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TELEPHONE RINGING SYSTEM

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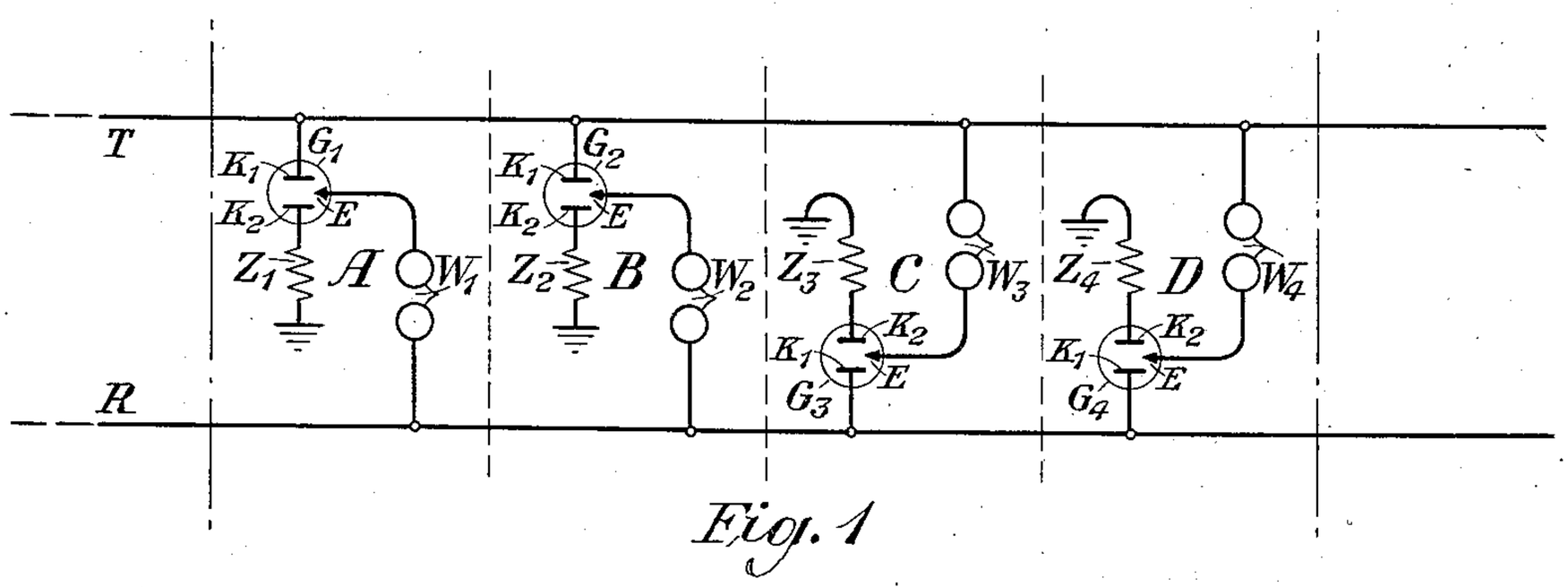

Fig. 1

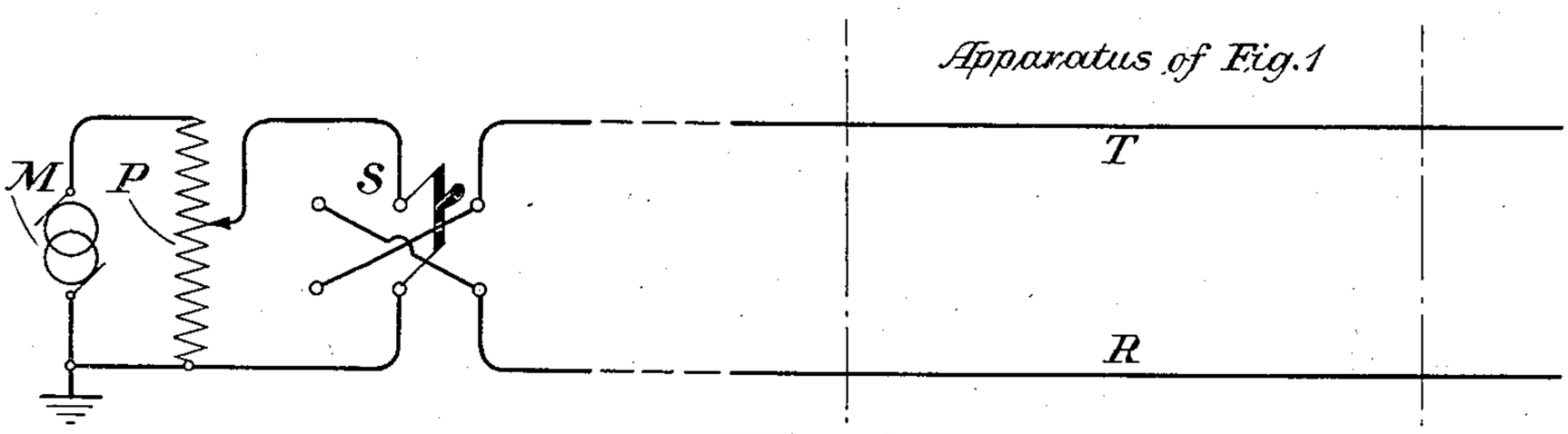

Fig. 2

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TELEPHONE RINGING SYSTEM

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5 Claims. (Cl. 179—86)

This invention relates to electrical circuits and, more particularly to that class of circuits used for selective ringing or signaling whereby a signal may be transmitted to one or more of a plurality of stations connected to the same line.

In signaling systems proposed heretofore, each ringer circuit connected to the line might include a three-electrode gas-filled tube comprising two cold cathodes and an anode, the two cathodes being connected across the line through a large resistor, the resistor being connected between one side of the line and one of the two cathodes, the ringer itself being connected between the anode and ground. A similar ringer circuit might also be connected in reversed relation across the same line, that is, the resistor being connected between the other side of the line and one of the cathodes. For such systems it has been proposed to transmit ringing current in the form of an alternating current of a frequency, for example, of twenty cycles superimposed upon a direct current.

It has been found, however, that such ringing circuits are falsely operated by interfering currents which are induced or otherwise impressed upon the line from foreign circuits such as electrified railroads. In other words, the currents so induced into the line have been found to operate the ringers even when no ringing current was transmitted to those ringers. Such false operation has, of course, been objectionable.

It is one of the objects of this invention to provide a ringing circuit employing gas-filled tubes which will not operate when interfering currents of the type referred to become superimposed on the line, but will respond only to ringing currents alone.

Another of the objects of this invention is to provide a ringing circuit employing gas-filled tubes that will operate in response to alternating currents alone without requiring the presence of direct currents also. In other words, it is the object of this invention to set up a ringing circuit which will operate the ringers when alternating current alone of some predetermined frequency is transmitted over the line. Such an arrangement will eliminate direct current biases heretofore proposed for ringing circuits.

These and other objects of this invention will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing in which Figure 1 illustrates one embodiment of the ringing circuit arrangement of this invention given merely for the purpose of illustration and Fig. 2 illustrates the unbiased alternating current circuit used to operate the apparatus of Fig. 1.

Referring to Fig. 1 of the drawing, the reference characters T and R represent two of the wires of a telephone line over which telephone and other signals may be transmitted. Across this line may be bridged a plurality of telephone ringing circuits, four of which are illustrated in the drawing by the letters A, B, C and D. The ringing circuits A and B are similar to each other and are connected between conductors T and R in exactly the same manner. The ringing circuits C and D are also alike and are connected in reverse across the conductors T and R. Other similar ringing circuits may be connected across conductors T and R in either of the two ways shown in the drawing.

Each ringing circuit comprises a cold cathode gas-filled tube of well known construction, the various tubes being designated G_1, G_2, G_3 and G_4 in the various circuits, a resistor, each resistor being designated Z_1, Z_2, Z_3 and Z_4 in the respective circuits and a ringer labelled in the various circuits W_1, W_2, W_3 and W_4, respectively, as shown in the drawing.

The two cathodes of each gas tube are designated K_1 and K_2 and these two electrodes form the control gap of the tube. Each tube also includes an anode E. The main gap of each tube comprises the cathode K_1 and the anode E.

It will be observed that the cathodes K_1 of tubes G_1 and G_2 are connected directly to conductor T, that resistors Z_1 and Z_2 are connected between the cathodes K_2 of these same tubes and ground and that the ringers W_1 and W_2 are connected between the respective anodes E of these tubes and the conductor R. Similarly, the cathodes K_1 of tubes G_3 and G_4 are connected directly to conductor R, the resistors Z_3 and Z_4 are connected between the cathodes K_2 of the tubes G_3 and G_4, respectively, and ground and the ringers W_3 and W_4 are connected between the respective anodes E of the latter tubes and the conductor T.

In order to operate any of the ringers shown in the drawing, an alternating current (not shown in Fig. 1) is transmitted over the conductors T and R, as will be explained hereinafter. The ringing current is alternating current alone, without any direct current bias or component whatever.

To operate either or both of the ringers W_1 and W_2, one terminal of the alternating current source is connected to the conductor T, the other terminal of the source being grounded and at

the same time connected to the conductor R. The voltage of this source is greater than that required to ionize the gas between the cathodes K_1 and K_2 of both tubes G_1 and G_2 and hence current will flow from the alternating current source over the control gaps K_1—K_2 of tubes G_1 and G_2 and over the respective resistors Z_1 and Z_2 in parallel to ground. Upon ionization of the gas of these tubes, the alternating current will then flow through both main gaps K_1—E of the tubes G_1 and G_2 in parallel and through the respective ringers W_1 and W_2 and over conductor R which is grounded at the source. Both ringers W_1 and W_2 will then be operated. The subscribers having the ringing circuits A and B will be selectively signaled by predetermined codes in a well known manner so that both subscribers will not answer the call intended for but one of the subscribers. These codes are formed, of course, by interruptions of the alternating current source.

When the conductor R is grounded as, for example, during the time when ringers at stations A and B are operating, none of the ringing current will flow through the ringing circuits of stations C and D. It will be observed that during this period, the electrodes K_1 of both tubes G_3 and G_4 are connected to ground by conductor R and that the electrodes K_2 of these tubes are also connected to ground through resistors Z_3 and Z_4 and hence the gas within the control gaps K_1—K_2 of tubes G_3 and G_4 remains deionized because no current flows therethrough. Furthermore the peak voltage of the alternating current ringing generator is less than the voltage required to ionize the gas between the main gaps K_1—E of both tubes G_3 and G_4 and hence no current will flow through ringers W_3 and W_4.

In one particular arrangement in which the circuit shown in the drawing was successfully operated, the various tubes were of the 313–A type, the resistors such as Z_1, etc., were of the order of 100,000 ohms and the alternating current generator was of a frequency of about 20 cycles and had an effective voltage which could be varied between 75 and 130 volts. The control gaps K_1—K_2 of the 313–A tubes will break down at around 70 volts, the main gaps K_1—E will break down at 130 volts or at a somewhat higher voltage and, after the gas within the control gap K_1—K_2 becomes ionized, the voltage required to transmit current through the main gaps K_1—E will be reduced to around 75 volts.

In order to transmit ringing current through the ringing circuits C and D, the ringing current generator is connected to conductor R and the conductor T is grounded at the source. The gas within tubes G_3 and G_4 will become ionized and the current of the generator will flow through both ringers W_3 and W_4 in parallel. The subscribers having these respective ringers will be selectively rung by predetermined codes, in a manner well known in the art. None of the current of the alternating current generator will flow through the tubes G_1 and G_2 and therefore the ringers W_1 and W_2 will remain unoperated.

An added feature of the circuit arrangement shown in the drawing is that it will not respond to interfering voltages emanating from electrified railways or the like. Any such voltage induced into either or both of the conductors T and R will ordinarily be impressed across the control electrodes K_1—K_2 of each tube connected to the conductor or conductors exposed to the interfering voltage. Such a voltage may at times be large enough to ionize the gase within the tubes connected to the exposed conductor or conductors, but it will not be so large as to operate any of the ringers W_1 to W_4. The reason why such interfering voltages are unable to actuate the ringers is that each ringer—W_1 to W_4—is connected in series with the electrodes K_2—E of the corresponding tube and in series also with a large resistor—Z_1 to Z_4—with respect to the interfering voltages and therefore any possible current flow through the ringers would be practically negligible.

Fig. 2 illustrates one form of circuit arrangement which may be utilized for operating any of the ringing circuits of Fig. 1. Here the generator of alternating current is designated M and it is connected to the conductors T and R through a potentiometer P and a double-pole double-throw switch S. When the switch S is thrown to the right, one terminal of the generator M will be connected to the conductor T and its other terminal connected to conductor R which also becomes grounded. Ringing currents may then be transmitted to stations A and B of Fig. 1 to actuate the ringers W_1 and W_2, as already explained. When the switch S is thrown to the left, the position of generator M will be reversed with respect to conductors T and R and the ringers W_3 and W_4 of stations C and D may be actuated as already explained. The potentiometer P is employed to vary the voltage of generator M transmitted to conductors T and R whenever desired.

Any well known type of generator of alternating current suitable for operating the various ringing circuits may be used in place of the arrangement of Fig. 2, but it is essential that one terminal of the generator be grounded.

While this invention has been shown and described in certain particular embodiments merely for the purpose of illustration, it will be understood that the invention may be set up in other and widely varied organizations without departing from the spirit of this invention and the scope of the appended claims.

What is claimed is:

1. A signaling arrangement operable by alternating current alone, comprising a pair of conductors, a three-electrode gas tube, a resistor connected in a series circuit with two of the electrodes of said tube and one of said conductors and ground, and a ringer connected between the third electrode of the tube and the other conductor.

2. A ringing circuit comprising two conductors over which alternating current alone may be transmitted for ringing purposes, a three-electrode gas tube, one of the electrodes of said tube being directly connected to one of the conductors, a resistor connected between another of the electrodes of the tube and ground, and a ringer connected between the third electrode of the tube and the other conductor.

3. In a signaling system, a pair of conductors, two ringing circuits connected in reversed relation between said conductors, each ringing circuit comprising a three-electrode gas tube, a resistor and a ringer, one of the electrodes of each tube being connected to one of the conductors, another electrode being grounded through the corresponding resistor, the third electrode of each tube being connected to the other conductor through the corresponding ringer, a grounded generator of alternating current, and means for

connecting said grounded generator between said conductors in one direction or in the opposite direction.

4. A multi-party unbiased ringing system comprising first and second conductors, first and second groups of ringing circuits connected in reversed relation between said conductors, each ringing circuit including a three-electrode gas tube, a resistor and a ringer, one electrode of each gas tube of the first group being connected to the first conductor, another electrode of each gas tube of the first group being connected to ground through the corresponding resistor, the third electrode of each tube of the first group being connected to the second conductor through the corresponding ringer, one of the electrodes of each tube of the second group being connected to the second conductor, another electrode of each tube of the second group being connected to ground through the corresponding resistor, the third electrode of each tube of the second group being connected to the first conductor through the corresponding ringer.

5. An arrangement similar to that set forth in claim 4 including, in addition, a grounded alternating current generator, and switching means for connecting said generator between the first and second conductors in one direction or the other.

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