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RADIO REMOTE CONTROL SYSTEM

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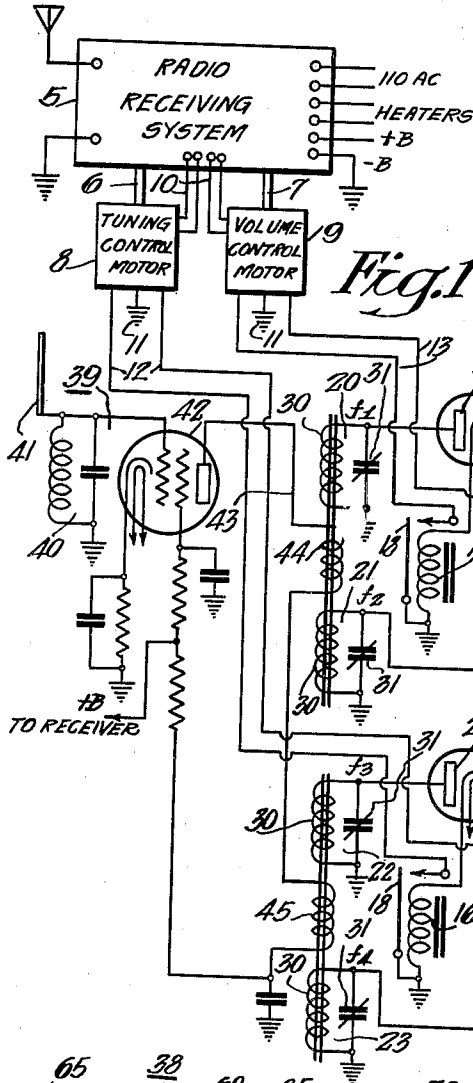


Fig. 1

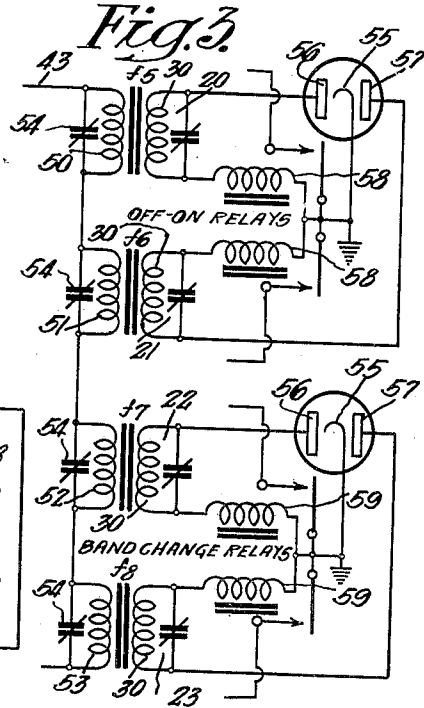


Fig. 3

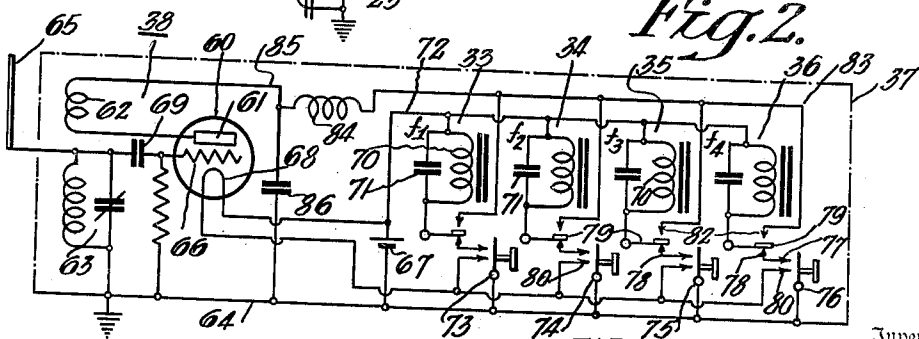


Fig. 2

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RADIO REMOTE CONTROL SYSTEM

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4 Claims. (Cl. 250—17)

The present invention relates to radio remote control systems whereby a plurality of functions are remotely controllable without the intermediary of cable or wire circuit connections. It has for its primary object to provide an improved remote control system of the character referred to including simplified means for generating and modulating a radio signal wave and means for utilizing said modulated wave for controlling a plurality of functions in a controlled radio apparatus at a remote point.

A control system embodying the invention is particularly adapted to provide remote control of tuning, signal level or volume, power supply, wave band change and like functions in a radio receiving system, and has for its further object to provide means for the remote control of a plurality of such functions without wire connections to the remote control device and at the same time without causing interference with radio signal reception or undesired accidental operation of other tuning or remote control systems, whereby radio waves may be utilized in a practical way for transmitting the control action.

In providing signal waves for remote control, to eliminate wire connections involving cables between the remote control point and the controlled apparatus, and contrary to the usual practice in radio wave controlled remote control systems, the present system utilizes modulated waves instead of interrupted waves or impulses and transmits a single micro-wave signal as compared with long wave signals employed in the operation of present remote control systems of the wireless type.

It is also a further object of the present invention to provide a remote control system for radio signaling apparatus free of all external wire connections including the usual power supply connection with the commercial light or power supply circuit, and to provide an improved form of signal wave generating means in such a system that it is adapted for economical operation from a small battery power supply source as a compact, portable control unit for the system.

It is important that operation of the remote control system does not interfere with other similar control systems and with radio reception and, accordingly, it is also an object of the present invention to provide an improved remote control system embodying radio wave transmitting and receiving devices which is adapted for economical operation with small battery power while providing energy sufficient to operate oscillatory tube circuits capable of signal transmission over relatively short distances with

a signal strength sufficient to ensure effective and dependable control.

It is also an object of the present invention to provide an improved signal generating and transmitting means in a remote control system which may provide an ultra high frequency signal, modulated selectively at any one of a plurality of differing control frequencies and involving an electric discharge tube oscillator, with a single battery source which may comprise a single cell, thereby permitting the remote control element to be simplified and reduced in size to facilitate portability and operation as a portable control unit.

The invention will, however, be better understood from the following description when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing:

Figure 1 is a schematic circuit diagram of the receiving portion and Figure 2 is a schematic circuit diagram of a transmitting portion of a remote control system embodying the invention, as applied to a radio receiver; and

Figure 3 is a similar schematic circuit diagram showing a modification of the circuit of Fig. 1 and the adaptation of the system for control of other functions in addition to that provided by the circuit of Fig. 1.

Referring to Fig. 1, for the continuous control of tuning and volume or any similar two functions in a radio receiver or receiving system, such as that indicated at 5 in the drawing, the tuning control shaft 6 and the volume control shaft 7 are connected to reversible electric motor means 8 and 9, respectively, energized through connections 10 from the radio receiver and controllable in direction of operation through a reversing circuit comprising a ground connection 11 and circuit leads 12 and 13.

As any suitable motor means may be provided which is reversible and controllable by a suitable control circuit, further description is believed to be unnecessary. The system is adapted for controlling the motor means through any suitable reversing control circuits, such as those indicated at 12 and 13, by energizing suitable relays 14, 15, 16 and 17. The latter are provided with contacts 18 for connecting the control leads 12 and 13 to ground, thereby causing operation of the motor means 8 and 9 in either direction as the relays 14 and 15 and the relays 16 and 17 are selectively energized by suitable means.

The relays 14—17 are preferably sensitive to

rectified signal currents and are each connected with a tuned rectifier circuit from which signal currents for operating it are derived through rectifier means. The number of tuned circuits correspond to the number of relays and functions to be controlled which, in the present example, are four, requiring four tuned circuits indicated at 20, 21, 22 and 23 for the relays 14, 15, 16 and 17, respectively. One side of each tuned circuit and each of the relay coils are connected to ground at one terminal, while the opposite terminals are connected through suitable rectifiers, indicated at 25, 26, 27 and 28.

The circuits 20—23, inclusive, each include an audio or modulation frequency inductance 30 provided with an adjustable shunt tuning capacitor 31, whereby the circuits are tuned to different modulation or audio frequencies which are to be utilized as the control frequencies for the system. In the present example, these control frequencies, which may be referred to as f_1 , f_2 , f_3 , f_4 , may be considered to be below 1,000 cycles and to be spaced substantially 100 cycles apart.

Signals at the desired control frequencies of the present example are supplied by vibrators 33, 34, 35 and 36 (Fig. 2) located in a portable remote control unit 37 and are conveyed to the receiving system and to the respective tuned rectifier circuits 20—23 on a carrier wave generated by an oscillator 38 in the remote control unit and demodulated at the receiver by a demodulator 39.

The demodulator comprises a circuit 40 tuned to the carrier wave and coupled to an antenna 41 for supplying the carrier wave, modulated at any one of the control frequencies, to a detector 42. The latter serves to demodulate the received signal and is provided with an output circuit 43 which is broadly responsive to all of the differing control frequencies.

In the present example, a tube detector is utilized for greater sensitivity and the output circuit 43 is an output anode circuit including two coupling coils 44 and 45 in series, to which the control frequency circuits 20—23 are coupled in pairs, one pair for each function to be controlled. In a preferred arrangement, as shown, the output circuit of the demodulator 42 is coupled through the winding 44 to the circuits 20 and 21 for the rectifiers 25 and 26 by placing the winding 44 and the windings 30 for the circuits referred to on a common core, or otherwise inductively coupling them to provide a coupling transformer having two secondary windings and a common primary winding.

The modulator output circuit is a simple untuned circuit involving a single coupling coil for each pair of control frequencies, and the transformer arrangement is greatly simplified, since the tuned circuits for each rectifier are inductively coupled or mounted on the same core with a common coupling coil.

The coil 45 is similarly coupled to the circuits 22 and 23 for the rectifiers 27 and 28. Thus, the function of volume control is responsive to signals received through the circuits 20 and 21 from the winding 44, and the function of tuning control is responsive to signals received through the circuits 22 and 23 from the winding 45.

These circuits may be coupled to the output circuit of the demodulator in any other suitable manner or additional circuits may be coupled to the demodulator output circuit 43, as shown, for example, in Fig. 3, wherein the windings 30 for

the tuned circuits 20—23 are each individually coupled to separate primary windings 50—53 respectively. This provides an arrangement whereby the circuits may be made more sensitive to the control frequencies, since each of the primary windings may be tuned to the same frequency as the secondary winding to which it is coupled, by means of a shunt capacitor 54.

Furthermore, as shown in Fig. 3, the rectifier for each pair of circuits, such as the circuits 20 and 21 and the circuits 22 and 23, may be provided with a common cathode 55 and separate anodes 56 and 57 for each of the associated circuits, to control relays 58 and 59 for the same or different functions, as in Fig. 1. For example, the relays 58 may control the power supply for the receiving system, whereby it is turned on and off from a remote point, as indicated, while the relay 59 may control the wave band change for two differing wave bands, as indicated.

Either rectifier circuit and transformer arrangement, as shown in Figs. 1 and 3, or a combination of both types, may be utilized in certain control systems, the circuit of Fig. 3 having the advantage, in addition to that hereinbefore noted, that it is slightly more sensitive, that the use of a single rectifier of the double anode type simplifies the circuit and permits a rectifier, for example, of the copper oxide type, to be used, thus obviating the necessity for connection with the receiving system for supplying cathode heating current.

The carrier frequency utilized is such that it does not interfere with radio reception and, therefore, may be of an order such that it falls outside the audio frequency, radio frequency and intermediate frequency ranges normally employed in receiving systems. For example, it may be of the order of 20 kc. However, preferably it may include ultra high frequency waves of the order of 300 mcs., or 1 meter, or even higher in frequency, in order that the carrier wave may not penetrate to any distance and may be about the same in this respect as acoustic waves, thereby permitting operation of this type of remote control system to be practical for ordinary houses, apartments and the like, where interference must be maintained at a minimum. The use of the higher frequency carrier has the further advantage that the antenna 41 may be small and may consist of a short rod and all of the receiving and transmitting circuits may include inductances which require very little space. Furthermore, the tubes used, such as the tube 42, and any transmitting tubes in the remote control unit 37 may be of the so-called "acorn" type, although the consideration of size is not of such great importance in the receiver.

Referring more particularly to Fig. 2, the oscillator 38 comprises an oscillator tube 60, which may be of the "acorn" type having an anode 61 coupled through a coil 62 with a tuned high frequency circuit 63, which is connected between ground or chassis 64 and an antenna 65. The circuit 63 is also coupled to the control grid 66 and through the ground connections 64, and a battery 67 is connected to the cathode 68. The oscillator is provided with the usual grid capacitor and grid leak 69.

Each of the vibrators 33—36 are provided with a tunable electromagnet or operating winding 70 across which is connected a shunt capacitor 71 for tuning said winding to a predetermined audio frequency, the various vibrator tuned circuits differing one from the other in

frequency. For example, the vibrators shown may be tuned for response at 500, 600, 700 and 800 cycles.

The windings are energized from the battery 67, one lead 72 being connected to the battery and to the coils 70 in parallel while the remainder of the battery circuit for each coil is completed through ground 64 and a push-button switch to the vibrator contact. In the present example, one switch is provided for each vibrator as indicated at 73, 74, 75 and 76 having contacts 77 connected with the vibrator contacts 78. The vibrator armatures are indicated at 79 and are connected with their respective coils.

The switches are also provided with an additional contact 80 through which the filament 68 is energized to cause simultaneous operation of the oscillator with a selected vibrator.

The circuit is so arranged that the anode current for the oscillator is derived from the tuned circuits of the vibrators by the connection of the oscillator filament and the low potential ends of the vibrator coils to ground through the battery 67, while the vibrator armatures are provided with contacts 82 connected in parallel with a supply circuit 83 for the oscillator anode which is connected through a high frequency choke coil 84 with the oscillator anode circuit 85. The anode circuit is provided with a suitable by-pass capacitor 82 to ground.

The contacts 82 are arranged to be engaged by the vibrator armature contacts when moved in the forward position under the impulse of the exciting current from the battery and serve to connect the coil circuit for the vibrator then in operation with the anode circuit, to apply the voltage across the circuit to the anode circuit thus eliminating the necessity for providing a separate plate supply battery in the remote control unit and permitting the said unit to be made relatively small in size.

With the new low filament voltage tubes available, the battery 67 may comprise a single dry cell of small size since the vibrator and oscillator are placed in operation only when tuning and the power requirements are low.

I claim as my invention:

1. In a radio remote control system, a control unit for said system including an oscillator tube having coupled anode and grid circuits, one of said circuits being tuned for generating said carrier wave, a plurality of electrical vibrator devices each having an inductive winding tuned to one of a plurality of modulation frequencies, said os-

cillator tube having a cathode and having the anode circuit energized from voltage developed in the inductive windings of said vibrator devices, and means for selectively energizing and operating said vibrator devices including a single battery element for energizing said cathode and vibrator devices in said control unit, whereby said unit may be of relatively small size and readily portable and said oscillator may be modulated by the energy derived from said devices.

2. In a radio remote control system, the combination of a control unit comprising a tunable oscillator, means for radiating a carrier wave from said oscillator at a predetermined high frequency, an anode circuit and a cathode circuit for said oscillator, a plurality of vibrator devices each comprising an inductive winding, means for tuning said windings to differing audio frequencies, and means for directly energizing the oscillator anode circuit selectively from each of said vibrator windings as sources of operating and modulating energy for the oscillator, thereby to modulate said carrier wave at any one of said audio frequencies.

3. In a radio remote control system, the combination as defined in claim 5, further characterized by the fact that each vibrator device is provided with a vibratory armature having a contact through which the vibrator winding is energized and a second contact associated therewith through which the anode circuit of the oscillator is energized from said winding, and said selective energizing means having contacts and connections with the cathode circuit and with each vibrator device whereby said cathode circuit and a selected vibrator device may conjointly and simultaneously be energized.

4. In a radio remote control system, the combination of a control unit comprising a tunable oscillator, means for radiating a carrier wave from said oscillator at a predetermined high frequency, an anode circuit and a cathode circuit for said oscillator, a plurality of vibrator devices each comprising an inductive winding, means for tuning said windings to differing audio frequencies, means providing a common source of low operating voltage for said vibrator devices and said cathode circuit, and means for energizing the anode circuit of said oscillator from each of said vibrator windings, whereby said windings provide the only source of operating potential for said circuit and the modulation component of the carrier wave.

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