

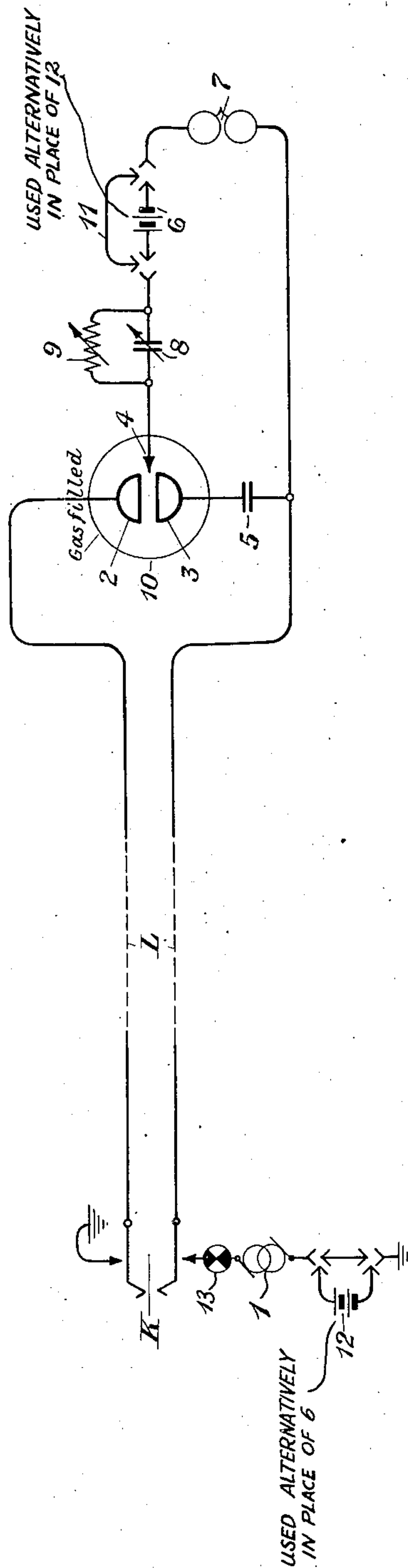
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SIGNALING SYSTEM

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SIGNALING SYSTEM

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This invention relates to signaling systems and more particularly to signaling systems which are capable of producing a variety of different signals as desired.

5 The arrangements of the invention are particularly adapted for use in signaling systems such as might be utilized in connection with telephone lines. By means of the invention a variety of ringing signals of different types may be pro-
10 duced at a station. For example, in response to the application of regularly interrupted signaling current to a line there may be produced at a station one normal ring followed by short rings, one normal ring followed by silence thereafter, one
15 short ring followed by a still shorter ring, and many other varieties or combinations of ringing or other signals. In the arrangements of the invention this is accomplished by providing at each station a gas-filled discharge tube and cir-
20 cuit arrangements therefor to control suitable signal responsive devices thereat. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

25 The invention may be more fully understood from the following description together with the accompanying drawing, in the figure of which is shown a circuit diagram embodying a preferred form of the invention.

30 In the drawing is shown a signaling line L. At one end of the line are shown means for applying signaling current to the line. For example, the key K might apply ground to one side of the line and alternating current from a source I to the
35 other side of the line. At the distant end of the line there would be provided the signaling arrangements of the invention. These would comprise the gas filled discharge tube 10. The gas filled discharge tube utilized in the arrangements of this invention is of the type commonly referred to in the art as a cold cathode ionic tube of the double gap type. Such tubes possess two cath-
40 odes preferably coated with some material to reduce the cathode fall, or activated, as this is termed, and so spaced from each other that the breakdown voltage between the two cathodes is relatively low. The discharge path between the cathodes is spoken of as the control discharge path or control gap. The tube is also provided
45 with an anode so spaced from one of the cathodes that the breakdown therebetween is much greater than that between the two cathodes. For example, in tube 10 the cathodes are shown as 2 and 3, and are connected to opposite sides of the line
50 L. The anode is shown as 4. A current limiting condenser 5 may be connected in series with one of the cathodes. 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, 5 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 only when the anode is positive with respect to one of the cathodes. When alternating signaling current 10 is applied to the line the tube will act as a half-wave rectifier in that part of the tube which includes the anode and cathode path. Connected to the anode 4 is a circuit which includes the bat-
15 tery 6 which has a voltage above the sustaining voltage but below the breakdown voltage of the tube. In the anode circuit is also provided a suitable signal responsive device such as 7. This, for example, might be a ringer which would re-
20 spond to the current of a pulsating nature which flows in the anode circuit due to the rectifying properties of the tube. Connected serially in the anode circuit is the condenser 8 which is shown as adjustable, for reasons which will be pointed out hereinafter. Shunted around the condenser 25 is a leak resistance 9 also shown as adjustable, for reasons to be pointed out hereinafter.

The arrangements operate in the following manner: When alternating ringing current which may be regularly interrupted either by the key 30 K or other desired means such as interrupter 13, is applied to the line a discharge will take place between the two cathodes 2 and 3 and cause a pulsating discharge to take place between one of the cathodes and the anode 4. This will cause 35 a pulsating current to flow in the anode circuit and will operate the ringing device 7. This pulsating current will build up a charge on condenser 8 which eventually prevents the flow of sufficient current in the anode circuit to operate 40 the ringer 7. If the values of the condenser 8 and the leak resistance 9 are of a certain value, the charge on the condenser near the end of the first ringing interval may be sufficient to prevent the breakdown of the main gap and to silence the 45 ringer on subsequent ringing intervals. If the call is abandoned and a new call initiated, resistance 9 discharges condenser 8 during the interval between calls, and the first ring on the next call is then effected. 50

By adjusting the value of resistance 9 it is possible to produce one ring only or one fairly long ring followed by shorter rings on succeeding ringing intervals. It is also possible by using a sufficiently large condenser for 8 to obtain one 55 long ring followed by several short rings and then silence on the remaining ringing intervals.

The attached table shows certain of the various types of signals which may be obtained with different values of the condenser 8 and the re- 60

distance 9. These values will, of course, depend to some extent on the ringing voltage and on the battery voltage.

5	Leak resistance	Capacity	First ring	Succeeding rings
	<i>Ohms</i>	<i>Millifarad</i>		
	35,000	20	Long.....	Fairly long.
	25,000	20	Full length.....	Full length.
10	40,000	20	Moderately long..	Moderately long.
	100,000	20	Short.....	Very short.
	167,000	20	Short.....	None.
	167,000	10	Very short.....	Exceedingly short.
	100,000	10	Very short.....	Exceedingly short.
	40,000	10	Short.....	Very short.
	35,000	10	Short.....	Very short.
15	25,000	10	Full length.....	Full length.
	250,000	10	Very short.....	None.

In case A. C.—D. C. or superimposed ringing current is employed at the central office instead of alternating current, the battery 12 would be connected in series with the alternating current supply 1. In this case the battery 6 can be either eliminated by the alternative connection 11 or reduced in voltage, so that the sum of the voltage of battery 12 and battery 6 will be above the maintaining voltage but below the breakdown voltage.

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

What is claimed is:

1. A signaling line, means for applying regularly interrupted signaling current thereto, a gas filled discharge tube of the cold cathode double gap type having two cathode electrodes and an anode, said cathodes being connected to said line whereby a discharge will take place between said cathodes when such signaling current is applied to said line, an anode circuit for said tube so arranged that when a discharge is started between said cathodes a pulsating discharge will be started between said anode and one of said cathodes resulting in the flow of a pulsating current in said anode circuit, and adjustable means in said anode circuit controlled by the duration of the flow of pulsating current therein for preventing the recurrence of said pulsating discharge between said anode and one of said cathodes.

2. A signaling line, means for applying regularly interrupted signaling current thereto, a gas filled discharge tube of the cold cathode double gap type having two cathode electrodes and an anode, said cathodes being connected to said line whereby a discharge will take place between said cathodes when such signaling current is applied to said line, an anode circuit for said tube so arranged that when a discharge is started between said cathodes a pulsating discharge will be started between said anode and one of said cathodes resulting in the flow of a pulsating current in said anode circuit, and an adjustable condenser shunted by an adjustable resistance in said anode circuit whereby the recurrence of said pulsating discharge between said anode and one of said cathodes may be temporarily prevented depending upon the duration of the flow of pulsating current in said anode circuit.

3. A signaling line, means for applying regularly interrupted signaling current thereto, a gas filled discharge tube of the cold cathode gap type having two cathode electrodes and an anode, said cathodes being connected to said line whereby a discharge will take place between said cath-

odes when such signaling current is applied to said line, an anode circuit for said tube so arranged that when a discharge is started between said cathodes a pulsating discharge will be started between said anode and one of said cathodes resulting in the flow of a pulsating current in said anode circuit, adjustable means in said anode circuit controlled by the duration of the flow of pulsating current therein for preventing the recurrence of said pulsating discharge between said anode and one of said cathodes, and signaling means in said anode circuit controlled by the pulsating current therein.

4. A signaling line, means for applying regularly interrupted signaling current thereto, a gas filled discharge tube of the cold cathode double gap type having two cathode electrodes and an anode, said cathodes being connected to said line whereby a discharge will take place between said cathode when such signaling current is applied to said line, an anode circuit for said tube so arranged that when a discharge is started between said cathodes a pulsating discharge will be started between said anode and one of said cathodes resulting in the flow of a pulsating current in said anode circuit, and a condenser shunted by a resistance included in said anode circuit, the values of said condenser and said resistance being so chosen that the charge accumulated on said condenser due to the flow of pulsating current in said anode circuit during the first interval during which said signaling current is applied to said line will control the duration of operation of said tube during the next succeeding interval during which said signaling current is applied to said line.

5. A signaling line, means for applying regularly interrupted signaling current thereto, a gas filled discharge tube of the cold cathode double gap type having two cathode electrodes and an anode, said cathodes being connected to said line whereby a discharge will take place between said cathodes when such signaling current is applied to said line, an anode circuit for said tube so arranged that when a discharge is started between said cathodes a pulsating discharge will be started between said anode and one of said cathodes resulting in the flow of a pulsating current in said anode circuit, and a condenser shunted by a resistance included in said anode circuit, the values of said condenser and said resistance being so chosen that the charge accumulated on said condenser during a signaling interval may prevent the operation of the tube during the next succeeding signaling interval.

6. A signaling line, means for applying regularly interrupted signaling current thereto, a gas filled discharge tube of the cold cathode double gap type having two cathodes and an anode, said cathodes being connected to said line whereby a discharge will take place between said cathodes when such signaling current is applied to said line, an anode circuit for said tube so arranged that when a discharge is started between said cathodes a pulsating discharge will be started between said anode and one of said cathodes resulting in the flow of a pulsating current in said anode circuit, adjustable means in said anode circuit for gradually reducing the flow of said pulsating current during its duration, and other adjustable means in said anode circuit operative between the regular interruptions in said signaling current for restoring said first mentioned adjustable means to its original condition.

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