Sept. 8, 1936. W. H. EDWARDS ET AL 2,053,605

SELECTIVE SIGNALING SYSTEM

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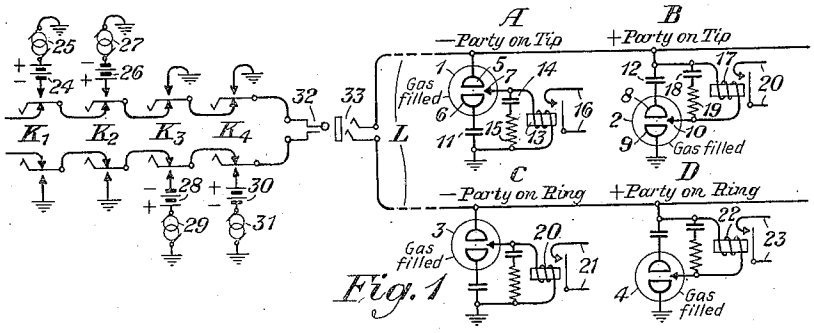


Fig. 1

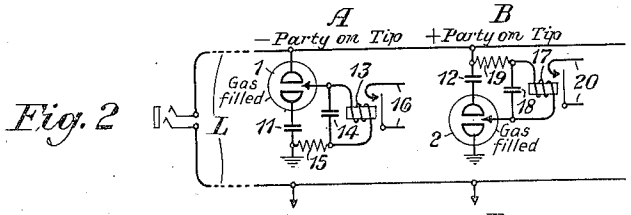


Fig. 2

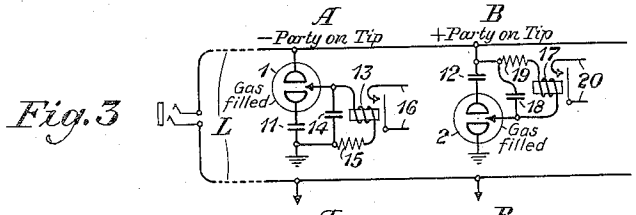


Fig. 3

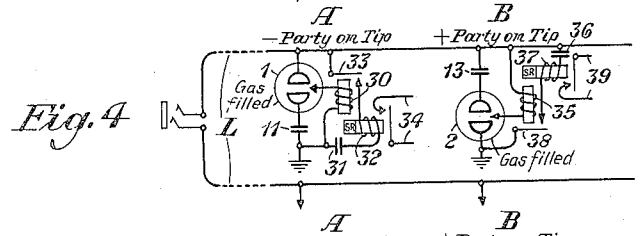


Fig. 4

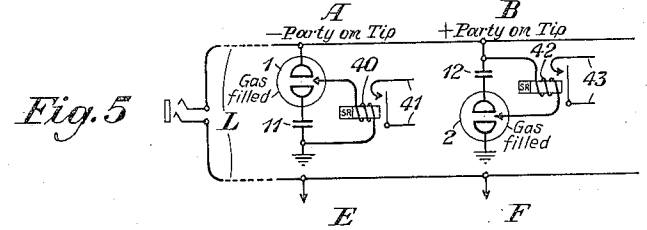


Fig. 5

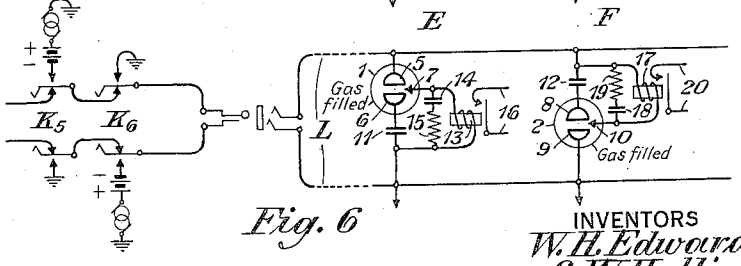


Fig. 6

INVENTORS
W. H. Edwards and
C. W. Halligan
BY
ATTORNEY

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SELECTIVE SIGNALING SYSTEM

William Hopple Edwards, Great Neck, and Clair William Halligan, New York, N. Y., assignors to American Telephone and Telegraph Company, a corporation of New York

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7 Claims. (Cl. 179—86)

This invention relates to signaling systems and, more particularly, to multi-party selective signaling systems.

One of the primary objects of the invention is to provide an arrangement whereby any desired one of a number of stations on a line may be selectively signaled to the exclusion of others. The invention is particularly adapted for use in telephone systems on grounded ringing four party selective or eight party semi-selective lines, or on two party selective or four party semi-selective lines with metallic ringing. In the arrangements of the invention, a gas-filled discharge tube is provided at each station and is connected from one side of the line to ground, in the case of the grounded ringing lines or to the other side of the line with metallic ringing lines. By taking advantage of the rectifying properties of these tubes selective operation thereof may be obtained by applying to either side of the line alternating current superimposed on properly poled direct current. In the arrangements of this invention there is provided in the anode circuit of each tube a relay together with means to prevent the chattering or intermittent operation thereof due to the pulsating character of the current in the anode circuits of the tubes. Each relay in turn may operate a local signaling circuit. 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 drawing, in the Figures 1, 2, 3, 4, 5, and 6 of which the invention is illustrated. Fig. 1 is a circuit diagram embodying a preferred form of the invention for grounded ringing lines. Figs. 2, 3, 4 and 5 are modifications thereof. Fig. 6 is a preferred arrangement for metallic ringing lines. Similar reference characters have been utilized to denote like parts in all of the figures.

In Fig. 1 is shown a line L to which might be connected four stations A, B, C, and D, which it might be desirable to signal. At each of these stations there would be connected, between one side of the line and ground, a gas-filled discharge tube. For example, at station A there is provided the gas-filled tube 1, at station B the tube 2, at station C the tube 3 and at station D the tube 4. In a manner to be pointed out hereinafter, the operation of these gas-filled tubes may be accomplished selectively and their operation will cause the functioning of a signal individual to each station. For an eight party semi-selective line, duplicates of each of the above stations would be provided and ringing discrimination between the duplicate parties obtained by code.

The line L is shown connected by means of a plug 32 and a jack 33 to an arrangement for selectively signaling the various stations. This arrangement comprises the keys K_1, K_2, K_3 and K_4. The operation of key K_1 will connect to the tip side of the line alternating current from the source 25 superimposed on the negatively poled battery 24. The operation of key K_2 will apply to the tip side of the line alternating current from the source 27 superimposed on the positively poled battery 26. The operation of key K_3 will apply to the ring side of the line alternating current from the source 29 superimposed on the negatively poled battery 28. The operation of key K_4 will apply to the ring side of the line alternating current from the source 31 superimposed on the positively poled battery 30.

The gas-filled discharge tubes utilized at each of the stations are of the type commonly referred to in the art as a cold cathode ionic tube of the double gap type. Such tubes possess a cathode, coated preferably with some material to reduce the cathode fall, or activated, as this is termed, an auxiliary electrode also activated, and so spaced from the cathode that the breakdown voltage between this electrode and the cathode is relatively low. The discharge path from the auxiliary electrode to the cathode is spoken of as the control discharge path or control gap and the current in this path is restricted to the current required by a current limiting condenser. These tubes are also provided with an anode so spaced from the cathode that the breakdown therebetween is much greater than that from the cathode to the auxiliary electrode. For example, in tube 1 the cathode is shown as 5, the auxiliary electrode as 6 and the anode as 7. The minimum voltage to sustain a discharge, once started, will be nearly the same for the two discharge paths, the main gap, or anode to cathode path being possibly 10 volts higher. It is found that if a voltage less than the breakdown voltage, but above the sustaining voltage, is applied to the main gap, and a discharge is caused to pass through the control gap, a breakdown of the main gap will take place, being triggered off by the control gap. The main gap, that is, the gap between the anode and one of the cathodes can be broken down to pass considerable current only when the anode is positive with respect to one of the cathodes. This main gap can be broken down when negatively poled superposed ringing current is applied to the anode but it will only

pass a negligible current under such conditions. When positively poled superposed ringing current is applied to the anode and this current passes between the anode and cathode, current is discharged through this path only during a portion of one-half cycle in which the voltage is positive and sufficiently high to cause and sustain the breakdown of the main gap. During the other half of the cycle there is practically no discharge between the anode and cathode. In other words, the tube acts as a half wave rectifier in that part of the tube which includes the anode and cathode path.

The operation of the arrangements of Fig. 1 is as follows: Let it be assumed that it is desired to signal the party at station A, namely, the —party on the tip. To do this the key K_1 is operated and negatively poled superimposed ringing current is applied to the tip of the line. The connection of the negatively poled battery 24 to the cathode 5 will cause the anode 7 to be positive with respect to the cathode. The voltage of the alternating current will cause a discharge to take place between the electrodes 5 and 6, and this, due to the fact that the anode 7 is positive with respect to the cathode 5, will cause a discharge to take place between the cathode 5 and the anode 7. As heretofore pointed out, due to the rectifying action of the tube, the current in the anode circuit will be of a pulsating nature. The anode circuit will be completed through the relay 13 to ground. Shunted around the winding of the relay 13 is a resistance 15 and a condenser 14. Due to the pulsating character of the current in the anode circuit the relay 13 would chatter or operate intermittently if the condenser 14 and resistance 17 were not provided. During the time that current flows through the relay winding the condenser is charged. When the current flow stops, the condenser will be discharged through the resistance and the winding of relay 13 in the same direction as the original current flow, thereby holding the relay operated. In this way all chatter or intermittent action of the relay 13 is eliminated. The operation of the relay 13 will close a local signaling circuit 16.

The control gap at station B will also be operated by the negative superimposed ringing current used to ring station A, but since during the negative half cycle when the voltage is sufficiently high to break down and sustain the control gap, the anode is negative with respect to the cathode, practically no current will flow and the relay will not be operated. Likewise during the positive half cycle of the negative superimposed ringing current, the voltage is ordinarily insufficient to cause and sustain a breakdown in the control gap, and even if the control gap discharge were created, the current flow from the anode to the cathode in the main gap would be negligible because of the slight difference between the applied voltage and the voltage necessary to maintain the discharge. Consequently the relay would not operate during this half cycle.

If it is desired to signal the station B, namely, the +party on the tip, the key K_2 would be operated and alternating current superimposed on positively poled direct current would be applied to the tip side of the line. This positively poled direct current at the station B will be applied through the winding of relay 17 directly to the anode 10, and the anode 10 will be positive with respect to the cathode 8 which, as has been pointed out, is a requisite for the operation of the tube 2. Accordingly, the application of this type of signaling current will operate the tube. Shunted about the tube 17 is a condenser 18 and a resistance 19 to prevent it from chattering or operating intermittently in a manner similar to the condenser 14 and resistance 15. The operation of relay 17 may serve to close a local signaling circuit 20. The conditions at station A when station B is being rung are such that the relay at station A will not operate for the same reasons that station B will not operate while station A is being rung.

Connected to the ring side of the line there would be provided at station C apparatus identical with that at station A, and at station D there would be provided apparatus identical with that at station B. To operate the signaling apparatus at station C the key K_3 would be operated, and to operate the apparatus at station D the key K_4 would be operated. As the operation of the arrangements at these stations is substantially the same as heretofore described, no further description of the operation thereof will be given.

In Fig. 2 is shown a modification of the arrangements of Fig. 1. The switching means for applying the different signaling currents to the line would be the same as that shown in Fig. 1, and, hence, has not been illustrated. Furthermore, in Fig. 2, only the apparatus at stations A and B is shown because the apparatus at stations C and D would be identical with the apparatus shown at stations A and B, respectively. At stations A and B are provided the gas-filled tubes 1 and 2 and the relays 13 and 17 connected in a manner similar to that shown in Fig. 1. The arrangement shown in Fig. 2 differs from Fig. 1 only in that the condenser 14 and the resistance 15 at station A, and the condenser 18 and resistance 19 at station B, are arranged in a slightly different manner than in Fig. 1. However, their operation is substantially the same, namely, in each case the condenser will charge while the current is flowing in the anode circuit and will discharge through the relay winding in the same direction as the original current flow when the current in the tube ceases. This will operate to hold the relay operated and prevent it from chattering or operating intermittently.

In Fig. 3 is shown a further modification of the arrangements of Figs. 1 and 2. It differs from these arrangements only in showing another arrangement of the condensers 14 and 18 and the resistances 15 and 19. The operation, however, is substantially the same as heretofore described, and the arrangement of the condensers and resistances will serve to prevent chattering or intermittent operation of the relays.

In Fig. 4 is shown a further modification of the arrangements of the invention. The apparatus at stations A and B has been illustrated, but the apparatus at stations C and D has not been shown as the apparatus thereat would be identical with that shown at stations A and B, respectively. Furthermore, the switching means for applying different types of signaling currents to the line has not been shown as it would be identical with the arrangement shown in Fig. 1. At stations A and B are shown the gas-filled tubes 1 and 2 having their anode circuits arranged in a manner substantially similar to the tubes in the other figures. However, in Fig. 4 the condensers and resistances are not utilized to prevent the chattering of the relay individual to each tube. The intermittent operation of the auxiliary circuit is avoided by providing relays

such as 30 and 35 which will operate on the pulses of current passed by their respective discharge tubes, so as to connect from the line to ground through D. C. blocking condensers 31 and 36, respectively. The intermittent operation of the relays 30 and 35 would in turn cause the operation of the relays 32 and 37, respectively, to control local signaling circuits such as 34 and 39. Due to the slow-release feature of the relays 32 and 37, any chattering or intermittent action of the contacts of these relays would be avoided.

In Fig. 5 is shown a modification of the arrangements shown in Fig. 4. In this figure there is provided in the anode circuits of the tubes the slow-release relays 40 and 42. These relays might be of the copper slug type. Each of these relays might control a local signaling circuit such as 41 and 43, respectively. Due to the slow-release features of these relays any chattering thereof or intermittent operation of the local signaling circuits might be avoided.

Fig. 6 shows the method of using these discharge tube arrangements on two party selective and four party semi-selective lines with metallic ringing. It is common practice on two party selective and four party semi-selective lines to connect the ringing circuit from the tip and ring sides of the line to ground. However, where there is considerable inductive exposure to power circuits, interfering voltages from the line to ground are created which operates signals falsely and causes undesired noise in the telephone receivers. Accordingly, wherever a polarized ringing source is available, namely, in A. C.—D. C., superimposed or pulsating ringing areas, the arrangement shown in Fig. 6 provides a metallic ringing arrangement with two selections of ringing. The operation of stations E and F when keys K_5 and K_6 are operated respectively is practically identical with the operation of stations A and B when keys K_1 and K_2 are operated except that the ring side of the line carries the current instead of the ground.

The same arrangements described above will operate selectively on another form of polarized ringing current in addition to superimposed ringing current, namely; pulsating ringing current. In this case during one half cycle the current will flow through the control gaps of both stations on the same side of the line, but will only flow through the main gap of the station in which the anode is positive with respect to the cathode in an amount sufficient to operate the relay. During the other half cycle, the line wire is grounded, so that no current will flow.

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

What is claimed is:

1. A multi-party signaling system comprising a line, means for selectively applying to either the tip or ring conductors of said line signaling current comprising either alternating current superimposed on positive direct current or alternating current superimposed on negative direct current, a plurality of stations connected to said line, each of said stations including a gas-filled discharge tube so connected between one of the sides of said line and ground that it will be discharged intermittently and allow appreciable current to flow only by the application of one of said types of signaling currents applied to said side of the line, relay means individual to each of said tubes and controlled by the intermittent discharge thereof, means for preventing said relays from operating intermittently when said tube is discharging intermittently, and signaling means controlled by each of said relays.

2. A multi-party signaling system comprising a line, means for selectively applying to either the tip or ring conductors of said line signaling current comprising either alternating current superimposed on positive direct current or alternating current superimposed on negative direct current, a gas-filled discharge tube of the cold cathode double gap type having two auxiliary electrodes and an anode, said auxiliary electrodes being connected in series with suitable current-limiting means between one of the sides of said line and ground and said anode being so connected with respect to said auxiliary electrodes that a discharge involving appreciable current flow will take place between said anode and one of said auxiliary electrodes only when one of said types of signaling current is applied to said side of said line, the resulting discharge between said anode and auxiliary electrode being pulsating in character, a second gas-filled discharge tube of the cold cathode double gap type having two auxiliary electrodes and an anode, said auxiliary electrodes being connected in series with suitable current-limiting means between the same side of the line and ground as those of said first tube and said anode being so connected with respect to said auxiliary electrodes that a discharge involving applicable current flow will take place between said anode and one of said auxiliary electrodes only when one of said types of signaling current is applied to said side of said line which is different from that used to operate said first tube, the resulting discharge between said anode and auxiliary electrode being pulsating in character, relay means in circuit with the anodes of said tubes, signaling devices controlled by each of said relays, and means for maintaining each of said relays continuously operated while the discharge between the anode and auxiliary electrode of its associated tube is pulsating in character.

3. A multi-party signaling system comprising a line, means for selectively applying to either the tip or ring conductors of said line signaling current comprising either alternating current superimposed on positive direct current or alternating current superimposed on negative direct current, a gas-filled discharge tube of the cold cathode double gap type having two auxiliary electrodes and an anode, said auxiliary electrodes being connected in series with suitable current-limiting means between one of the sides of said line and ground and said anode being so connected with respect to said auxiliary electrodes that a discharge involving appreciable current flow will take place between said anode and one of said auxiliary electrodes only when one of said types of signaling current is applied to said side of said line, the resulting discharge between said anode and auxiliary electrode being pulsating in character, a second gas-filled discharge tube of the cold cathode double gap type having two auxiliary electrodes and an anode, said auxiliary electrodes being connected in series with suitable current-limiting means between the same side of the line and ground as those of said first tube and said anode being so connected with respect to said auxiliary electrodes that a discharge involving appreciable current flow will take place

between said anode and one of said auxiliary electrodes only when one of said types of signaling current is applied to said side of said line which is different from that used to operate said first tube, the resulting discharge between said anode and auxiliary electrode being pulsating in character, relay means in circuit with the anodes of said tubes, signaling devices controlled by each of said relays, and means for maintaining each of said relays continuously operated while the discharge between the anode and auxiliary electrode of its associated tube is pulsating in character, said last mentioned means comprising condensers and resistances associated with the windings of said relays, said condensers being adapted to charge when current flows through the relay windings and to discharge through said relay windings in the same direction as the current flow when the current ceases.

4. A multi-party signaling system comprising a line, means for selectively applying to either the tip or ring conductors of said line signaling current comprising either alternating current superimposed on positive direct current or alternating current superimposed on negative direct current, a gas-filled discharge tube of the cold cathode double gap type having two auxiliary electrodes and an anode, said auxiliary electrodes being connected in series with suitable current limiting means between one of the sides of said line and ground and said anode being so connected with respect to said auxiliary electrodes that a discharge allowing appreciable current to flow will take place between said anode and one of said auxiliary electrodes only when one of said types of signaling current is applied to said side of said line, the resulting discharge between said anode and auxiliary electrode being pulsating in character, a second gas-filled discharge tube of the cold cathode double gap type having two auxiliary electrodes and an anode, said auxiliary electrodes being connected in series with suitable current-limiting means between the same side of the line and ground as those of said first tube and said anode being so connected with respect to said auxiliary electrodes that a discharge involving appreciable current flow will take place between said anode and one of said auxiliary electrodes only when one of said types of signaling current is applied to said side of said line which is different from that used to operate said first tube, the resulting discharge between said anode and auxiliary electrode being pulsating in character, third and fourth gas-filled discharge tubes identical to said first and second tubes respectively connected to the other side of said line, relay means in circuit with the anodes of all of said tubes, signaling devices controlled by each of said relays, and means for maintaining each of said relays continuously operated while the discharge between the anode and auxiliary electrode of its associated tube is pulsating in character.

5. A multi-party signaling system comprising a line, means for selectively applying to either the tip or ring conductors of said line signaling current comprising either alternating current superimposed on positive direct current or alternating current superimposed on negative direct current, a gas-filled discharge tube of the cold cathode double gap type having two auxiliary electrodes and an anode, said auxiliary electrodes being connected between one of the sides of said line and ground in series with a suitable current-limiting means and said anode being so connected with respect to said auxiliary electrodes that a discharge involving appreciable current flow will take place between said anode and one of said auxiliary electrodes only when one of said types of signaling current is applied to said side of said line, the resulting discharge between said anode and auxiliary electrode being pulsating in character, a second gas-filled discharge tube of the cold cathode double gap type having two auxiliary electrodes and an anode, said auxiliary electrodes being connected in series with suitable current-limiting means between the same side of the line and ground as those of said first tube and said anode being so connected with respect to said auxiliary electrodes that a discharge involving appreciable current flow will take place between said anode and one of said auxiliary electrodes only when one of said types of signaling current is applied to said side of said line which is different from that used to operate said first tube, the resulting discharge between said anode and auxiliary electrode being pulsating in character, relay means in circuit with the anodes of each of said tubes, signaling devices controlled by each of said relays, and means for making each of said relays slow releasing.

6. A multi-party signaling system comprising a line, means for selectively applying to either the tip or ring conductors of said line signaling current comprising either polarized ringing current of positive polarity or polarized ringing current of negative polarity, a plurality of stations connected to said line, each of said stations including a gas-filled discharge tube so connected between one of the sides of said line and ground that it will be discharged intermittently and allow appreciable current to flow only by the application of one of said types of signaling currents applied to said side of the line, relay means individual to each of said tubes and controlled by the discharge thereof, means for preventing said relays from operating intermittently when said tube is operating intermittently and signaling means controlled by each of said relays.

7. A multi-party signaling system comprising a line, means for selectively applying to either the tip or ring conductors of said line signaling current comprising either polarized ringing current of positive polarity or polarized ringing current of negative polarity, a plurality of stations connected to said line, each of said stations including a gas-filled discharge tube so connected between the sides of said line that it will only be discharged intermittently and allow appreciable current to flow depending upon the polarity of said signalling current applied to said line, relay means individual to each of said tubes and controlled by the discharge thereof, means for preventing said relays from operating intermittently when said tube is operating intermittently, and signaling means controlled by each of said relays.

WILLIAM HOPPLE EDWARDS.
CLAIR WILLIAM HALLIGAN.