the movement of said wipers over said terminals, means for controlling said magnet to cause said wipers to engage a set of terminals corresponding to a wanted station on said party line, a source of potentials, means for applying to one of the terminals of each set of terminals a potential characteristic of each party line station, a plurality of sources of ringing current, and means responsive to said characteristic potentials for applying a selected source of ringing current to said party line.

19. The telephone system according to claim 18, and in which said potentials are direct current potentials.

20. The telephone system according to claim 18, and in which a talking connection is established by the final selector over the terminal to which the characteristic direct current potential is applied.

21. The telephone system according to claim 18, and in which each set of terminals comprises a test terminal, means for applying to the test terminals direct current potentials characteristic of the designation of the associated station, and means responsive to the last-mentioned potential for stopping the final selector wipers on the terminals of the desired station.

22. In a telephone exchange system, a plurality of subscribers' lines including a party line, a final selector having a plurality of sets of talking

and test terminals for said lines, a set of wipers and a magnet for controlling the cooperation of the wipers with the terminals, numerically operable means for controlling over one terminal of the called line the operation of the magnet and the seizure of the terminals by the selector, sources of different signaling current, and means controlled by the numerically operable means and over another terminal of the selected set for applying one of said sources of signaling current to the called line over the wipers and terminals of the selector.

23. In a telephone exchange system, a plurality of subscribers' lines including a party line, a final selector having a plurality of sets of terminals for said lines and a set of wipers cooperating therewith, means operable in accordance with the numerical designation of the called line for controlling the operation of the selector, sources of different potentials, electron discharge devices, a switching means for applying variable potentials to the discharge devices twice in succession, means operable when the potentials first applied to discharge devices have a predetermined relationship to one another for stopping the wipers on a set of terminals, a plurality of different sources of ringing current, and means controlled by said discharge devices when the two potentials applied thereto the second time bear a predetermined relationship to one another for connecting one of said sources of ringing current to the called line.

24. In a telephone exchange system, a party line having a plurality of stations, a final selector including a set of wipers and a plurality of co-operating sets of terminals one for each station of said party line, a magnet for controlling the movement of said wipers over said terminals, means for controlling said magnet to cause said wipers to engage a set of terminals corresponding to a wanted station on said party line, a source of potentials, means including a relay individual to said party line for applying to one of the terminals of each set of terminals a potential characteristic of each station on the line, a plurality of sources of ringing current and selective means responsive to said characteristic potentials for applying a source of ringing current to said party line.

25. The telephone system according to claim 24, and in which the party line has two line relays and a cut-off relay, the first line relay connected with the line over contacts of the cut-off relay, an energizing circuit for the second relay controlled in parallel by the first line relay and the cut-off relay, and contacts for one of the line relays controlling the application of the characteristic potentials to the terminals.

GERALD DEAKIN.