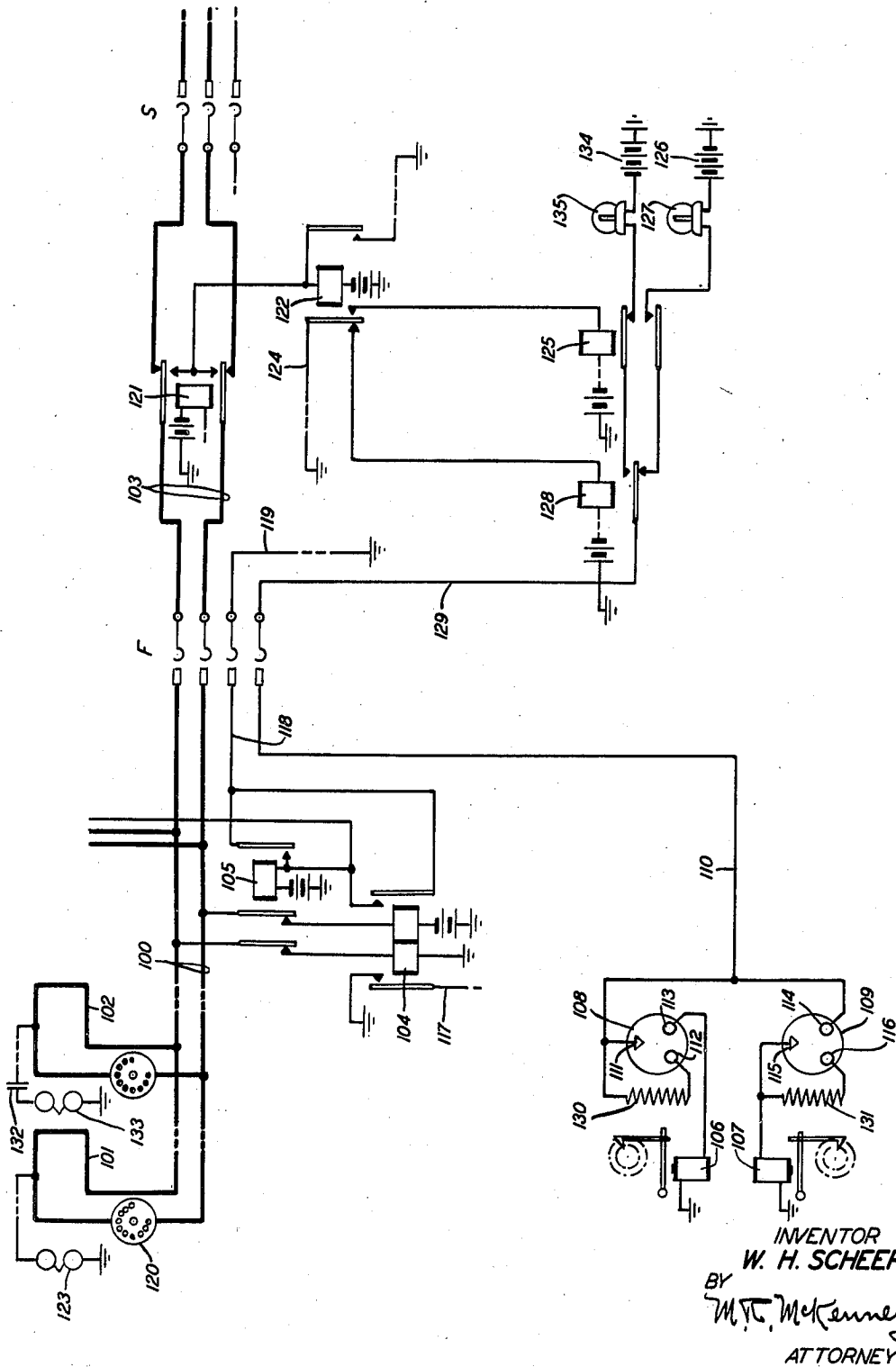


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COMMUNICATION SYSTEM

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This invention relates to communication systems and particularly to measured service for party lines.

The objects of the invention are to minimize the amount of equipment necessary for the selective operation of message registers; to enable the selective operation of a plurality of registers over a single control conductor; to safeguard against false operation; and in other respects to simplify and improve systems of this character.

In automatic telephone systems having two-party lines arranged for message register service it is particularly desirable to control the operation of both party registers over a single control conductor extending through the contact bank of the automatic switch in which the line appears. And it is also essential that the selection and operation of each register shall be performed without causing the false operation of the associated register.

In accordance with the present invention, these requirements are realized and the foregoing objects are attained by means of a system in which a simple three-element discharge tube is provided for each station on the party line. These tubes are so constructed that the anode-cathode gaps are strongly unidirectional, making it possible to obtain the selective operation of the tubes by connecting their electrodes to the single control conductor. More specifically, the unidirectional main discharge gap of one tube is connected in series with the control conductor and the associated register in a direction to transmit current of one polarity, whereas the main discharge gap of the other tube is connected in series with the control conductor and the other register in a direction to transmit current of the opposite polarity. The control or starting gaps of both tubes are also connected in series with the control conductor and the associated message registers. Thus the application of operating voltage of either polarity to the single control conductor causes both starting gaps to ionize, but only one of the tubes transmits operating current through its discharge gap to selectively operate the desired register.

Other features and advantages of the invention will be explained more fully in the following detailed specification.

The drawing accompanying the specification illustrates a portion of an automatic telephone system incorporating the features of the present invention.

Although the invention is applicable in its broader aspects to the selective control and op-

eration of registers or similar devices when used in various types of system, such as telephone, telegraph or other communication systems, it has been disclosed herein for the purpose of illustration in a two-party message register telephone system of the automatic type.

Referring to the drawing, the subscriber's line 100, having two substations 101 and 102 thereon, appears in the terminal bank of an automatic switch, such as a line finder switch F. The finder F is joined by a link or trunk circuit 103 to a first selector switch S, which, together with succeeding switches, serves to extend the line 100, when calling in the direction of a called line.

The line 100 is provided with the usual line and cut-off relays 104 and 105 and with message registers 106 and 107 and space discharge tubes 108 and 109. The register 106 and the associated tube 108 are individual to the party station 101, and the register 107 and tube 109 are individual to the other station 102. The tubes 108 and 109 are of the type having three separate electrodes, an anode, a cathode and a starting electrode. The anode and cathode form the main discharge gap, and these electrodes have different shapes so as to give the gap a strong directional characteristic. The starting electrode and the cathode form the starting gap, and since these electrodes are similarly shaped, this gap is non-directional in character. Although both gaps present a high impedance when deionized, the starting gap ionizes on a much lower voltage than the main gap. The three electrodes are enclosed in a container filled with any suitable gas or mixture of gases. Two of the electrodes, the cathode and the control or starting electrode, form a control or ionizing gap for starting purposes; and the third electrode, the anode, forms the main discharge gap with the cathode. The control gap is non-directional, that is, it ionizes when potential of either polarity and of sufficient magnitude is applied thereto. The main discharge gap, however, is highly directional; it will conduct current of one polarity in response to the ionization of the control gap, but it will pass very little current of the opposite polarity. The meters 106 or 107 shall be constructed to operate on the high current flow and not to operate on the low current flow.

In the present system the unidirectional character of the main discharge gaps of the tubes serves to enable the selective operation of the registers over the single control conductor 110. To this end the anode 111 and the control electrode 112 of the tube 108 are connected to the

conductor 110, and the cathode 113 is connected through the winding of the non-polarized message register 106 to ground. The other tube 109 has its cathode 114 connected to the control conductor 110 and its anode 115 and control electrode 116 connected through the winding of the register 107 to ground. By analyzing these electrode connections it will be seen that if positive potential is applied to the conductor 110 when the control gaps of both tubes are ionized current will flow across the main discharge gap of tube 108 from anode 111 to cathode 113 and through resistor 106, whereas current in any substantial amount will not flow across the main discharge gap of tube 109. On the other hand, if negative potential is applied to the control conductor 110 while both control gaps are ionized, current will flow through the main gap of tube 109, operating register 107, whereas no appreciable current will flow through the other tube.

The link 103 interconnecting the finder F and first selector S is provided with the usual controlling equipment for controlling the switches, for making the party line test to determine which station is calling, and for applying voltage of the proper polarity to the control conductor for operating the register corresponding to the calling line. Much of the equipment has been omitted in the drawing for the sake of clearness. It will be understood, however, that the automatic switches, the link controlling equipment and the circuits at the substations 101 and 102 may be of any suitable types such as those disclosed in the patent to Johnson et al. 1,804,778, of May 12, 1931.

To further explain the operation of this system it will be assumed that the subscriber at station 101 wishes to make a call. When the calling party removes his receiver, the line relay 104 operates in an obvious circuit and applies ground potential to the start conductor 117 to start the movement of the line finder F. When the finder F advances its brushes to the terminal of the calling line 100, a circuit is closed from battery through the winding of cut-off relay 105, contacts of line relay 104, sleeve conductor 118 through the terminal and brush of the line finder F to ground over conductor 119. The cut-off relay 105 operates and locks in this circuit, and the line finder F comes to rest. The operation of cut-off relay 105 releases the line relay 104.

Thereafter the subscriber manipulates his dial 120 to operate the switch S and succeeding switches to establish the desired connection. Also at any desirable time, either while the dialing operations are in progress or after they have been completed, a test is made to determine which party is calling. To perform this test the relay 121 is operated to establish a circuit from battery through the winding of test relay 122, contacts of relay 121 and thence over both conductors of the link 103 and line 100 to the calling substation 101. At this particular substation the test circuit finds a path through the windings of the ringer 123 to ground. Relay 122 in operating locks through its own contacts to grounded control conductor.

If the calling party is successful in establishing the desired connection and the called party answers, the following circuit is established at any suitable time thereafter: ground over conductor 124, front contacts of the operated test relay 122 through the winding of relay 125 to battery. Relay 125 operates, and a circuit is completed from the positive pole of battery 126, resistance lamp

127, front contacts of relay 125, back contacts of relay 128, conductor 129, brush and terminal of finder F, conductor 110 to the anode 111 and through the resistor 130 to the control electrode 112 of the tube 108. This potential is also applied over conductor 110 to the cathode 114 of the tube 109. Since the negative pole of battery 126 is connected through the register 106 to the cathode 113 of tube 108 and through the register 107 and resistor 131 to the control electrodes 115 of tube 109, the control gaps of both tubes ionize. These control gaps ionize on voltage, and substantially no current flows through the registers 106 and 107 since resistances 130 and 131 are of a high value. The positive pole of battery 126 being applied to the anode 111 of the tube 108, the ionization of the control gap transfers to the anode, and discharge current now flows over the conductor 110 across the main discharge gap from anode 111 to cathode 113 and through the register 106 to ground. This current is of sufficient magnitude to operate the register. Since, however, the main gap of the tube 109 conducts in the opposite direction, no substantial amount of current flows through this gap and register 107; hence the register 107 does not operate at this time.

At the termination of the conversation between the subscriber at station 101 and the subscriber at the called station, the connection is released and the circuits are restored to their normal condition.

When the party at station 102 makes a call, the party line test relay 122 fails to operate since the condenser 132 is interposed between the tip and ring conductors of the line and the grounded terminal of the ringer 133. Later, when ground is connected to conductor 124, relay 128 operates in a circuit extending through the back contact of test relay 122, and relay 125 remains deenergized. The negative pole of battery 134 is now connected to the control conductor 110 over a circuit traceable through the resistance lamp 135, normal contacts of relay 125, front contacts of relay 128, conductor 129 and the brush and terminal of the line finder F. Since the control gaps of the tubes are unidirectional, both of these gaps ionize in response to the application thereto of negative potential. In this instance the main gap of the tube 109 discharges in a circuit traceable from the positive or grounded pole of battery 134 through the winding of register 107, anode 115, cathode 114, conductor 110 and thence as traced to the negative pole of the battery 134. The register 107 operates in this circuit, but register 106 does not operate.

What is claimed is:

1. In a communication system, a central office, a line terminating in said central office and having two stations thereon, a pair of message registers individual to said stations respectively and located in the central office, a control conductor for said line, a pair of discharge tubes individual respectively to said stations and, also, located in the central office, each of said tubes having a cathode and an anode which are shaped to form a unidirectional main discharge gap and a starting electrode which is shaped to form with said cathode a non-directional starting gap, circuit means for connecting the starting gap of each tube in series with said control conductor and the associated register, circuit means for connecting the main discharge gap of one of said tubes in series with said control conductor and the associated register to permit the flow of current

over said conductor in one direction only, circuit means for connecting the main discharge gap of the other tube in series with said control conductor and the associated register to permit the flow of current over said control conductor in the opposite direction only, said starting and main discharge gaps having high impedances which serve normally to isolate said registers from the control conductor, sources of operating voltage of opposite polarities, means for connecting either one of said sources of voltage to said control conductor to cause the ionization of the starting gaps of both of said tubes, the starting gap ionization of the tube corresponding to the desired register transferring to the anode to cause the discharge of the main gap and the flow of operating current over said control conductor through the winding of said desired register to selectively operate it, and high resistance elements connected in circuit respectively with said starting gaps to prevent the flow of current in the associated registers by way of the ionized starting gaps.

2. In a communication system, a central office, a party line terminating in said central office and having two substations thereon, a pair of message registers individual to said substations respectively and located in the central office, a control conductor for said line separate from the talking conductors thereof, a pair of discharge tubes individual respectively to said substations and also located in the central office, each of said tubes having a cathode and an anode of different shapes forming a unidirectional main discharge gap and a starting electrode similar in shape to said cathode and forming therewith a non-directional starting gap, circuit means for connecting

the starting gap of each tube in series with said control conductor and the associated register, circuit means for connecting the main discharge gap of the first one of said tubes in series with said control conductor and the associated register and in parallel with the starting gap of said first tube, the main discharge gap of said first tube serving to permit the flow of register operating current over said control conductor in one direction only, circuit means for connecting the main discharge gap of the second tube in series with said control conductor and the associated register and in parallel with the starting gap of said second tube, the main discharge gap of said second tube serving to permit the flow of register operating current over said control conductor in the opposite direction only, said starting and main discharge gaps having high impedances which serve normally to isolate said registers from the control conductor, sources of operating voltage of positive and negative polarities, selective means for connecting either the positive or negative source of voltage to said control conductor to cause the simultaneous ionization of the starting gaps of both of said tubes, the starting gap ionization of the tube corresponding to the desired register transferring to the anode to cause the discharge of the main gap and the flow of operating current over said control conductor through the winding of said desired register to selectively operate it, and high resistance elements connected in circuit respectively with said starting gaps and the message registers to prevent the flow of current in said registers in response to the ionization of said starting gaps.

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