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Lee

[11] **3,783,193**

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[54] **APPARATUS FOR ACTIVATING A REMOTELY LOCATED DEVICE IN RESPONSE TO THE RINGING OF A CALLED TELEPHONE SUBSCRIBER STATION**

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[52] **U.S. Cl.** ..... **179/2 A,** 179/41 A

[51] **Int. Cl.** **H04m 11/00**

[58] **Field of Search** ..... 179/41 A, 2 A

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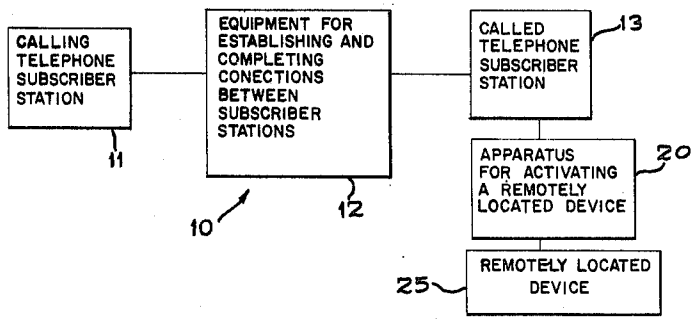
[57] **ABSTRACT**

Apparatus for the activation of a remotely located device under the control of telephone subscriber lines and stations. The apparatus of the present invention is located in the vicinity of a called telephone subscriber station and is operated to activate a remotely located device through two series of ringing signals initiated by a calling telephone subscriber station and produced by the called telephone subcriber station. The first series of ringing signals activates a timer which resets a counter that controls the operation of the remotely located device providing the counter is not on a preselected code position. The timer disables the counter from receiving counting pulses during the first series of ringing signals. In addition thereto, the timer enables the counter to receive counting pulses during a period P_2. Should the second series of ringing signals be produced by the called subscriber station within the period P_2 and be a preselected number of ringing signals, the counter will then activate the remotely located device.

8 Claims, 6 Drawing Figures



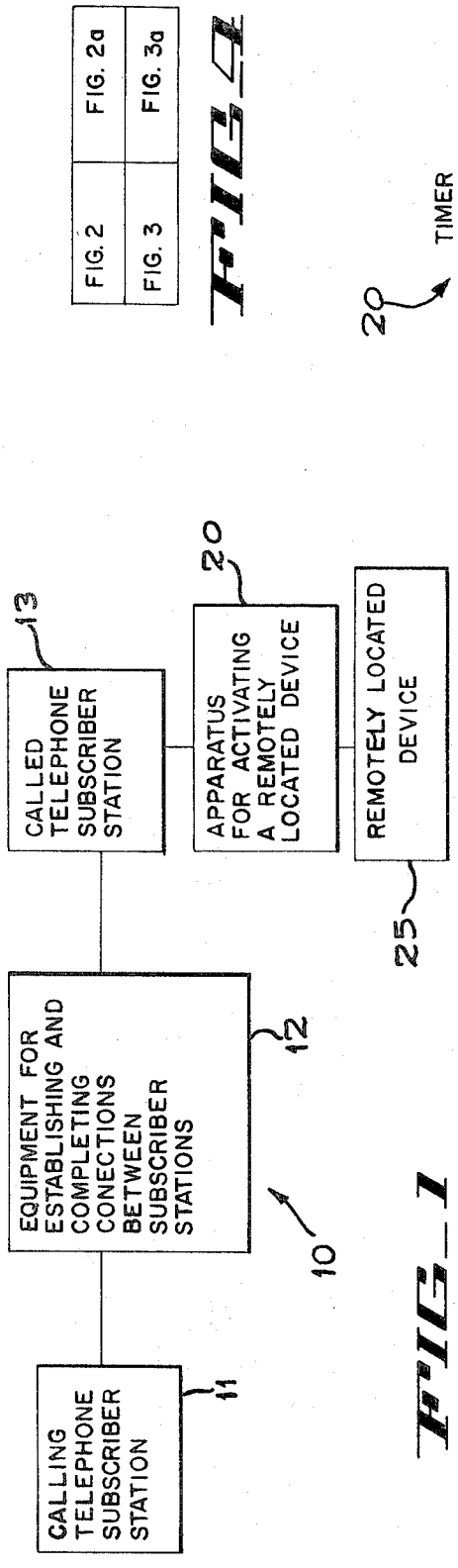


FIG. 1

FIG. 2	FIG. 2a
FIG. 3	FIG. 3a

FIG. 4

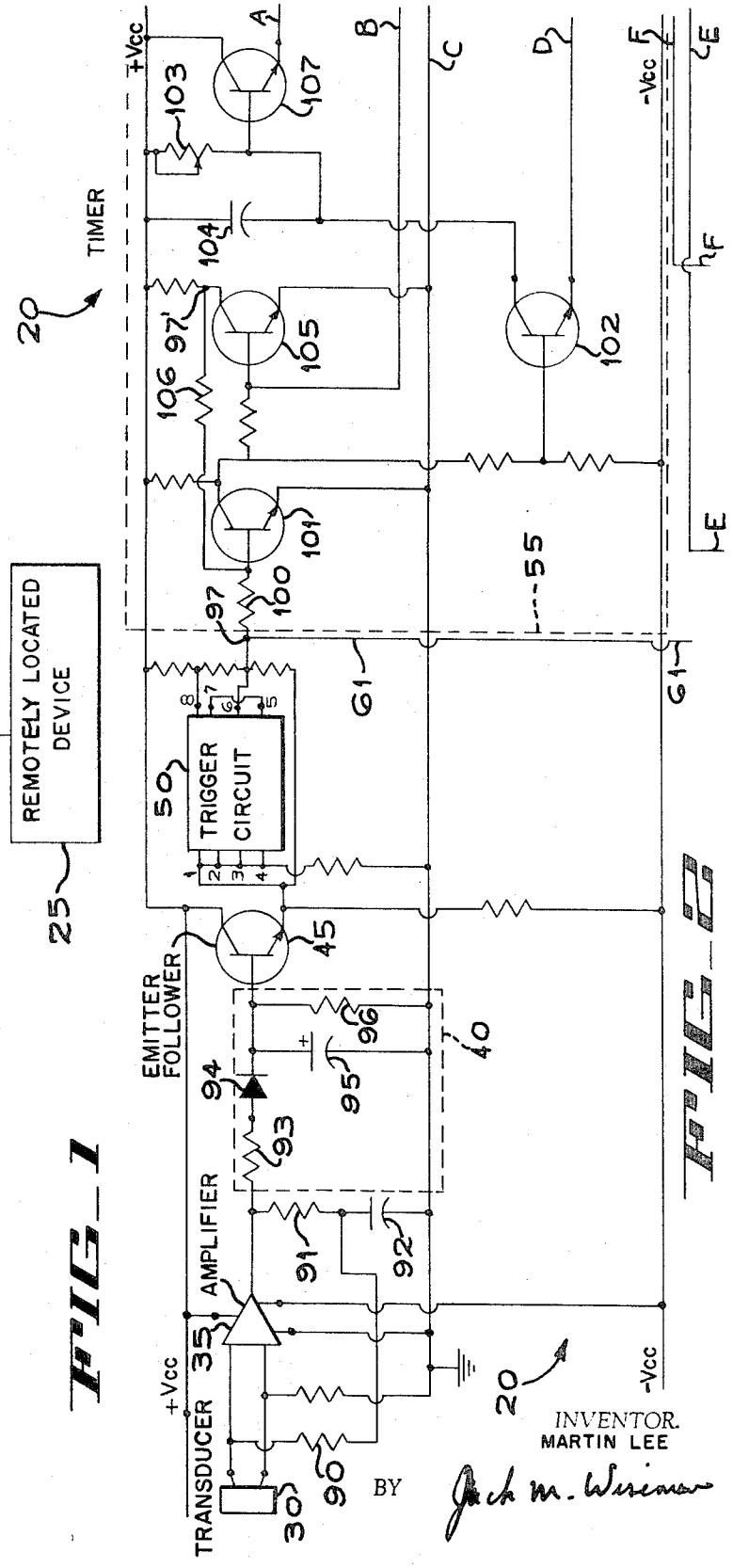


FIG. 2

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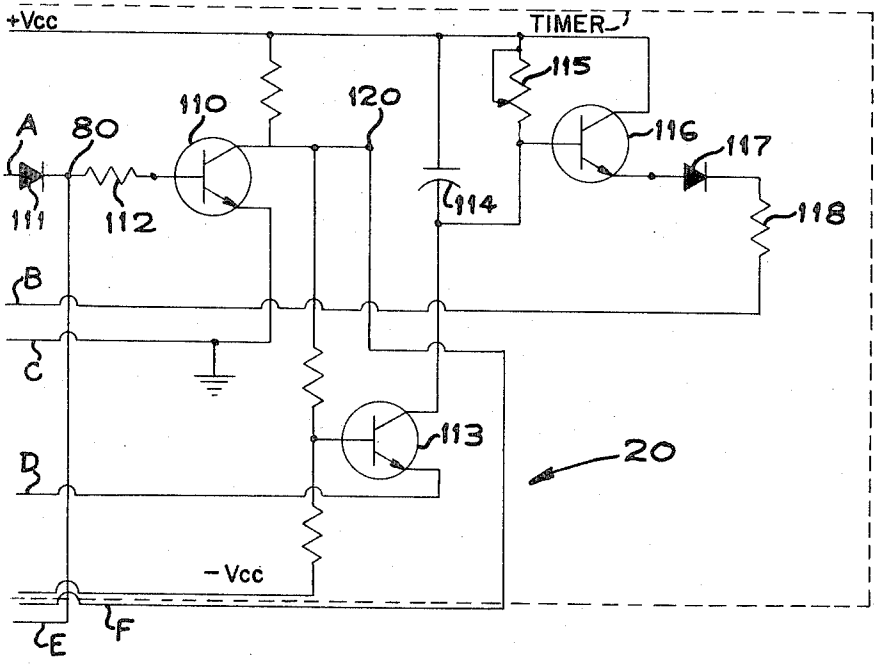

FIG 2A

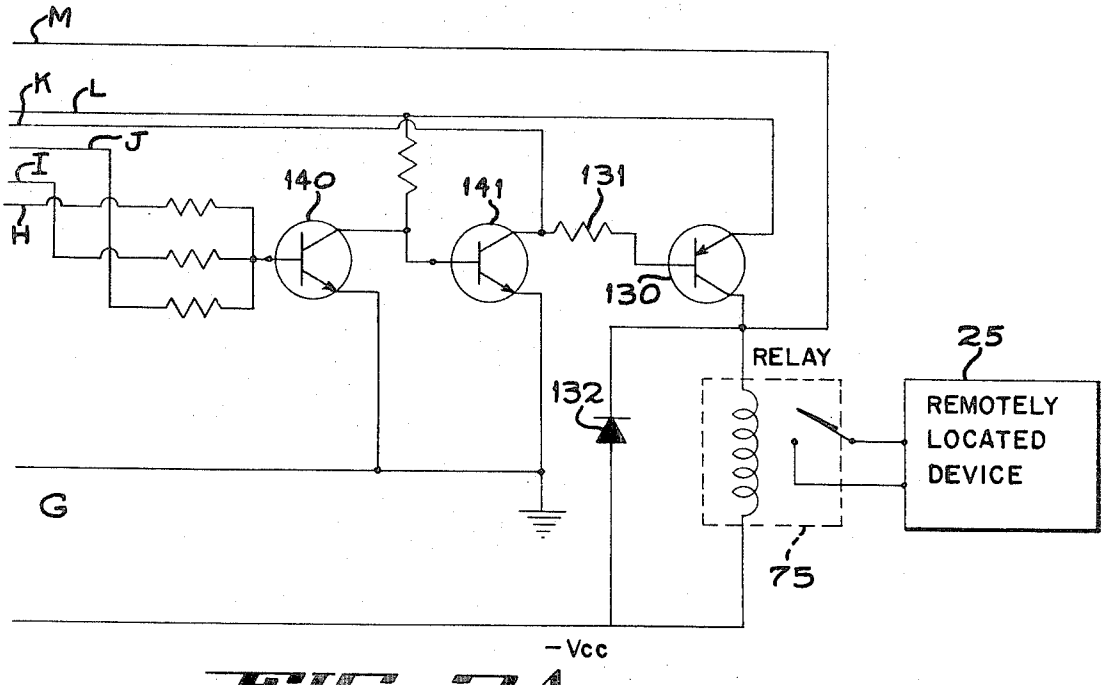

FIG 3A

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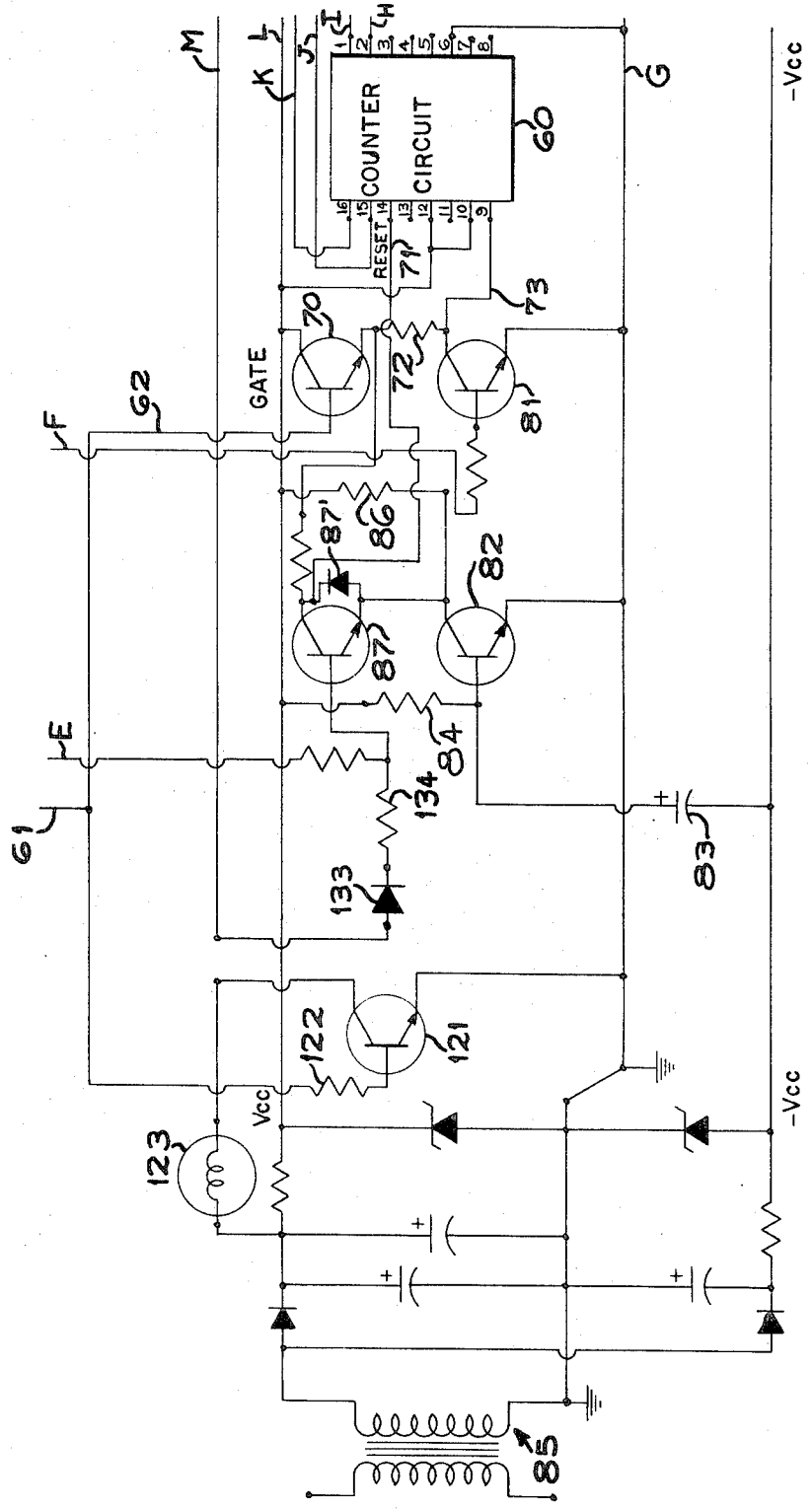

FIG. 3

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APPARATUS FOR ACTIVATING A REMOTELY LOCATED DEVICE IN RESPONSE TO THE RINGING OF A CALLED TELEPHONE SUBSCRIBER STATION

BACKGROUND OF THE INVENTION

The present invention relates in general to remote control systems and more particularly to apparatus for activating and deactivating a remotely located device in response to the ringing of a called telephone subscriber station.

Heretofore, remote control systems were employed to control the activation of various devices. Certain remote control systems did use telephone subscriber lines to operate the remotely located devices. However, such remote control systems had no provision for preventing the activation of the remotely located devices when unintended or false conditions were present.

Furthermore, such remote control systems employed complicated and cumbersome equipment and components. Such equipment and components had tended to decrease the reliability of the remote control system. Additionally, many of these remote control systems had depended upon one or more characteristics of the system for establishing connections with the remotely located devices. In so doing, the usefulness and practicality of the remote control systems were limted in using telephone subscriber lines and stations.

United States Pats. of interest in this art are as follows. Waldman, No. 3,049,592; Bloxsom, No. 3,267,-379; Robbins, No. 2,363,145; McNutt, No. 2,616,-972; Chaloupka, No. 3,347,987; New et al., No. 3,383,467; Jahns et al., No. 3,400,219; Hoffman, No. 3,428,750; Lovell, No. 3,484,553; Walker, No. 3,485,-952; Stenhammar, No. 3,324,245; Waldman et al., No. 3,308,239.

SUMMARY OF THE INVENTION

Apparatus for the activation of a remotely located device under the control of telephone subscriber lines and stations. The apparatus of the present invention is located in the vicinity of a called telephone subscriber station and is operated to activate a remotely located device through a plurality of series of ringing signals initiated by a calling telephone subscriber station and produced by the called telephone subscriber station. One series of ringing signals activates a timer, which enables the counter to receive counting pulses during a preselected time period. Another series of ringing signals during this preselected time period causes counting pulses to operate the counter for controlling the operation of the remotely located device.

This arrangement serves to obviate the activation of the remotely located device by false or unintended signals.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a remote control system embodying the present invention and employing telephone subscriber lines and stations.

FIGS. 2, 2A, 3 and 3A when arranged in the manner shown in FIG. 4 are a schematic diagram of the apparatus of the present invention for activating a remotely located device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Illustrated in FIG. 1 is a remote control system **10** embodying the present invention, which employs conventional telephone subcriber lines and stations. By way of example, a conventional telephone subscriber station **11** has an operator dial the telephone instrument thereof to initiate a call at the calling telephone subscriber station through conventional telephone equipment for establishing and completing connections between the calling telephone subscriber station **11** and a called telephone subscriber station **13.** In so doing, the operator through the telephone instrument at the calling subscriber station **11** dials successively the predetermined number of a conventional called telephone subscriber station **13,** which results in the producing of two series of ringing signals in the form of pulses or ringing tones at the called telephone subscriber station **13,** while the handset of the instrument at the telephone subscriber station **13** remains in the cradle thereof. During the entire operation hereof, the handset of the instrument at the called telephone subscriber station remains in the cradle in engagement with the plunger thereof. Located in the vicinity of the called telephone subscriber station **13** is the apparatus **20** of the present invention. Should the second series of ringing signals produced by the called telephone subscriber substation **13** be of a predetermined number and be produced within a preselected time period P_2, then the apparatus **20** of the present invention will activate a suitable remotely located device **25,** such as a sprinkler system, electric lights, electrically operated furnace, electric coffee maker or the like. On the other hand, should the number of ringing signals produced by the called telephone subscriber station **13** during the second series of ringing signals not be of the preselected code or not be produced during the preselected time period P_2, then the apparatus **20** would not activate the remotely located device **25.**

As shown in FIGS. **2, 2A, 3** and **3A,** the apparatus **20** of the present invention comprises a suitable transducer or a sound pick-up device **30,** such as a crystal microphone or inductive pick-up coil to pick up the ringing signal produced by the called subscriber station **13.** A device with an attenuator could be wired directly to the subscriber station **13** to sense ringing pulses in lieu of detecting ringing tones. Connected to the output of the transducer **30** is a suitable amplifier **35.** The output signal from the amplifier **35** is fed to a suitable half-wave rectifier **40** for rectification.

The direct current signals are fed to a conventional emitter follower circuit **45** and the emitter follower circuit **45** drives a suitable trigger circuit **50,** such as the well known Schmidt trigger circuit.

The operation of the trigger circuit **50** during the first series of ringing signals produces pulses to initiate the operation of a timer circuit **55** and resets a conventional counter circuit **60** over a conductor **61,** conductor **62,** an emitter circuit **70,** and reset conductor **71** should the counter circuit **60** not be on a preselected code. The timer circuit **55** is now activated and will inhibit the counter circuit **60** from receiving counting pulses during the time period that the first series of ringing signals is produced by the called telephone subscriber station **13.** Actually, the timer circuit inhibits the counter circuit **60** from receiving counting pulses

at all times, excepting the period P_2. More specifically, the trigger circuit **50** activates the timer **55** at a time T_o which is the beginning of the period P_1 and which is also the initiation of the first series of pulses. The timer circuit **55** will remain so activated until the time T_1, which is the expiration time for the period P_1. The time T_1 occurs at a preselected time interval after the time T_o. The period P_1 is the time interval between T_o and T_1. Commencing at the time T_1, the timer circuit **55** enables counting pulses to be transmitted to the counter **60** over the conductor **73** and through a resistor **72.** At the end of a time period P_2, the timer circuit **55** inhibits the conduction of counting pulses over the conductor **73** and the timer circuit **55** is now reset for further activation under the control of the trigger circuit **55** for beginning a new cycle of operation. The period P_2 is a fixed time interval commencing at the time T_2 and ending at a time T_3. The operator at the subscriber calling station **11** also initiates a second call to the called subscriber station **13** within the period P_2. The second call, of course, causes the called telephone subscriber station **13** to generate ringing signals, such as a series ringing pulses or a series of ring tones, which are again picked up by the transducer **30.** Should the second series of ringing signals be produced within the time period P_2 and be of a preselected number of ringing tones, then the counter **60** will operate the remotely located device **25.** For deactivating the remotely located device **25,** the operator repeats the above procedure to move the counter **60** from the coded condition that heretofore had operated the remotely controlled device **25.**

In a manner previously described, the second series of ringing signals during the time period P_2 is amplified by the amplifier **35;** rectified by the rectifier circuit **40;** advance through the emitter follower **45** and produce trigger pulses in the output of the trigger circuit **50.** The trigger pulses are transmitted from the trigger circuit **50** over the conductor **61,** the conductor **62,** through the emitter follower circuit **70,** through the resistor **72** over the conductor **73** to the counter circuit **60.** Should the operator permit the second series of ringing signals to be produced during the period P_2 and to continue for a preselected time duration or a preselected number of ringing signals by counting the ring-back tones, the counter circuit **60** will cause a relay **75** to be energized. This action closes the contacts of the relay **75** to activate the remotely located device **25.** It is apparent that false operation of the remotely located device **25** is obviated, since the counter circuit **60** requires a preselected number of pulses controlled by the operator at the calling telephone subscriber station **11** counting the series of ring back tones produced at the calling telephone subscriber station **11** which must be produced during a predetermined time interval. During the entire operation, the handset of the telephone instrument at the called subscriber station **13** remains on the cradle in engagement with the plunger or plungers thereof.

The following description relates to protecting against false operations due to power failure and resets the apparatus **20** when initially turned on.

When the apparatus **20** is initially turned on, there is no signal picked-up by the transducer **30** and, hence, there is no output triggering signal produced by the trigger circuit **50.** Thus, the timer circuit **55** is not activated and a low voltage appears at an output junction **80** thereof. The conductor **73** over which counting pulses are transmitted is now grounded through a transistor **81.** Bias is removed from a transistor **82** until a capacitor **83** is charged. When current flows through a resistor **84** by virtue of a conventional power supply **85** being turned on, the capacitor **83** charges.

While the capacitor **83** is charging, the collector electrode and the transistor **82** does not have current flowing therein aand allows current flow through a resistor **86** to forward bias a transistor **87.** From a design point of view, operating conditions can be improved by connecting a diode **87'** across the transistor **87.** The forward biasing of the transistor **87** resets the counter circuit over the conductor **71.** The transistor **87** also allows a reset signal to be conducted over the conductor **71** to the reset input terminal of the counter circuit **60** whenever the potential of the junction **80** of the time circuit **55** is low and relay **75** is not energized.

When an operator desires to change the state of the remote control apparatus **25** or to activate the same, he dials the number of the called subscriber station **13** at a time T_o and the series of ringing tones is produced at the called station **13.** Subsequently, the operator dials the number of the called subscriber station **13** during the time period P_2 and the second series of ringing tones is produced at the called station **13** for a preselected period of time to apply a prescribed number of counting pulses to the counter circuit **60,** which is attained by counting the ring-back tones at the calling station **11.**

The transducer **30** is located in the vicinity of the called subscriber station **13** to pick-up the ringing tone signals produced therefrom. The transducer **30** has its output signal applied to the input side of the amplifier **35.** Direct current stability of the amplifier **35** is maintained through a resistor **90,** a resistor **91** and a capacitor **92.** The output alternating current of the amplifier **35** is not fed back to the inverting input thereof through the resistors **90** and **91,** since the capacitor **92** connects the resistor **91** to ground. However, the alternating current output signal from the amplifier **35** is transmitted to the half-wave receiver **40** through a resistor **93** and is rectified by a diode **94** to charge a capacitor **95.** The capacitor **95** will discharge through a resistor **96** in the absence of a signal from the amplifier **35.**

The emitter follower **45** is connected to the resistor **96.** When the voltage across the capacitor **95** reaches a prescribed magnitude, the trigger circuit **50** will produce a trigger pulse in the output thereof to cause a junction **97** to be at a high potential. This occurs when the first series of ringing tones produced by the called station **13** charges the capacitor **95** to the firing potential of the trigger circuit **50** so that the junction **97** will be at the high potential, when the output signal from the amplifier **35** is discontinued and the capacitor **95** discharges through the resistor **96.** When the capacitor **95** discharges so that the potential thereon is below the firing point of the trigger circuit **50,** the junction **97** is at a low potential.

When the junction **97** is at a high potential, a timer input resistor **100** has a current flow therethrough which causes current to flow through the base of a transistor **101.** This action results in the collector of the transistor **101** being at a low potential. As a consequence thereof, the bias on a transistor **102** is removed. The removal of the bias on the transistor **102** allows a resistor **103** to discharge a capacitor **104.** When the collector of the transistor **101** is at a low potential, the bias on a transistor **105** is removed and the potential on

the collector of the transistor **105** goes high, whereby current flows through a resistor **106** to the base of the transistor **101** to maintain the transistor **101** in a saturated state after the potential at the junction **97** goes low.

The discharge of the capacitor **104** through the resistor **103** results in the potential applied to the base electrode of a transistor **107** to be high. The resistor **103** and the capacitor **104** form an R-C timing network for selecting the fixed time period P_1.

When the potential applied to the base electrode of the transistor **107** is high, a bias is applied to the base electrode of a transistor **110** through a diode **111** and a resistor **112.** At this time the potential at the junction **80** is high. This action causes the potential on the collector electrode of the transistor **110** to go low and to remove the bias from the base electrode of a transistor **113.** At this time, the potential at a junction **120** is low. Thereupon, a capacitor **114** discharges through a resistor **115.** The resistor **115** and the capacitor **114** form an R-C timing network for selecting the fixed time period P_2.

When the base electrode of a transistor **116** reaches a sufficiently high potential through the discharge of the capacitor **114** through the resistor **115,** the transistor **116** conducts. Thereupon, current flows through a diode **117** and a resistor **118** to the base electrode of the transistor **105.** As a result thereof, the transistor **103** and the transistor **101** are returned to their initial state at the expiration of the fixed time period P_2.

To recapitulate the timing operations and the potential conditions at junction **97'**, **80** and **120** for the timing circuit **55,** it is to be observed that at the time T_0 the junctions **97'** and **120** are at a high potential and the junction **80** is at a low potential. At the time T_1, the junction **120** is at a low potential and the junctions **80** and **97'** are at a high potential. At the expiration of the time period P_2 or at the time T_2, the junctions **97'** and **80** are at a low potential and the junction **120** is at a high potential. At the completion of the first series of ringing pulses or tones, the junctions **80** and **97'** are at a high potential and remains in this condition until the transistors **101** return to their initial state.

The junction **97** is connected to a transistor **121** through a resistor **122.** When the potential at the junction **97** is high, which occurs at time T_0, the transistor **121** conducts and current flows through the collector electrode thereof. As a consequence thereof, a lamp **123** is energized. The lamp **123** serves to show that the apparatus **20** will properly receive the incoming ringing signals with sufficient magnitude to initiate and complete a cycle of operation. One side of the lamp **123** is connected to the collector electrode of the transistor **121** and the other side of the lamp **123** is connected to the power supply **85.** The junction **97** is also connected to the base electrode of the emitter follower transistor **70** over the conductor **62.** Simultaneously, the transistor **70** functions as an emitter follower causing the counter circuit **60** to reset in a manner previously described. Any counting pulses present will be shorted to ground through the transistor **81** in a manner previously described, since the potential at the junction **120** is high.

At the completion of the period P_1, the junctions **97'** and **80** are at a high potential and the junction **120** is at a low potential. When the potential at the junction **120** is low, the bias is removed from the gate circuit transistor **81** which enables trigger pulses to be transmitted from the trigger circuit **50** through the junction **97,** through the emitter follower transistor **70,** through the resistor **71,** over the conductor **73** to be applied to the counter circuit **60.**

Should the called station **13** produce a second series of ringing tones or pulses during the time period P_2, the counter circuit **60** is operated in the manner just described. Should the number of ringing tones or pulses be the preselected code, the counter circuit **60** applies a potential to the base electrode of a transistor **130** through a resistor **131** to cause the transistor **130** to conduct. Thereupon, a diode **133** conducts through a resistor **134** to apply a potential to the base electrode of the transistor **87.** The transistor **87** now inhibits any new calls during the period P_1 from resetting the counter **60.** As a consequence thereof, the relay **75** is energized to activate the remotely located device **25.** A diode **132** serves to protect the transistor **130** from excessive voltage when the relay **75** is deenergized.

During the time period P_2, the transistors **82** and **87** conduct to short out the reset terminal for the counter **60** over the conductor **71.** The transistor **82** always operates in a saturated state when the apparatus **20** is turned on. Initially, the bias is removed from the transistor **82** until the capacitor **83** is charged by the conduction of current through the resistor **84** in a manner previously described. During the time the capacitor **83** is charging, the collector electrode of the transistor **82** does not have any current flow therethrough and the current flow through the resistor **86** forward biases the transistor **87** to reset the counter circuit **60.** The transistor **87** enables signals to advance to the reset terminal of the counter circuit **60** whenever the junction **80** is at a low potential and the collector electrode of the transistor **130** is at a low potential. This would occur prior to the time T_1, or when the relay **75** is not energized.

At the expiration of time period P_2, the junction **120** is at a high potential in a manner previously described and the transistor **81** conducts to ground the counting input of the counter circuit **60** in a manner previously described for inhibiting counting pulses to be transmitted over the conductor **73** to the input counting terminal of the counter circuit **60.**

When the counter terminal **9** of the counter circuit **60** has had a suitable number of pulses to cause the transistor **130** to conduct, the relay **75** is energized in a manner previously described. Should either the counter terminals **1, 2,** or **15** of the counter circuit **60** have a suitable potential thereon, a transistor **140** does not conduct, which in turn causes a transistor **141** to conduct. Thereupon, the transistor **130** conducts in the manner previously described for energizing the relay **75.** The relay **75** remains energized since the counter circuit **60** remains in its coded state.

To deenergize the relay **75,** the above sequence of operations is repeated. This serves to advance the counter circuit **60** to remove the same from its coded state to deenergize the relay **75.**

I claim:

1. Apparatus for use in a remote control system employing telephone subscriber lines and equipment and having a calling telephone subscriber station to initiate ringing signals to be detected at a called telephone subscriber station, said apparatus comprising:

a. means for activating a remotely located device;

b. a counter operative for controlling the operation of said means;

c. circuit means located in the vicinity of said called telephone subscriber station to detect ringing signals at said called telephone subscriber station and producing therefrom pulses, said circuit means being connected to said counter for applying pulses to said counter for operating said counter; and

d. a timer circuit activated by said circuit means and operative for controlling the predetermined time interval in which said circuit means applies pulses to said counter;

e. said circuit means transmitting a series of pulses to said counter in response to detecting ringing signals at said called subscriber telephone station during said predetermined time interval, the number of pulses transmitted by said circuit means being commensurate with the number of ringing signals detected by said circuit means, said counter operates said means in response to said circuit means applying a predetermined number of pulses to said counter during said predetermined time interval,

f. said circuit means detecting a first series of ringing signals and a second series of a predetermined number of ringing signals, said circuit means in response to said first series of ringing signals activates said timer circuit, whereby said timer circuit enables said counter to receive the second series of ringing signals after the completion of the first series of ringing signals to operate said means in response to said circuit means transmitting to said counter during said predetermined time interval a second series of a predetermined number of pulses.

2. Apparatus as claimed in claim **1** wherein said predetermined time interval commences at a fixed time interval after the initiation of said first series of ringing pulses and terminates at the expiration of a preselected time interval thereafter.

3. Apparatus as claimed in claim **2** wherein said timer circuit resets said counter during said first series of ringing signals when said counter is not operating said means.

4. Apparatus as claimed in claim **3** wherein said timer circuit inhibits said circuit means from operating said counter to operate said means at a time other than during said predetermined time interval.

5. Apparatus as claimed in claim **4** and including protecting means responsive to said circuit means and said timer circuit and connected to said counter for reseting said counter after power failure.

6. Apparatus as claimed in claim **5** wherein said protecting means resets said counter when said apparatus is turned on.

7. Apparatus as claimed in claim **1** and comprising indicator means connected to said timer circuit and operative in response to said circuit means detecting signals of preselected magnitude produced at said called subscriber station.

8. Apparatus as claimed in claim **1** wherein said subscriber station produces a third series of ringing signals and a fourth series of ringing signals, said circuit means in response to said third series of ringing signals activates said timer circuit, whereby said timer circuit enables said counter to change its state to operate said means for deactivating said remotely located device in response to said circuit means transmitting to said counter during a predetermined time interval a fourth series of pulses.

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