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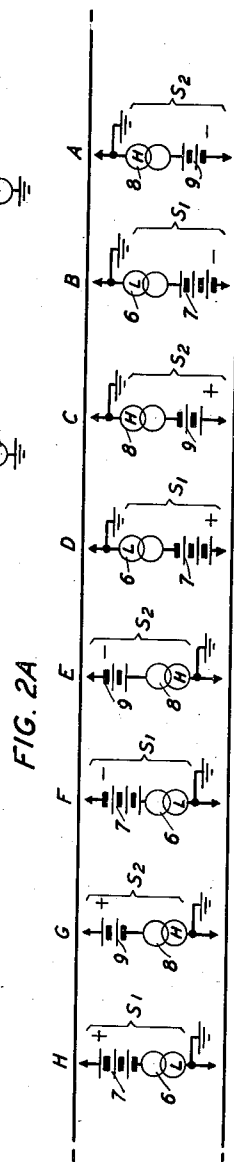
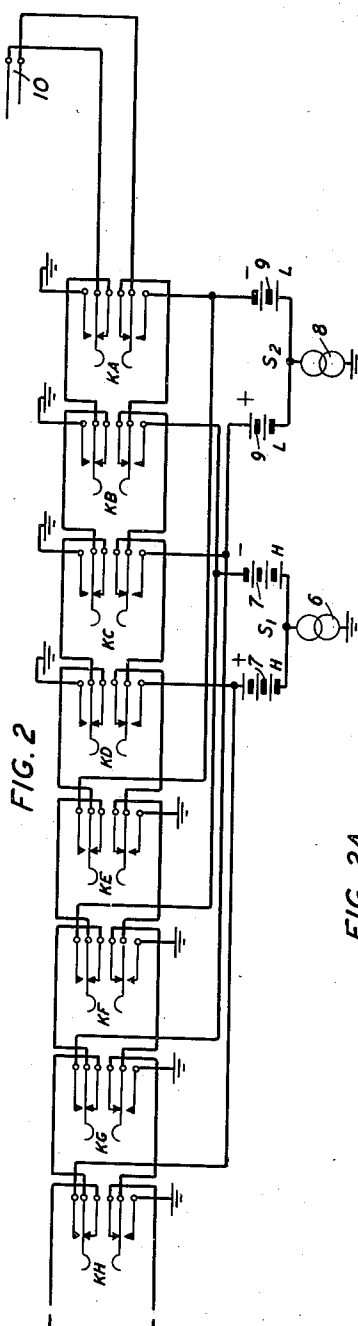
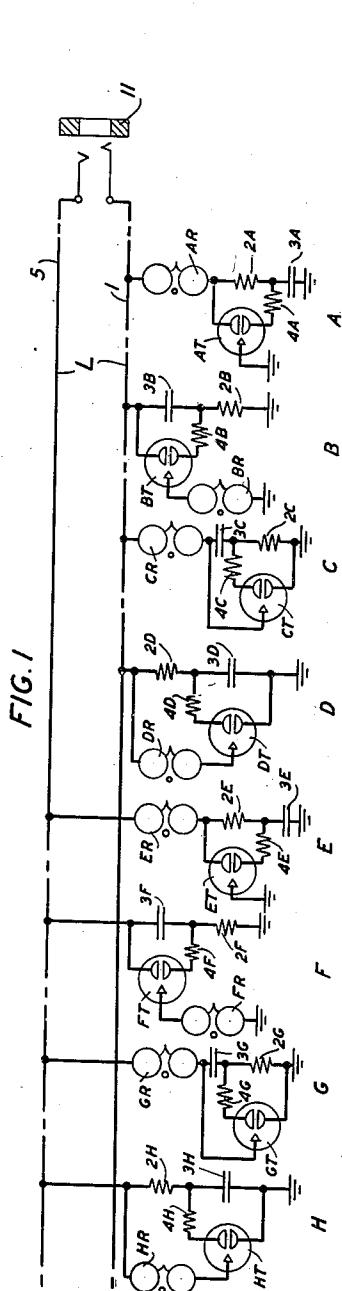
C. W. HALLIGAN

2,261,620

TELEPHONE RINGING SYSTEM

Filed April 24, 1940

2 Sheets-Sheet 1



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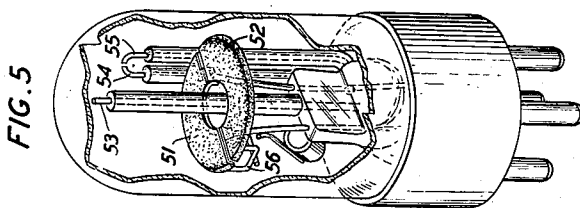
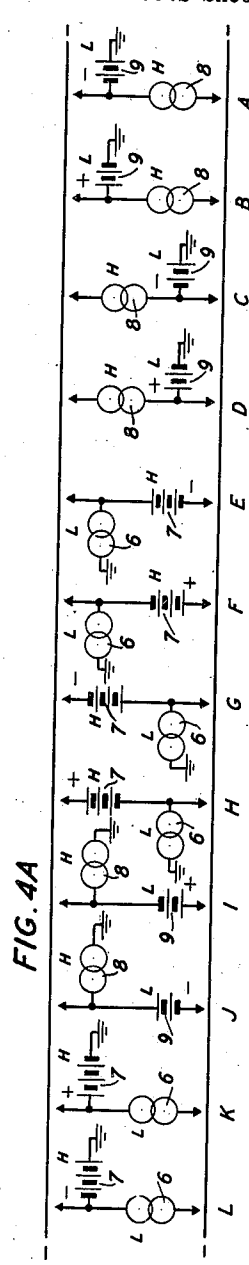
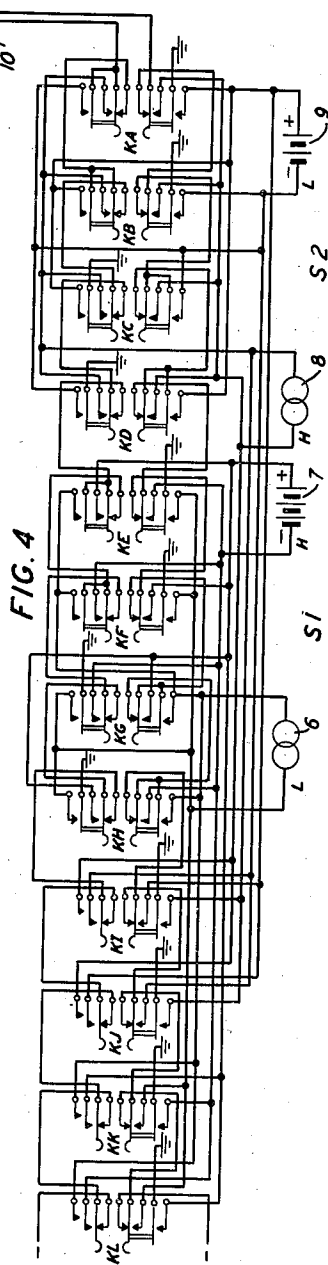
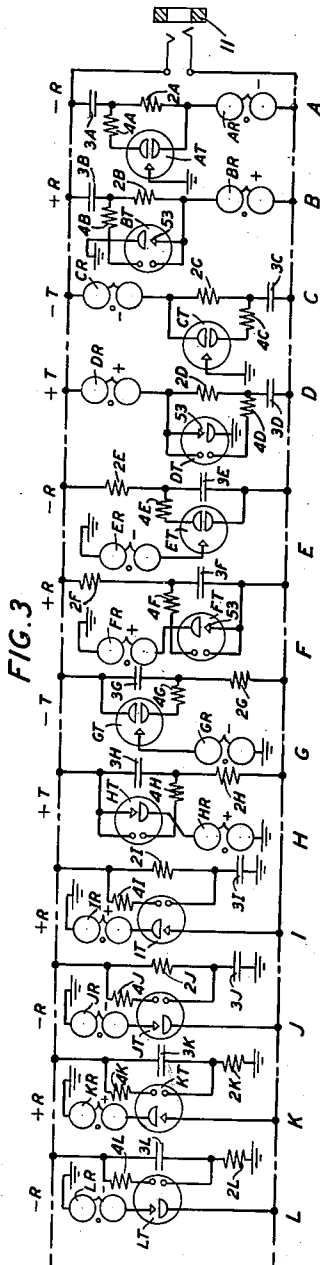
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TELEPHONE RINGING SYSTEM

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,261,620

TELEPHONE RINGING SYSTEM

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Application April 24, 1940, Serial No. 331,296

19 Claims. (Cl. 179—86)

This invention relates to full selective ringing telephone systems and more particularly to systems of the character disclosed in U. S. Patent 2,088,311, issued to L. J. Stacy on July 27, 1937, in which gas-filled tubes are employed and so arranged that any one of a plurality of four stations can be selectively called to the exclusion of all the others, when alternating current superimposed on a direct current source, is applied to the line in a predetermined manner.

An object of the invention is to selectively operate any one of more than four electromagnetic devices associated with a two-conductor line to the exclusion of the others.

A feature of the invention resides in the provision of such signaling source component voltages, both alternating and direct current, and means for their selective application to a line and ground, in either polar direction and in so connecting an electromagnetic device and gas-filled discharge tube to the line and ground at each station, in association with suitable impedance elements, that the selective application to the line of such signaling current will cause the selective response of a desired particular one of said connected devices to the exclusion of all the others.

The invention will be understood from the following description and accompanying drawings in which:

Fig. 1 represents a line having eight stations connected thereto;

Fig. 2 represents a portion of an operator's cord circuit arranged to selectively connect ringing current to the line of Fig. 1 in different manners to selectively operate the station ringers connected thereto;

Fig. 2A is a schematic representation of the different manners in which ringing current is connected by the cord circuit of Fig. 2;

Fig. 3 is a line having twelve stations connected thereto;

Fig. 4 represents a cord circuit arranged to selectively connect ringing current to the line of Fig. 3 in twelve different manners to selectively operate the station ringers connected thereto;

Fig. 4A is a schematic representation of the different manners in which ringing current is connected by the cord circuit of Fig. 4; and

Fig. 5 is a four-element gas-filled discharge tube of the type described in a copending application, filed April 24, 1940 in the name of W. H. T. Holden, Ser. No. 331,270, employed at certain of the stations of the line shown in Fig. 3.

Referring to Fig. 1 eight stations, A, B, C, D,

E, F, G and H are shown on the line L, at each of which is located a ringer R and a three-element gas-filled discharge tube T, and indicated as AR, AT, BR and BT, etc. The ringer AR at station A is connected between the ring conductor of the line L at ground in series with a resistance 2A and condenser 3A. Across the resistance 2A is connected a control gap of the gas-filled discharge tube AT in series with a current-limiting resistance 4A. The anode of tube AT is also connected to ground. At station C the ringer CR is also connected between the ring conductor of the line at ground in series with the resistance 2C and condenser 3C of substantially the same value as resistance 2A and condenser 3A, and the control gap is connected across resistance 2C in series with current-limiting resistance 4C. At this station, however, the anode of tube CT is connected to the ring conductor 1 in series with the ringer, i. e., connected between the ringer and condenser 3C as shown.

At stations B and D the ring conductor is grounded through serially connected resistances and condensers 2B and 3B and 2D and 3D, respectively. The control gaps at both stations are connected across the respective condensers 3B and 3D. At station B the anode is connected to ground in series with the ringer BR and at station D the anode is connected to the ring conductor of the line in series with the corresponding ringer DR.

At stations E and G the respective ringers are connected between the tip conductor 5 of the line at ground in series with the respective resistances and condensers 2E, 3E and 2G and 3G. The control gaps of the tubes at these stations are connected across the respective resistances 2E and 2G. At station E the anode is connected to ground, and at station G the anode is connected to the tip conductor 5 of the line in series with the respective ringer GR.

At stations F and H the connection arrangements are the same as for stations B and D previously described except that the connections are to the tip conductor 5 of the line instead of the ring conductor 1, i. e., the control gaps are connected across the respective condensers 3F and 3H, the anode of the tube at station F is connected to ground through the ringer and at station H the anode is connected in series with the ringer to the tip of the line and the opposing electrode, i. e., the cathode is connected to ground.

Now referring to the cord circuit of Fig. 2 eight selective ringing keys KA, KB, KC, etc. are

shown each so connected as to apply either of the two superimposed ringing current sources S1 or S2 to the line in a different one of four manners. Source S1 comprises an alternating current ringing generator 6 of comparatively low voltage and a direct current source 7 of relatively high voltage and source S2 comprises an alternating current ringing generator H of a relatively higher voltage than generator 6 and a direct current source 9 of relatively lower voltage. In practice the low voltage alternating source 6 may be of the order of 45 to 50 volts, the high voltage alternating current source 8 of the order of 90 volts, the low voltage direct current source of the order of 45 to 50 volts, and the high voltage direct current source of the order of 100 to 110 volts, the controlling requirement being that when source S1, comprising a high voltage direct current component, and a low voltage alternating current component is applied between either side of the line and ground, the direct current voltage shall produce such a potential drop across the condensers connected to that side of the line as to fire the control gaps of the tubes connected across them, while the alternating current component shall not cause a sufficient potential drop across the corresponding resistances to fire the control gaps connected thereacross. Conversely when source S2 comprising a high voltage alternating current component and a low voltage direct current component is connected between either side of the line and ground the alternating current component shall cause a sufficient drop across the resistances connected to that side of the line to fire the control gaps of the tubes connected thereacross and the direct current components shall not be high enough to effect a voltage drop across the corresponding condenser to fire the tubes with control gaps connected in bridge thereto.

Insertion of plug 10 in jack 11 and operation of key KA, for example, effects connection of the source S2 to the line in a manner diagrammatically shown at A of Fig. 2A, i. e., the tip conductor 5 of the line is grounded and negative superimposed current is connected to the ring conductor 1. Source S2, as before mentioned, comprises a high voltage alternating current source 8 (of the order of 90 volts) and this voltage when applied to the ring conductor of the line will cause a control gap discharge at those stations connected to the ring conductor whose gaps are connected across a resistance, i. e., at stations A and C. The tubes at stations B and D have their control gaps connected across condensers 3B and 3D, respectively, and as the direct current component voltage of source S2 does not cause a high enough potential drop across these condensers, the control gaps at these stations do not break down. Stations E, F, G and H have their tubes and ringers connected to the tip conductor 5 and therefore no control gap breakdown occurs at any of these stations.

At station A tube AT becomes ionized by the control gap discharge and due to the fact that negative superimposed current is present on the ring conductor 1 of the line a main gap discharge occurs and current flows from the grounded anode to the cathode, through the ringer AR, conductor 1 of the line, and thence to the negative pole of the direct current component of source S2 in sufficient volume to cause the ringer to respond.

At station C the anode of tube CT is connected in a reverse direction to that of the anode at

station A and as the main gaps of the tubes employed are substantially rectifying, i. e., current will flow in appreciable amounts only in the direction of the anode to the cathode, no main gap discharge will take place at station C and the ringer CR will be unaffected.

Operation of key KC also connects source S2 to the ring conductor 1 of the line but reverses the polarity of the direct current component, i. e., key KC connects positive pulsating current to the line. At stations A and C the respective tube control gaps break down as before but, as the effective impedance of the current pulsations are in a positive direction the main gap of tube CT breaks down to cause ringer CR to operate whereas the reverse connection of the main gap at station A prevents such a discharge through the tube.

Operation of key KB connects source S1 in a negative direction to the ring conductor 1 of the line. As before explained the direct current component of this source (S1) is of the order of 100 volts which is sufficient to impress a control gap breakdown potential across the condenser at all four stations connected to the ring conductor, i. e., stations A, B, C and D. Only stations B and D, on the ring side of the line, however, have their two control gaps connected across condensers and therefore only these tubes will ionize. The tube anode at station B is connected to ground through the ringer BR and the cathode of the main gap is connected to the ring conductor of the line. Hence this gap will break down on the peak potential of the pulsating source S1 and sufficient current will flow in the ringer coils to cause its operation.

In a similar manner, actuation of key KD will connect source S1 in the positive direction to the ring conductor and ground the tip. The control gaps of tubes BT and DT will fire as in the case when key KB was actuated but, as the polarity of pulsating current connected to the line is positive instead of negative with respect to ground, only the main gap of the tube at station D will pass current sufficient to operate the ringer.

It will be noted that the connection of stations E, F, G and H are identical with stations A, B, C and D, respectively, except for the difference that these four stations are connected to the tip of the line instead of the ring and that keys KE, KF, KG and KH are arranged to connect the current sources S1 and S2 to the tip conductor 5 of the line in exactly the same manner as the respective keys KA to KD are arranged to connect to the same sources to the ring conductor. Therefore, the selective operation of any one of the eight keys KA, etc. will cause the selective operation of a particular one of said stations A, B, etc. to the exclusion of the others.

The fundamental characteristics of the present invention, as exemplified in the foregoing description, resides in the use of circuit arrangements for firing, i. e., breaking down, the control gaps of the gas-filled tubes employed at the station, certain of which circuit arrangements are sensitive to alternating currents only and others of which are sensitive to direct current only and in the provision of such superimposed alternating and direct ringing current supply sources that one source will have a sufficiently high alternating current voltage component to fire those tubes at the station whose circuits are sensitive to alternating current only and another source which will have a direct current component voltage suffi-

ciently high to fire those tubes whose circuits are sensitive to direct current.

In the arrangement shown in Figs. 1, 2 and 2A, a combination of alternating and direct current is applied in all cases to the control gap circuit of the tube and considerable care is therefore necessary to so choose the component voltages of the ringing sources and to so adjust the control gap circuit arrangement that the proper margin of operation and non-operation at the different stations are maintained.

An alternative, and in some respects more preferable arrangement, is to arrange the connection so that either alternating current alone or direct current alone is applied to the control gap circuits of the tube, while at the same time applying combined alternating current and direct current superimposed one on the other, to the main gap. Such an arrangement which necessitates the use at certain of the stations of a slightly different tube structure, having four instead of three electrodes, is shown in Figs. 3, 4, 4A and 5, which latter figure shows a tube having the same anode-cathode structure as the conventional three-element tube now in use, but in which two independent closely spaced electrodes are provided which constitute the control gap.

Referring more specifically to Fig. 5, a gas-filled discharge tube of conventional size and shape is shown having two half disc electrodes 51 and 52 supported in the base in any convenient manner and coated with some well-known electron emitting or activating substance. Extending upwardly through the center of the tube and suitably insulated from the electrodes 51 and 52 is the usual uncoated wire electrode 53 which forms the anode of the device. Due to the small area of the uncoated free end of anode 53 and the coated electrodes 51 and 52, the gap therebetween has a substantially rectifying characteristic and requires a relatively high cold breakdown potential. In the circuit of the present invention, wherein tubes of the character shown in Fig. 5 are used, the half disc electrodes 51 and 52 may be permanently connected together to form a single electrode as shown by the connection 56, which connected electrodes now become one cathode element of the main gap of which the electrode 53 is the anode. Also supported within the tube and suitably insulated from the electrodes 51, 52 and 53, as well as from each other are two other wire electrodes 54 and 55 whose upper extremities are coated with some activating substance and closely positioned with respect to each other to provide a short discharge gap and a substantially bilateral discharge characteristic of a low breakdown potential, i. e. of the order of 70 volts. These two electrodes provide a control gap for the tube which is independent of the main gap which exists between electrodes 53 and 51, 52.

Now referring to Figs. 3 and 4, which show a full selective twelve-station line made possible by the use of tubes constructed in accordance with Fig. 5, and a cord circuit having means for selectively ringing any one of the connected stations on the line to the exclusion of the others, which cord circuit means employs two pulsating or superimposed ringing current sources similar in all respects to the sources S_1 and S_2 previously described and shown in Fig. 2. The manner in which the components of these two sources are connected to the line of Fig. 3 to effect selective operation of the station ringers thereon is shown in Fig. 4A.

It will be noted that in Fig. 3, the first eight stations A, B, C, D, E, F, G and H have their control gaps fired by potentials connected in bridge of the line in contradistinction to the arrangement of Fig. 1 in which the control gaps are fired by potentials connected between one side or the other of the line and ground. At the last four stations I, J, K and L, the control gaps are fired by potentials of the proper characteristics connected between one side of the line and ground and the corresponding main gaps are discharged in a circuit between the opposite side of the line and ground.

Stations A, C, E, G, J and L are the so-called negative stations, i. e., station ringers respond to negative superimposed pulsating current and employ conventional three-element discharge tubes whereas stations B, D, F, H, I and K which are the so-called positive stations, i. e., stations whose ringers respond to positive pulsating current, employ four-element tubes of the type previously described and shown in Fig. 5.

In Fig. 4, as in Fig. 2, two sources of signaling current S_1 and S_2 are provided, source S_1 comprising a high voltage source 7 of direct current and a lower voltage source 6 of alternating ringing current and source S_2 comprising a high voltage source of alternating current and a lower voltage source of direct current. In practice the potentials of the different components of sources S_1 and S_2 are the same as previously given for Fig. 2.

The operation of Figs. 3 and 4 will now be described:

Assuming that station A (Fig. 3) is to be signaled, the operator will actuate key KA of the cord circuit (Fig. 4) thereby connecting source S_2 to the line and ground in the manner shown A of Fig. 4A, i. e., the high voltage alternating current component of the source is connected in bridge of the line by way of plug 10 and jack 11 and the negative pole of the low voltage direct current component 9 is connected to the tip of the line and the positive pole grounded, the effect of this being to connect the high voltage component of the source alone in bridge of the line and to connect negative superimposed pulsating current to the ring conductor. At station A of the line (Fig. 3) a bridge exists across the line which comprises condenser 3A, resistance 2A, and ringer AR in series. Connected across resistance 2A is the control gap of the tube AT. The value of resistance 2A is so chosen that the high voltage of generator 8 (of the order of 90 volts) causes the voltage drop thereacross sufficient to fire this gap (i. e. of the order of 70 volts), thus causing ionization of tube AT whereupon the negative pulsating current, connected to the ring conductor of the line causes a main gap discharge to take place in tube AT in the direction of the anode to cathode and through the ringer AR thereby causing this ringer to be actuated.

At stations B, C, D, E, F, G and H, a bridge circuit also across the line which bridge, in each instance, comprises a resistance 2 and a condenser 3 and therefore application of the high voltage alternating current across the line at the central office causes the potential drop across the resistance element of the bridges of each of the stations, which is of the order of 70 volts. At stations B, C and D, the respective tube control gap will break down and cause ionization within the tubes due to the fact that their control gaps are connected across the respective resistances at whose terminals a control gap potential exists.

At stations E, F, G and H, however, the tube control gaps thereat are connected across the respective condensers 3 which condensers offer a comparatively low impedance to the alternating current connected to them and therefore will not cause a sufficient potential drop to fire these tubes.

Although the tubes at stations B, C and D are ionized by a control gap breakdown, no main gap discharge, or only a relatively small such discharge takes place due to the manner in which the respective anodes and cathodes are connected with respect to the line. At station B the main gap will only conduct in a positive direction to the ring of the line through the ringer and across the anode-cathode gap to ground and as the ring conductor of the line in the present instance is negative, the ringer BR at station B will be unaffected. At stations C and D the main gap connections are to the tip of the line instead of the ring as at stations A and B and hence in view of the fact that the pulsating current is applied to the ring conductor no main gap discharge occurs at these stations. The low voltage direct current source 9 is not of sufficient potential to affect the main gaps at stations C and D.

At stations I, J, K and L, the control gap breakdown potential is derived from a voltage drop across an impedance connection between the tip of the line and ground and hence ionization of the tubes in these stations is not effected, since source 9 is of insufficient potential for the ionization of these tubes.

If station F is to be signaled, key KF will be operated connecting the high voltage direct current component 7 of source S₁ across the line with the positive pole to the ring and the negative pole to the tip and connecting the lower voltage alternating current component 6 between ground and the negative pole of the direct current component, thereby in effect connecting positive pulsating current to the ring of the line. In this case it will be obvious that at station F, a three-element tube will be inoperative and therefore a tube having independent control and main gap of the type shown in Fig. 5 is necessary. At this station the tube ST has its control gap connected across condenser 3F in series with the current limiting resistance 4F. Due to the fact that a high direct current voltage is impressed across the line at the central office, the condenser is charged to a potential which is sufficiently high to cause the control gap to break down and ionize the tube. The anode of the main gap is connected to the ring conductor of the line and the opposing or cathode electrode is connected in series with the ringer to ground by which method of connection, positive pulsating current on the ring will flow across the main gap to ground through the ringer to cause its actuation.

It will be obvious without further description that none of the other ringers will respond, either due to the fact that their corresponding tubes are not ionized or due to the fact that the direction of the superimposed pulsating current is either in the wrong direction or connected to the wrong side of the line to cause the main gap discharge.

As before pointed out stations I, J, K and L have their control gaps connected between the tip of the line and ground and the main gap between the ring of the line and ground and hence superimposed pulsating current connected between the ring of the line and ground will not

cause a control gap discharge. Likewise the low voltage source 6 is of insufficient potential to cause a control gap discharge at these stations.

Operation of keys KC and KD connect superimposed current having a high voltage alternating current component between the tip of the line and ground and hence control gaps at stations I and J will break down and operation of keys KG and KH connect superimposed current having a high direct current component in a similar manner thereby breaking down the control gaps at stations K and L, but due to the fact that the main gaps are connected to the ring of the line, no discharge thereacross occurs.

It may be mentioned that although a line has been shown employing both three and four-element tubes, in practice it may be found desirable to maintain uniformity of apparatus and therefore to equip each station with four-element tubes which will be connected in an obvious manner.

It will also be obvious that although the present invention has been described as a selective ringing telephone system, any suitable type of electromagnetic device other than a ringer, as for example a relay, can be employed and selectively operated in the same manner.

What is claimed is:

1. In a party line telephone system, means for selectively ringing any one of twelve stations on a line comprising a polarized ringer and a gas-filled tube at each station, two sources of different voltage alternating current, and two sources of different voltage direct current.

2. In a multiparty selective ringing telephone system, a line, a plurality of stations thereon, a gas-filled discharge device having control and main discharge gaps at each station, a ringer in series with each main gap between ground and one side of the line, a condenser and a resistance in a series bridge across the line at certain of said stations, and in series from one side of the line to ground at certain other stations, connections at certain of said stations shunting the control gap of the discharge device thereat across the respective resistance and at other stations across the respective condenser, two different voltage sources of alternating current and two different voltage sources of direct current and means for selectively connecting the higher voltage current source of either characteristic and the lower voltage source of the other characteristic in series and in either polar direction between ground and either side of the line and the high voltage source alone either across the line or between ground and one side of the line, the values of said resistances, condensers and voltages being so chosen that a control gap discharge will take place in those devices whose control gaps are shunting a resistance when the alternating current applied is higher than the direct current and in those devices whose control gaps are shunting a condenser when the direct current voltage applied is higher than the alternating current.

3. In a multiparty selective ringing telephone system employing gas-filled discharge tubes and polarized ringers at the stations, a line, a ringer and a gas-filled tube at each station, two different voltage sources of alternating current and two different voltage sources of direct current, a selective switch for simultaneously associating either the high voltage alternating current and low voltage direct current or the low voltage alternating current and high voltage direct current with the line and ground in a plurality of differ-

ent manners, and means for causing the tube and ringer at each station to respond to a different operation of said switch.

4. In a multiparty selective ringing telephone system, a line, a plurality of subscribers' stations thereon, a ringer at each station, two different voltage sources of alternating current and two different voltage sources of direct current, means for selectively and simultaneously connecting in different manners, the higher voltage alternating current source and the lower voltage direct current source, or the lower voltage alternating current source and the higher voltage direct current source to the line and ground, a gas-filled discharge tube having main and control gaps at each station, and means at each station associating the respective tubes and ringers with the line and ground in such a manner that the connection to the line of the higher voltage alternating current source and lower voltage direct current source, in a particular one of said manners will cause selective actuation of the ringer at a predetermined station, and connection of the higher voltage direct current source and lower voltage alternating current source in another one of said same manners will cause selective actuation of a ringer at another station.

5. A selective ringing telephone system for party lines having more than four stations and employing polarized ringers and gas-filled tubes at the stations characterized by two different sources of superimposed ringing current, one source having an alternating current component of a voltage higher than the control gap breakdown voltage of the tubes employed and a direct current component of a voltage less than said control gap breakdown voltage and said other source having a direct current component of a voltage higher than said control gap breakdown voltage and an alternating current component of a lower potential than said breakdown voltage, and means for selectively applying either of said sources to the line in a plurality of different manners.

6. In a selective ringing party line telephone system employing polarized ringers at each station on the line, two sources of different voltage direct current and two sources of different voltage alternating current, means for selectively and simultaneously connecting either the higher voltage alternating current and lower voltage direct current or the higher voltage direct current and lower voltage alternating current to the line and ground in a plurality of different manners and means for connecting the station ringers to the line and ground in such different manners that a single and different ringer will respond to each selective connection of said current sources.

7. In a multiparty selective ringing telephone system, a line, a plurality of polarized ringers associated therewith, two sources of different voltage alternating current, two sources of different voltage direct current, means for selectively and simultaneously connecting either the high voltage alternating current source and the lower voltage direct current source or the higher voltage direct current source and the lower voltage alternating current source to the line and ground in different predetermined manners, and means comprising a gas-filled discharge device associating each ringer with the line and ground in such different manners that the connection of said current sources to the line and ground in any one of said different manners will cause se-

lective actuation of a predetermined one of said ringers to the exclusion of the others.

8. In a selective signaling system, a line, a plurality of electromagnetic devices, two sources of composite signaling current, one source comprising a high voltage alternating current component and a lower voltage direct current component and the other source comprising a high voltage direct current component and a lower voltage alternating current component, a gas-filled discharge tube connecting each electromagnetic device to one side of the line, and switching means for selectively connecting either source to the line in such a manner that the higher voltage component of the applied source is connected in one manner and both components in series are connected in a different manner to selectively operate a particular one of said devices to the exclusion of the others.

9. In a multiparty selective ringing telephone system, a line, a plurality of stations thereon, a gas-filled discharge device, having a control and a main discharge gap, at each station, a ringer in series with each main gap between ground and one side of the line, a condenser and resistance serially connected in bridge of the line at certain of said stations and from one side of the line to ground at certain other stations, connections at certain of said stations shunting the control gap thereat across the respective resistance and at other stations across the respective condenser, two sources of different voltage alternating current and two sources of different voltage direct current, and means for selectively and simultaneously connecting the high voltage source of either characteristic and the low voltage source of the other characteristic to the line and ground in such different manners that any one of twelve ringers connected to the line can be selectively actuated to the exclusion of eleven others.

10. In a twelve-party selective ringing telephone system, a line, a plurality of polarized ringers associated therewith and means for selectively actuating any one of twelve of said ringers to the exclusion of eleven others, said means comprising two sources of different voltage alternating current and two sources of different voltage direct current selectively connected to said line and ground in different manner.

11. In a selective ringing party line telephone system employing a polarized ringer at each station, means for selectively actuating any one of twelve ringers on the line to the exclusion of eleven others, said means comprising two different voltage sources of direct current and two different voltage sources of alternating current, a switching device for selectively and simultaneously connecting the higher voltage direct current source and the lower voltage alternating current source or the higher voltage alternating current source and lower voltage direct current source to the line and ground in different manner and a gas-filled discharge tube at each station, each tube being connected to the line associated ringer and ground in such a different manner that each ringer will respond to a different selective connection to the line of said current sources.

12. In a twelve-party selective ringing telephone system, a line, a plurality of stations thereon, a ringer and a gas-filled discharge device connected to said line and ground at each station in different manners and means for selectively actuating any one of twelve ringers connected to said line to the exclusion of eleven others.

ers, said means comprising two different voltage sources of alternating current and two different voltage sources of direct current, and a switching device for selectively and simultaneously connecting the higher voltage source of either characteristic and the lower voltage source of the other characteristic to the line and ground in six different manners.

13. In a multiparty selective ringing telephone system, a line, twelve stations thereon, a ringer and a gas-filled discharge device at each station, a source of direct current and a source of alternating current each having a peak voltage higher than the potential required to fire the control gap of the discharge device, another source of direct current and another source of alternating current, each having a peak voltage lower than the control gap breakdown potential, means for selectively and simultaneously connecting the high voltage source of either characteristic and the low voltage source of the other characteristic of the line and ground in six different manners, and means for connecting said ringers and associated gas tube devices to the line and ground in such different manners that the selective connection of said sources to the line and ground in any one of said six manners will cause the selective actuation of the ringer at a particular one of said twelve stations to the exclusion of the others.

14. In a telephone ringing system, a line, a plurality of polarized ringers, two sources of different voltage alternating current and two sources of different voltage direct current, means for selectively connecting said sources to the line and ground in twelve different manners, and means comprising a gas-filled tube for associating each ringer with the line, said tubes being so constructed and individually connected to the line, respective ringer and ground, that the selective connection of said sources to the line in any one manner will cause the selective actuation of a single one of said twelve ringers to the exclusion of the other eleven.

15. In an eight-party selective ringing telephone system, a line, eight stations thereon, a ringer at each station, two separate sources of superimposed ringing current, one of said sources including a high voltage alternating current component and a relatively low voltage direct current component, and the other source including a high voltage direct current component, and a relatively low voltage alternating current component, means for selectively connecting the two components of each source with the line and ground in four different manners, and means at each station, in association with the respective ringers, including a gas-filled tube, so connected and arranged that the particular connection to the line of either source in any one manner will cause the selective actuation of a particular ringer to the exclusion of all the others.

16. In a multiparty selective ringing telephone system, a line, a plurality of subscribers' stations thereon, a ringer at each station, two different voltage sources of alternating current and two different voltage sources of direct current, means for selectively and simultaneously connecting the higher voltage source of alternating current across the line and the lower voltage direct current source in either polar direction to either side of the line in series with the alternating current source and ground, or the higher voltage direct current source across the line in either polar direction and the lower voltage alternating

current source to either side of the line in series with the direct current source and ground, a three-electrode gas-filled discharge tube at each station, and connecting means for associating the respective ringer and tube at each station with the line in such a manner that a different one, and only one, of said ringers will respond to each particular simultaneous connection to the line of alternating and direct current.

17. In an eight-party selective ringing telephone system, a line, eight stations thereon, a first composite source of high voltage alternating and low voltage direct current, a second composite source of low voltage alternating and high voltage direct current, means for selectively connecting either composite source to the line and ground in such a manner that the components thereof are in series across the line, either pole of the direct current component is connected to either side of the line, and ground is connected to the side of the line opposite to that to which the direct current component is connected, a ringer at each station, means including a gas-filled discharge tube at each station for associating the respective ringer with the line in such a manner that the connection of either first or second sources of current in a particular selective manner will cause the selective operation of a single one of said ringers to the exclusion of all the others.

18. In a selective ringing telephone system, a line, a plurality of stations thereon, a ringer at each station, two sources of superimposed pulsating ringing current one having a high voltage alternating current component and a low voltage direct current component, and the other a low voltage alternating current component and a high voltage direct current component, selective switching means for connecting either source in either polar direction across the line and for grounding either side of the line, a ringer and a gas-filled tube having main and control discharge gaps at each station, and means for associating said ringers and tubes with the line and ground in such a manner that any selective operation of said switching means will cause the selective actuation of a predetermined particular ringer to the exclusion of all the others.

19. In a selective ringing telephone system, a line, eight stations thereon, a ringer at each station, two sources of ringing current, one having a high voltage alternating current component and a low voltage direct current component and the other a low voltage alternating current component and a high voltage direct current component, selective switching means for simultaneously connecting the components of either source with the line and ground in four different manners, a gas-filled tube at each station, each tube having control and unilateral main discharge gaps, and means for associating said tubes and respective ringers with the line and ground in such a manner that the connection of one source to the line in either of the four manners will cause a control gap discharge at four of said stations and a selective main gap discharge and operation of the corresponding ringer at one of them and connection of the other source to the line in any one of the same four manners will cause a control gap discharge at the other four stations and a selective main gap discharge and operation of a corresponding ringer.

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