

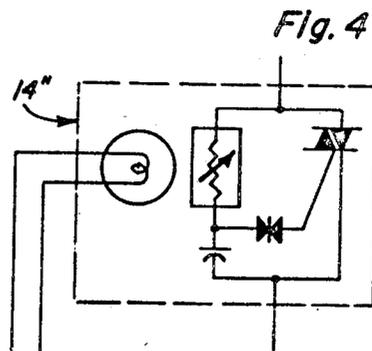
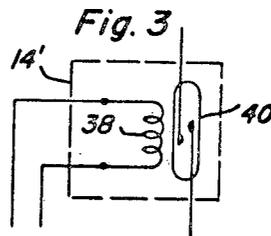
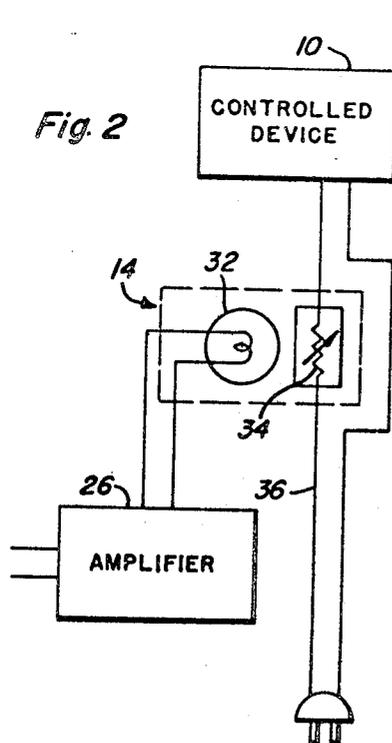
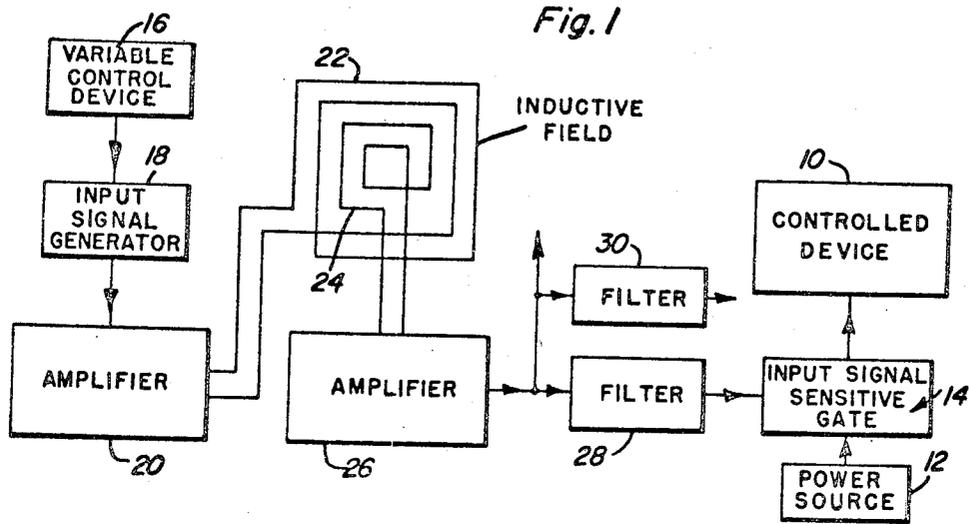
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W. T. CLARK III

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INFINITELY VARIABLE INDUCTIVE REMOTE CONTROL SYSTEM

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William T. Clark III
INVENTOR.

BY *Alvin A. Dixon*
and Harvey B. Jackson
ATTORNEYS

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INFINITELY VARIABLE INDUCTIVE REMOTE CONTROL SYSTEM

William T. Clark III, 400 Bayou Rapides Road, Alexandria, La.

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6 Claims

ABSTRACT OF THE DISCLOSURE

A wireless remote control system has a controlled device supplied by an electrical power source, and gating device is connected between the source and the advice for varying the electrical energy supplied to the device by the source. A controlled oscillator having an output frequency below radio frequencies is coupled to the gating device by an air core transformer wherein the secondary winding is within the magnetic field of the primary winding.

This invention relates to a control system through which the supply of electrical energy to a control device may be infinitely varied in a reliable yet wireless manner from a remote location.

Remote control in accordance with the present invention is effected through magnetic induction to thereby avoid the instability and sensitivity to environmental conditions associated with radio control systems. The system of the present invention is therefore particularly suited for use in a confined area such as theaters in order to provide an infinitely variable control over the supply of energy to control electrically powered devices such as lamps and electric motors. Stable control by radio apparatus in such environments is impracticable because of spurious noises generated by other equipment such as air conditioning and lighting instruments causing frequency drift.

In accordance with the objects of the present invention, the supply of electrical energy to a powered device may be infinitely varied from a remote location by utilizing a gating device sensitive to an electrical effect produced by varying the signal characteristic associated with the output of a signal generator separate and independent of the electrical power source from which the controlled device is powered. A variable control device is therefore associated with the source of signal energy for modulation thereof in an infinitely adjustable manner to produce the electrical effect to which the gating device responds, the signal energy being in the form of magnetic waves within a frequency range including frequencies below RF values without any deliberate radiation of electric waves.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully in the details hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 diagrammatically illustrates the system of the present invention.

FIGURE 2 illustrates one form of gating device utilized in the system of the present invention.

FIGURES 3 and 4 respectively illustrate other types of gating devices capable of being utilized in the system of the present invention.

Referring now to the drawings in detail, FIGURE 1 illustrates the remote control system through which a controlled device 10 such as a lamp or an electric motor may be powered from a suitable source of electrical energy 12. The supply of energy to the controlled device

is controlled and regulated through a gating device generally referred to by reference numeral 14 interconnected between the power source and the controlled device. The gating device is controlled from a remote location by means of a variable control device 16 which may be in the form of an infinitely variable potentiometer through which the output of a signal generator 18 is modulated.

The signal generator 18 produces an oscillating output at any frequency capable of being handled by the gating device usually below radio frequencies. One or more of the signal characteristics associated with the oscillating output is adjustably modulated by the variable control device such as frequency, amplitude and phase. The signal characteristic to be modulated and its adjustment range must be selected in accordance with the particular gating device utilized so that any variation in the signal modulation will produce a corresponding response in the gating device to proportionately regulate the flow of electrical energy from the power source 12 to the controlled device 10. Thus, the oscillating output of the signal generator 18 constitutes the signal energy through which input information from the variable control device 16 is transferred to the input signal sensitive gating device 14.

As shown in FIGURE 1, the output of the signal generator 18 is fed to an amplifier 20 which is impedance matched to a primary loop 22 preferably surrounding an area within which the controlled device 10 is disposed. Disposed within the magnetic field of the primary loop 22, is a secondary inductor loop 24. The primary and secondary loops thus form a relatively large air core transformer the efficiency of which will be determined by the closeness of the primary and secondary inductors. The inductors may be made of any suitable, electrically conductive material such as wire or conductive paint. Thus, the amplified oscillating output of the signal generator 18 is transferred from the amplifier 20 to the secondary loop 24 by magnetic induction. The oscillating output inductively transferred by the air core transformer may be further amplified by another amplifier 26 impedance matched to the secondary loop 24 in order to raise the energy level of the signal generator output to a value capable of operating the gating device 14.

The signal energy fed to the gating device 14 may be transmitted through a filter device 28 placed either after the amplifier 26 as shown in FIGURE 1 or before the amplifier in order to select a predetermined range of signals to which the gating device will respond by discriminating against all other signals. The filter device may be of any suitable type whether it be electrical, electronic or mechanical in order to prevent passage of unwanted signals and signals intended for other controlled devices. For example, other devices may be controlled by the signal output of the same amplifier 26 through a plurality of other filters 30 connected thereto, separating the signal output of the amplifier by differences in frequency, amplitude or phase. A plurality of functions may therefore be performed from the variable control device 16. The present invention also contemplates the disposition of a plurality of secondary inductors within the magnetic field enclosed by the primary loop 22 in order to independently control a plurality of controlled devices.

It will be apparent therefore from the foregoing, that the output derived from the filter or amplifier, if the filter is eliminated, will control the behavior of the gating device 14 in order to regulate the flow of electrical energy to the controlled device under control of the variable control device 16. Gradual dimming of a lamp may thereby be effected or the speed of an electric motor infinitely varied by variation in the frequency, amplitude or phase of signal control pulses fed to the gating device. In one form of gating device shown in FIGURE 2, the amplitude of the signal pulses determines the brightness of an incan-

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descent lamp bulb 32 forming a photoresistive link with the variable photoresistive element 34 connected in one of the power lines 36 through which electrical energy is supplied from the power source to the controlled device 10. An amplitude responsive gating device is therefore formed so as to regulate the amount of electrical power supplied to the controlled device proportionate to or as a reproducible function of the adjustment in amplitude of the oscillating output from the signal generator 18 by the variable control device 16.

A frequency responsive gating device 14' is shown in FIGURE 3 wherein the output of the amplifier or filter is fed to a frequency responsive coil 38 controlling a highly compliant reed relay switch 40. The frequency of the signal pulses fed to the gating device 14 will determine the number of times the switch device 40 connects the power source to the control device per unit time in order to statistically vary the amount of power delivered in proportion to or as a definite function of the frequency value of the signal pulses. Other types of gating devices having similarly suitable properties may also qualify such as a combination photoresistor link and bilateral silicon controlled rectifier circuit 14'' as shown in FIGURE 4. It will also be appreciated that other proportionate controlled gating devices may be utilized involving saturable reactors and thyratrons.

From the foregoing description, it will be apparent that a uniquely stable, remote control system is disclosed which depends upon the response characteristics of a gating device to a signal effect produced at a remote location through a variable control device associated with a signal generator the output of which is transferred through magnetic induction to the gating device. The signal energy is accordingly radiated between the inductor loops by magnetic waves only as compared to the existence of both magnetic and electric wave radiation in radio apparatus. Signal transmission is thereby effected more reliably and without any detector component utilizing a gating device operative to infinitely vary the power supplied to a controlled, power operated device from a power source which is independent from the source of signal energy through which signals are transferred to the gating device.

What is claimed as new is as follows:

1. In a wireless remote control system for a controlled device powered by a source of electrical energy, a signal generator having an oscillating output within a frequency range including signals below radio frequencies, variable control means connected to the signal generator for adjustable modulating at least one signal characteristic of

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said oscillating output, inductive coupling means connected to said signal generator for transferring said oscillating output by a magnetic field only to a location remote from the variable control means while faithfully reproducing the modulated signal characteristic thereof comprising an air core transformer having a primary winding and a secondary winding, means connecting the primary winding to the output of said oscillator, the secondary winding being disposed in the magnetic field of said primary winding, and gate means connected to the secondary winding and sensitive to variations in said signal characteristic for infinitely varying the electrical energy delivered from the source to the controlled device as a reproducible function of the adjustable modulation of the signal characteristic by the variable control means.

2. The combination of claim 1 including filter means connected to the gate means for selecting a predetermined range of signal characteristics to which said gate means will respond.

3. The combination of claim 2 including impedance matching amplifiers connecting the inductive coupling means to the signal generator and the gate means for increasing the energy level of said oscillating output to operate the gate means.

4. The combination of claim 1 wherein said gate means comprises a frequency responsive device varying the energy supplied to the controlled device in proportion to frequency modulation of the oscillating output by the variable control means.

5. The combination of claim 1 wherein said gate means comprises an amplitude responsive device.

6. The combination of claim 1 wherein said oscillating output of the signal generator is phase modulated by the variable control means.

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