Oct. 16, 1945. A. EDELMAN 2,386,942

ELECTRIC SIGNALING DEVICE

Filed March 15, 1944 2 Sheets-Sheet 1

FIG. 1

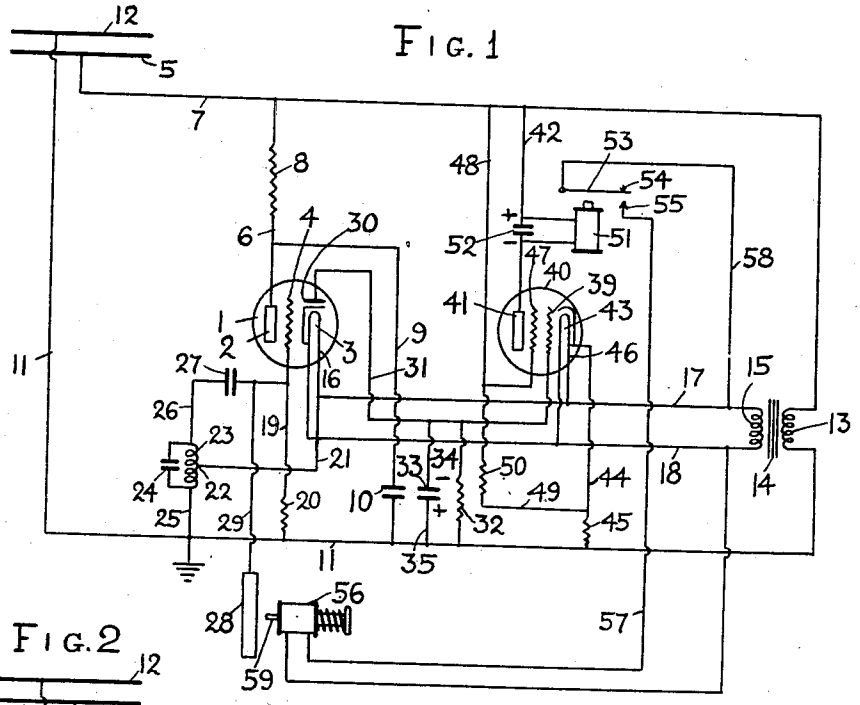
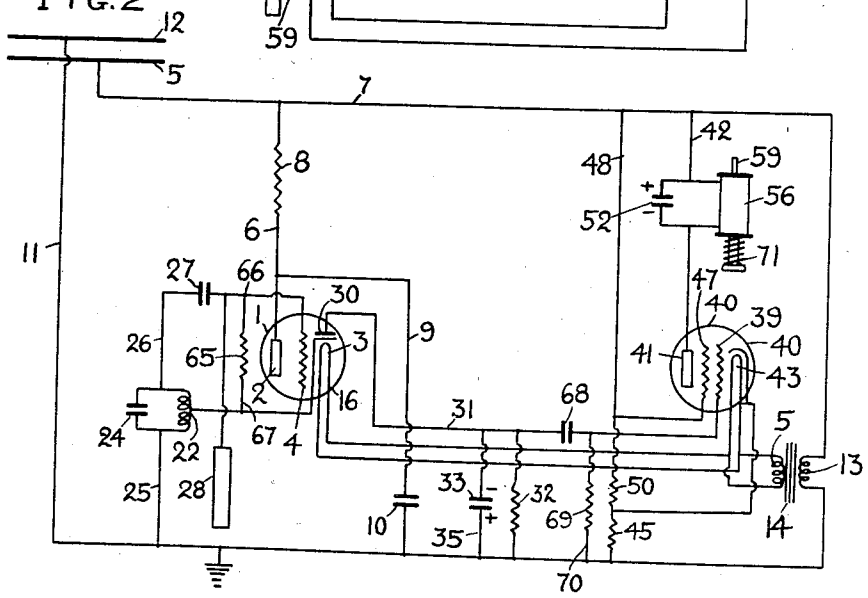


FIG. 2



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FIG. 3

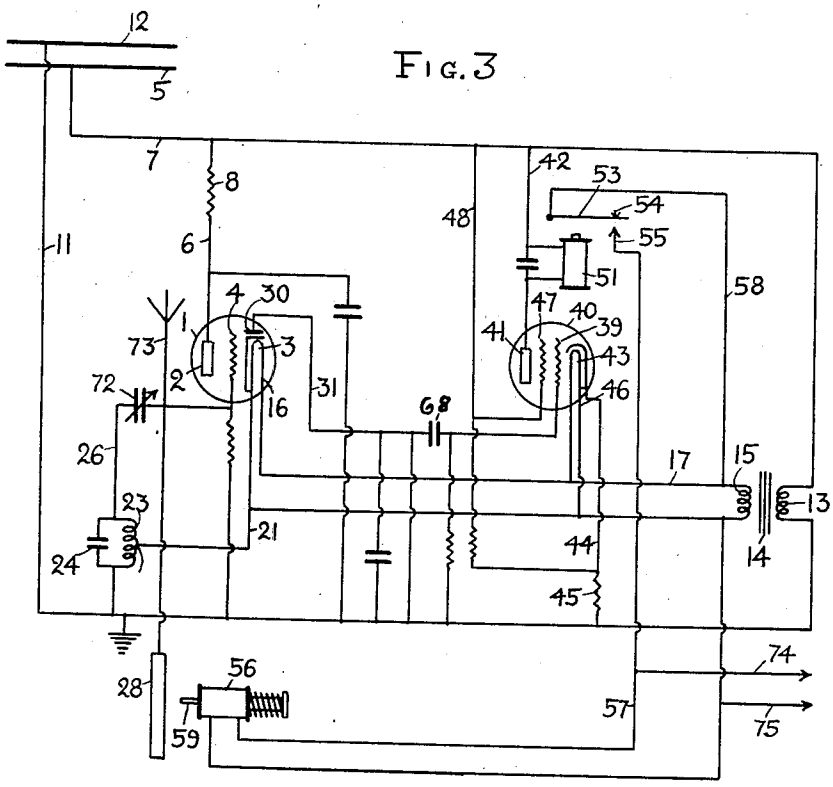
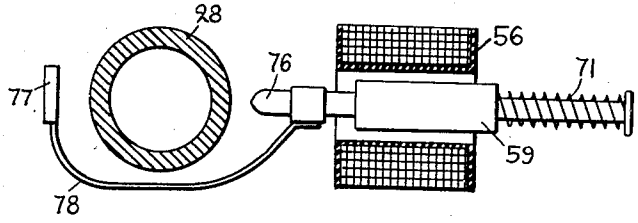


FIG. 4



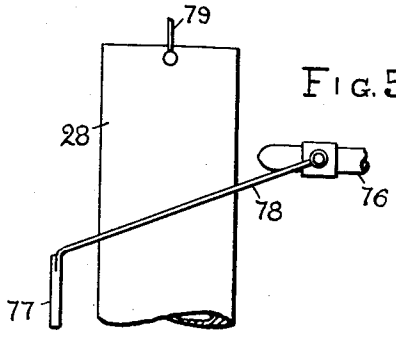


FIG. 5

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2,386,942

ELECTRIC SIGNALING DEVICE

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Application March 15, 1944, Serial No. 526,615

7 Claims. (Cl. 177—352)

My invention relates to improvements in electric signaling devices producing an audible and/or a visible signal, particularly to improvements in electric signaling devices in which the audible and/or visible signal is controlled by a change of a capacitance caused, for example, by the approach of a body.

One object of my invention is a signaling device of the class described which is simple to install and use and will create audible or visible signals when it is approached by persons or objects.

Another object of my invention is a signaling device which may be installed without requiring wire installations connecting the controlling elements and the signal producing elements of the device outside of the device itself.

Another object of my invention is a signaling device in which the controlling elements and the signal producing elements of the device are combined into one structural unit thus increasing the reliability of the device and eliminating or at least reducing any danger of tampering with the connections between controlling and signal producing elements.

Another object of my invention is a signaling device in which the signal producing elements such as an audible resonating tube, bar or wire, or any similar sound producing body which will create audible sounds when struck, is also used as an antenna whose capacitance to ground may be changed by the approach or removal of a body; in other words, one element of the device performs two functions normally performed by two separate elements.

Another object of my invention is to provide means by which the operation of the signaling device is made substantially independent of the humidity of the air and the placement of a body adjacent to the sound producing body.

Other and further objects and advantages of my invention will be hereinafter set forth and other features thereof by the appended claims.

A signaling device according to my invention may be used as a door signal, gate signal, burglary alarm and for any other purposes where it is advisable to announce or indicate the approach of a body to a certain point. It should be understood that the signaling device can also be adjusted in such a manner that the removal of a body from the vicinity of the point to be supervised is indicated by a signal.

Referring to the drawings which illustrate several of the various possible embodiments of my invention but to which my invention is by no means restricted since the drawings are merely shown by way of illustration and not by way of limitation.

Figure 1 is a circuit diagram of a signaling device according to my invention.

Figure 2 is a circuit diagram of a modification of a signaling device according to my invention.

Figure 3 is a circuit diagram of a second modification showing a signaling device according to my invention in combination with an additional antenna and remote controlled signals, and

Figures 4 and 5 show in section and elevation a detailed view of a sound producing antenna for a signaling device according to my invention.

The circuit diagram shown in Figure 1 comprises an oscillator tube 1 including a plate 2, a cathode 3, and a grid 4. Plate 2 is connected to line 5 of a source of current through leads 6 and 7. This source of current may be a 115 volt D.-C. line or an A.-C. line having a suitable frequency such as 60 cycles. Tube 1 is continuously operative when operated with D.-C. current, the plate then being continuously positive to its cathode. When the tube 1 is operated with A.-C. current the tube is operative only part of the time, to wit, during the time the plate is sufficiently positive to its cathode. However, this periodic interruption does not interfere with the function of the tube. The plate supply lead 6 includes a resistor 8 and is connected to ground through a lead 9 and a capacitor 10 serving as a filter decoupling the oscillator tube from the supply line 7 by preventing any oscillatory energy from the oscillator tube from leaving through the plate connection and to disturb the supply line. Lead 9 is grounded through capacitor 10 and a lead 11 which is extended to line 12 of the source of current and also connected to one end of the primary coil 13 of a transformer 14, the other end of coil 13 being connected to supply line 5 through lead 7. The secondary coil 15 of the transformer is connected to the heater 16 of the cathode 3 of tube 1 through leads 17 and 18 respectively. Grid 4 of tube 1 is connected to grounded lead 11 through a lead 19 including a resistor 20. The cathode 3 of tube 1 is connected through a lead 21 to the tap 22 of a coil 23 of a tank circuit composed of this coil and a capacitor 24. The tank circuit is connected at one side to grounded lead 11 through a lead 25, the other side of the tank circuit being connected to grid 4 through a lead 26 including a capacitor 27. Lead 26 is also connected to a second capacitor 28 in form of an antenna in the form of a tube capable of vibrating at an audible frequency through a lead 29. This tube antenna also called "chime

tube antenna" may be placed near a door or any other suitable place where people pass whose presence or approach should be signaled.

During operation the plate current from the tube 1 will flow through the lower part of the tank circuit coil 22 creating a magnetic flux in this coil. This flux links the upper part of the tank circuit coil also, thereby generating a signal between the grid and the cathode. This signal is the "feedback" which will cause oscillations by methods well known in the art.

Assuming now a state of oscillation for the tank circuit, it will be noted that the maximum oscillation voltage occurs across the tank circuit which may be considered as a source of the oscillation. Across this source are connected the two capacitors 27 and 28 in series. Capacitor 28 simply represents the capacitance between the chime tube antenna and ground. The entire tank circuit voltage may therefore be divided between the two capacitors; and the voltage across these two capacitors is approximately in the same phase as that across the tank circuit. The feedback voltage to the oscillator tube is the voltage across capacitor 27 and therefore the amplitude of oscillation must be proportional to this voltage; that is the total amplitude of the tank circuit voltage must be proportional to the voltage across capacitor 27 since the latter is the voltage that excites the oscillator tube. Furthermore, the ratio of the voltage across capacitor 27 to the voltage across capacitor 28 is determined by the relative capacitances of capacitors 27 and 28, and any change of the capacitance of capacitor 28 will change this ratio. Consequently, it is apparent that the tank circuit voltage may be varied or controlled by variations in capacitor 28. As the capacitance of capacitor 28 increases (as it will when a body approaches near to it), the amplitude of oscillation decreases correspondingly.

The oscillations of the tank circuit occur with respect to the ground terminal 12 of the supply voltage which is one fixed point of the tank circuit. The cathode 3 of the oscillator tube 1 is part way between the ground point and the point of maximum oscillations, hence the cathode 3 of the oscillator tube 1 also oscillates with respect to ground. The oscillator tube is provided with an extra plate electrode 30, adjacent to the cathode 3. As the cathode potential oscillates, intervals occur during which the cathode is lower in potential than plate 30 so that electrons flow from the cathode to plate 30. As a result the plate will accumulate a surplus of electrons and achieves a potential negative to the cathode to such extent as will reduce or stop the further flow of electrons.

Plate 30 is connected to grounded line 11, through a lead 31, including a high resistance 32. Electrons leak off plate 30 to ground through this resistance at a regular rate, the regularity being accomplished by charging and discharging a parallel capacitor 33 connected to lead 31 through a lead 34 and to grounded lead 11 through a lead 35. The diode formed between the cathode and plate 30 therefore furnishes a rectified voltage across the "oscillator load resistor" 32 shown in the figure. The magnitude of this voltage is proportional to the amplitude of oscillations of the cathode itself and therefore is controlled by the size of the capacitance 28 and hence by the approach of objects to the chime tube antenna.

The changes in the voltage across oscillator load resistor 32 affect the voltage of a grid 39 of an amplifier tube 40 having a plate 41 connected to lead 7 through a lead 42 and a cathode 43 connected to grounded lead 11 through a lead 44 including a cathode bias resistor 45. The heater 46 of the cathode is connected to leads 17, 18 which in turn are connected to the secondary transformer coil 15. Tube 41 further includes a second grid 47 connected to lead 7 through a lead 48. Lead 7 is also connected to a voltage divider resistor 50 and to the cathode bias resistor 45 through a lead 49. The plate connection 42 includes a relay coil 51. The plate current is filtered by a capacitor 52. Relay coil 51 controls a pivotal contact arm 53 held against a stop 54 by any suitable retrieving means such as a spring and engaging a contact point 55 when attracted. Contact arm 53 and point 55 control the energizing circuit of an electromagnet 56 connected to leads 17, 18 through leads 57 and 58 respectively. The electromagnet if energized causes its plunger 59 to strike against the chime antenna 28, as will be more fully explained hereinafter.

When a body approaches the chime antenna 28, the oscillator output amplitude diminishes and the voltage across load resistor 32 decreases. The control grid 39 of the amplifier tube 40 rises to a less negative potential. This permits current to flow in the amplifier tube 40 where previously no current did flow. The current supply for the amplifier tube may be either a D.-C. or an A.-C. current. In the first case the plate 41 will be continuously positive and in the latter case the plate will be positive only part of each cycle, but this will merely affect the efficiency of the amplifier tube.

The adjustment of the cathode potential and of the potentials of the other electrodes is such that the approach of a body to the antenna 28 causes a signal or change allowing sufficient plate current to flow to energize relay 51. This relay by attracting its arm 53 against point 55 energizes electromagnet 56 which in turn will produce an audible signal by causing its plunger 59 to strike against the tube antenna and cause it to resonate audibly and thereby furnish a signal.

The circuit diagram shown in Figure 2 is distinguished from the circuit diagram according to Figure 1 only by minor variations such as connecting a resistor 65 having a high resistance in comparison to the impedances of the capacitors 27 and 28 from the mid point connection 66 of the capacitors to the mid point connection 22 of the tank circuit through a lead 67. The electromagnet 56 is directly controlled by the plate current. A condenser 68 is included in the lead 31 connecting plate 30 of the tube 1 to grid 39 of tube 40. Finally, a grid resistor 69 is connected to grounded lead 11 through a lead 70.

Changes in the voltage across oscillator lead resistor 32 affect now the voltage of grid 39 of tube 40 through capacitor 68. When the voltage across load resistor 32 is diminished due to the approach of a body to antenna 28, the potential of the left side of capacitor 68 is raised to a less negative value since the capacitor is included in a circuit with high resistances and has a large capacitance, the time constant of the circuit is quite large, of the order of a few seconds and the capacitor cannot be charged or discharged quickly. The capacitor therefore acts as a "time delay capacitor."

As a result of the increase of the potential of the left side of the time delay capacitor to a less

negative value, the right hand side of the capacitor must also rise in potential because the potential across the capacitor cannot change suddenly. The potential of the control grid 39 of the amplifier tube 40 will rise together with the potential of the right hand side of the capacitor. The potentials of the right hand side of capacitor 68 and grid 39 will slowly return to their initial or normal values as the charge in the capacitor changes due to the current flow in the various resistors of the circuit.

During the time the control grid of the amplifier tube is at higher potential, a current will flow through the plate connection sufficient to operate the electromagnet 56. This electromagnet now attracts its plunger 59 against the action of a retrieving spring 71 and striker 59 will strike against the chime tube antenna 28, thus causing an audible signal.

After a delay determined by the time constant of the grid capacitor 68 and its associated resistors, grid 39 will return to its initial potential at which little or no plate current flows in the amplifier tube 40. The plunger 59 will return from its striking position to a resting position preferably against a stop by the action of spring 71.

The system shown in Figure 2 has the advantage that any changes in the capacitance of the antenna 28 such as may occur due to placing a body adjacent to the chime antenna or variations in the humidity of the air will not influence the amplifier tube and cause an audible signal unless they occur quickly, and then only for a brief signal. The value of capacitors 27 and 28 need not be accurately set but may be set approximately. The entire system will function thereafter even if capacitor 28 changes for uncontrolled reasons, such as those previously mentioned.

The circuit system shown in Figure 3 is similar to the one shown in Figure 1, but it includes a time delay capacitor 68 and a variable capacitor 72. Figure 3 shows an additional antenna 73 and how remote controlled signals may be added by connecting such signals to leads 74 and 75. Such additional devices will not improperly influence the operation of the system. The additional signaling means and the controlling elements may be placed in any suitable location—for example, they may be located at a second entrance of a house whose main entrance door is guarded by a chime antenna.

The audibly resonant antenna may be made of any suitable material such as brass and may have any suitable form. For example, it may be a tube shaped as shown, or have the shape of a bowl, taut wire, or framework. If a visible signal is desired instead of, or in addition to an audible signal, an electric lamp may be provided whose housing or shade will serve as an antenna. The light switch of the lamp may be controlled by relay 51 included in the plate circuit of tube 40.

As it will appear from the previous specification, the capacitance to ground of the audibly resonant antenna 28 is increased as the plunger 59 approaches the tube. This feature may be used to lock the relay or the electromagnet in its operated position so that the alarm or signal continues until reset. This purpose can be attained by simply adjusting the equipment accordingly. If such lock-in feature is not desired, the equipment may be adjusted so that it is not sensitive to small changes in the capacitance such as will occur when the striker approaches the chime tube. For certain purposes it is advantageous to retain the capacitance of the chime tube to ground substantially unchanged. This can be accomplished by fastening a plate or wire electrode 77 to a striker 76 by means of an arm 78. The plate 77 is preferably placed lower than striker 76 to prevent the striker from turning. It is, of course, also possible to employ any other type of support for plate 77. The tube antena is supported by an insulating thread 79 or other suitable means and is electrically connected to lead 29.

As it appears from Figures 4 and 5, plate 77 moves away from the chime tube when the striker approaches the tube 28 so that the capacitance remains virtually unchanged. The same principle can be employed to diminish the capacitance to ground of the tube when the striker approaches. This result can be conveniently accomplished by increasing plate 77 so that it represents a substantial part of the total capacitance to ground of the tube. When now a body approaches the tube the increased capacitance to ground causes the electromagnet to act. The magnet by acting diminishes the capacitance and this releases the electromagnet. The result is a series of reoperations of the electromagnet.

While my invention has been described in detail with respect to certain particular examples, it will be understood by those skilled in the art after understanding the invention that various changes and further modifications may be made without departing from the scope of the invention, and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. Sound producing device for electric signaling devices of the class described comprising an antenna adapted to change its capacitance in response to the presence of a body in its vicinity and to produce an audible signal when struck, electromagnetic means controlled by a change of the capacitance of said antenna, a movable plunger controlled by said electromagnetic means and adapted to sound the antenna, a member adapted to affect the capacitance of the antenna by a change of its position relative to the antenna, the position of said member being controlled by the plunger.

2. Sound producing device as described in claim 1 in which said member is supported by the plunger.

3. Sound producing device for electric signaling devices of the class described comprising an antenna arranged to produce an audible signal when actuated and to change its capacitance in response to the presence of a body in its vicinity, means for actuating the antenna, and means for rendering said actuating means operative in response to a change of the capacitance of the antenna.

4. Sound producing device for electric signaling devices of the class described comprising an antenna arranged to produce an audible signal when actuated and to change its capacitance in response to the presence of a body in its vicinity, electromagnetic means arranged and connected to be rendered operative in response to a change of the capacitance of the antenna, and a movably mounted armature arranged to strike the antenna when the electromagnetic means are rendered operative, thereby sounding the antenna.

5. Sound producing device for electric signaling devices of the class described comprising an antenna arranged to produce an audible signal when struck and to change its capacitance in response to a change of the position of a body in its vicinity, electromagnetic means arranged and connected to be energized in response to a change of the capacitance of the antenna, and a movable plunger arranged to be attracted by the electromagnetic means and to strike the antenna when attracted thereby sounding the antenna.

6. Sound producing device for electric signaling devices of the class described comprising an antenna member made of a metallic body capable of producing an audible signal when struck and to change its capacitance in response to a change of the position of a body in its vicinity, electromagnetic means arranged and connected to be rendered operative in response to a change of the capacitance of the antenna, and a movably mounted armature arranged to strike the antenna when the electromagnetic means are rendered operative thereby sounding the antenna member.

7. Sound producing device as described in claim 6 in which the said antenna member is tube shaped.

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