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2,263,298

SIGNAL RECEIVER FOR REMOTE CONTROL APPARATUS

Filed July 18, 1940

2 Sheets-Sheet 1

FIG. 1.

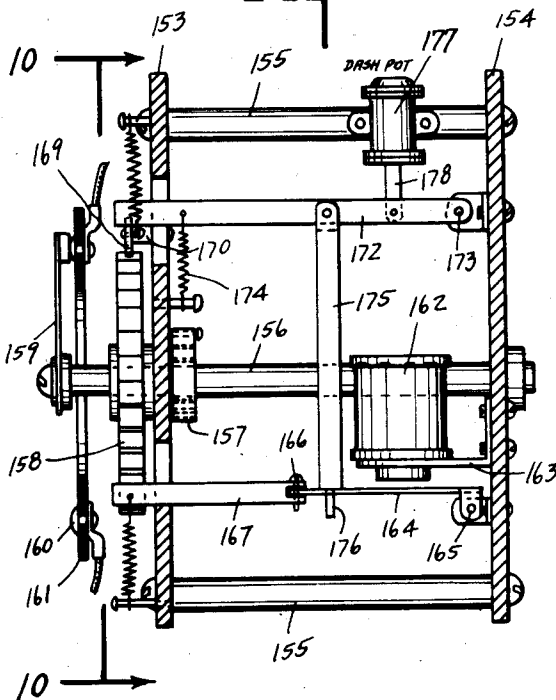
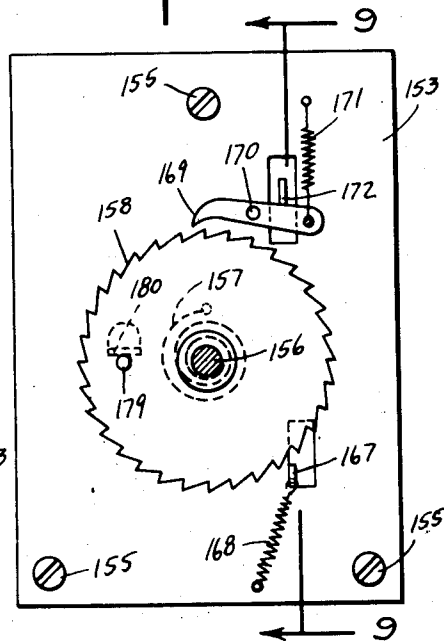


FIG. 2.



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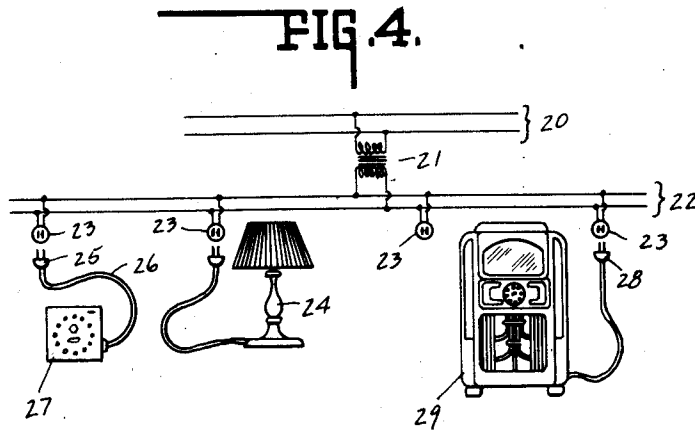
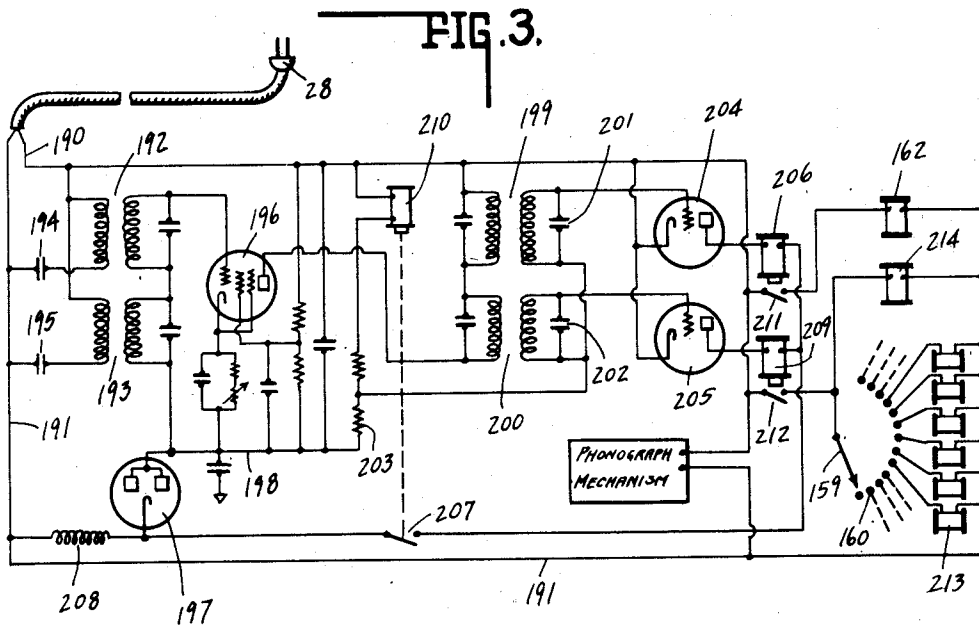
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SIGNAL RECEIVER FOR REMOTE CONTROL APPARATUS

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2 Sheets-Sheet 2



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SIGNAL RECEIVER FOR REMOTE CONTROL APPARATUS

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2 Claims. (Cl. 171-97)

This invention relates to a signal receiver for remote control apparatus which is particularly adapted to the selective control of automatic record changing phonographs.

One object of the invention is to provide a remote control in which selective operation may be accomplished by means of electrical signals transmitted over power lines supplying the operating power for the phonograph and for a remotely positioned transmission apparatus.

Another object of the invention is to provide improved apparatus for receiving such signals and for operating a phonograph in response to said signals.

The invention in its preferred form may be used with a transmitter unit of the type disclosed in co-pending application of Osborne and Wright, Serial No. 305,920, filed November 24, 1939, although other forms of transmitters operating upon the same general principle may be used. The transmitter is combined with a signal generating unit adapted to generate electrical signals of frequencies above the audible range and to apply such signals to the power mains supplying the generating unit and the phonograph in the form of high frequency modulation of the normal alternating current voltages carried by said power mains.

At the phonograph there is employed a novel form of receiving unit operating in response to the high frequency signals carried by the power mains and adapted to control the operation of the phonograph in accordance with such signals. In the present application the invention has been shown in a form best adapted to control an automatic record-changing phonograph of the type disclosed in Wilcox Patent No. 2,002,236, issued May 21, 1935. However, adaptations to the control of other types of apparatus will be apparent.

Other objects and features of the invention will be understood from the accompanying drawings and the following specification and claims:

Fig. 1 is an elevational view with parts shown in section of mechanical portions of a receiver constructed in accordance with a preferred form of the invention. Fig. 2 is a sectional view taken on the line 2-2 of Fig. 1. Fig. 3 is a diagram of electrical connections illustrating electrical elements used with the apparatus of Figs. 1 and 2, certain parts of said apparatus being shown diagrammatically therein. Fig. 4 is a diagrammatic drawing illustrating the connection of the transmitter and a phonograph to the power line. Referring first to Fig. 4, there is shown therein

a pair of power mains 20 supplying power through a transformer 21 to a pair of power lines 22. The mains 20 may be taken to represent the usual distributory lines from the sub-station of the public utility, carrying alternating current voltages greater than that allowable for household wiring. The power lines 22 are the usual conductors supplying current for operation of lights and other appliances in the building in which the phonograph is to be used and preferably carry alternating current of 110 volts, 60 cycles. A number of outlet sockets 23 are supplied from the power lines 22 and may be used for lighting fixtures 24 or other electrical appliances. In any one of said sockets there may be inserted a plug 25 connected by a cable 26 to a transmitter unit 27. In another of said sockets may be inserted a plug 28 connected to a phonograph cabinet 29 and supplying current for operation of said phonograph and for operation of the signal receiving mechanism which may be housed in the cabinet of said phonograph.

The transmitter 27 forms no part of the present invention and need not be described in detail. It is sufficient to say that it is adapted to modulate the normal voltage of the power lines 22 by impressing thereon a series of "indexing" signals consisting of equally spaced impulses of a given high frequency and "selection" signals consisting of impulses of a different frequency occurring simultaneously with or immediately after selected signals in the indexing series. Any suitable apparatus for generating such signals and impressing the same on the power lines may be employed for the purpose.

The mechanical parts of the receiving apparatus are shown particularly in Figs. 1 and 2. The frame of the receiver consists of a pair of plates 153 and 154 secured together by spacer bolts 155 and mounted in any convenient position adjacent the phonograph preferably within the cabinet of the phonograph itself.

A shaft 156 is journaled in the plates 153 and 154 and is normally urged in the clockwise direction (Fig. 2) by a torsion spring 157. Said shaft carries a ratchet 158 and a scanning finger 159. The tip of said scanning finger is adapted to engage electrical contact buttons 160 mounted on a dial 161 formed of insulating material and supported in any suitable manner on the plate 153. An electromagnet 162 is mounted on a bracket 163 secured to the plate 154 and when energized serves to lift an armature 164 pivotally mounted at 165. Said armature has secured thereto by means of a vertical pivot pin 166 an

arm 167 projecting forwardly through a suitable opening in the plate 153 and normally retained by a diagonally arranged tension spring 168 in the lower corner of said opening. Each actuation of the magnet 162 lifts the armature 164 and arm 167. The resulting engagement of said arm with the teeth of the ratchet wheel 158 moves said wheel in the counterclockwise direction of Fig. 2 a distance corresponding to one tooth.

A pawl 169 pivotally mounted on the plate 153 at 170 is urged by a tension spring 171 toward engagement with the teeth of the ratchet wheel 158. An arm 172 pivotally mounted at 173 extends through a suitable opening in plate 153 to engage the tail of the pawl 169. Said arm is urged downwardly by a tension spring 174. A rod 175 is pivotally connected at its upper end to the arm 161 and rests at its lower end on the armature 164. A reduced extension 176 of said rod passes through a suitable opening in said armature and retains the same in proper relation thereto. A dashpot 177 mounted on one of the spacer bolts 155 has its plunger 178 pivotally connected to the arm 172. Said dashpot may be of any well known form adapted to permit unrestricted upward movement of the arm 172 but to delay downward movement thereof. A retarding device of well known form operated by clockwork mechanism has been found satisfactory for the same purpose.

In the operation of the mechanical part of the receiver just described, the arm 172 normally rests on the pawl 169 and is held in that position by the spring 174. Said pawl is thus released from the teeth of the ratchet wheel 158 and the spring 157 holds said ratchet wheel in an idle position in which a stop pin 179 carried by said wheel engages a stop member 180 carried by the plate 153. The electromagnet 162 is operated in response to indexing signals from the remote stations as will be described hereinafter. The first of a series of such signals causes said magnet to move the ratchet wheel one space in the counterclockwise direction. At the same time the rod 175 lifts the arm 172 from the tail of the pawl 169 and permits the pawl to engage the teeth of the ratchet to retain the same in its new position. Succeeding indexing signals arrive at predetermined time intervals. The action of the dashpot 177 is so timed with relation to the timing of the signals that the arm 172 cannot reengage the pawl 169 in the interval between two successive signals. As long as a series of indexing signals continues, the ratchet 158 is moved one step by each signal and the pawl 169 prevents return movement. At the conclusion of a series, the spring 174 returns the arm 172 slowly to its original position, releases the pawl 169 and permits the ratchet wheel 158 to return to its original position under the influence of spring 157. During the movement of the ratchet wheel 158 the scanning member 159 rests on a different one of the contact buttons 160 at each position. Thus the scanning member 159 is moved in synchronism with the signals in the indexing series and engages a particular contact button during and immediately after each indexing signal of the series.

Electrical circuits associated with the receiver just described are shown in Fig. 3. The plug 28 shown in said figure and in Fig. 4, when inserted in one of the sockets 23, provides a direct connection between the power lines 22 of Fig. 4 and a pair of power lines 190 and 191 of Fig. 4. The last mentioned power lines therefore receive the

usual commercial alternating current modulated by the high frequency signals generated at the transmitter. Power for operating the controlled machine may be taken from the power lines 190 and 191 as shown in the drawings by connection of these lines to the rectangle marked "Phonograph mechanism."

A pair of input transformers 192 and 193 have their primary windings connected across the power lines 190 and 191 through condensers 194 and 195 respectively. The secondary windings of the transformers 192 and 193 are connected in the grid circuit of an amplifier tube 196 which may be the usual pentode tube connected in the conventional manner shown in the drawings. The circuits of the transformers 192 and 193 are tuned to transmit to the amplifier tube only high frequency energy having the frequencies of the indexing and selection signals respectively. Direct current for operation of the amplifier tube 196 is supplied by a rectifier 197 which establishes the necessary direct current potential between a conductor 198 and the power line 190 which serves as the high voltage direct current distributory as well as an alternating current power line.

The output circuit of the tube 196 is connected to the primary windings of a pair of transformers 199 and 200. The secondary windings of said transformers are provided with bridging condensers 201 and 202 properly chosen to provide tuned circuits sensitive respectively to the frequencies of the indexing and selection signals. One terminal of each of said secondary windings is connected to the low voltage direct current conductor 198 through a resistance 203. The opposite terminal of the secondary winding of transformer 199 is connected to the control grid of a gas filled triode discharge tube 204 and the secondary winding of transformer 200 is similarly connected to a similar tube 205. The anode of the tube 204 is connected through a relay coil 206, a normally open switch 207 and a radio frequency choke coil 208 to the power line 191. The anode of the tube 205 is similarly connected through a relay coil 209. The cathodes of the tubes 204 and 205 are connected to the power line 190. Thus when the switch 207 is closed, alternating voltage is established between the anodes and cathodes of said tubes. In the idle condition of the apparatus, however, the control grids of said tubes are biased to cut off by their connection through the secondary windings of the transformers 199 and 200 to the low voltage direct current line 198. Thus, in the absence of a high frequency signal, no current flows through the tubes 204 and 205. The presence of a signal voltage of the predetermined high frequency in the transformers 199 and 200 causes the potential of the control grids of said tubes to be raised sufficiently on alternate half cycles to pass current through said tubes to operate the relay coils 206 and 209.

To prevent establishing the alternating voltage across the elements of said tubes before the control grids can be biased to cutoff, a direct current relay coil 210 is connected between the power line 190 and the low voltage direct current line 198 and serves when energized to close the switch 207. Thus, when current is first established, the direct current voltage must be built up sufficiently to operate the relay coil 210 and to bias the grids of tubes 204 and 205 before switch 207 may be closed to establish the alternating potential across said tubes. The use of the relay 210

thus prevents unauthorized operation of said tubes by pulling and replacing the plug 28.

By means of the wiring just described, the high frequency modulations received on the power lines 190 and 191 are amplified by the tube 196 and are caused to operate the discharge tubes 204 and 205. The characteristics of the circuit associated with tube 204 are such that it responds only to the frequency of the indexing signal. Similarly the characteristics of the circuits associated with the tube 205 respond only to the frequency of the selection signal. Thus the relay 206 is actuated in response to each indexing signal and the relay 209 is actuated in response to each selection signal.

The relay 206 when actuated closes a switch 211 which connects the electromagnet 162 of the receiver directly across the power lines 190 and 191 and thus actuates said magnet to move the scanning member 159. The relay 209 when actuated in response to each selection signal closes a switch 212 which connects the scanning arm 159 to the power line 190. Each of the contact buttons 160 is connected to one of a series of electromagnets 213, each of which is adapted to control an operation of the machine. When operating a phonograph of the type shown in Wilcox Patent No. 2,002,236, the magnets 213 correspond to the magnets 175 of the Wilcox machine, each of which is adapted to control the selection of a predetermined record for playing. Each of said magnets has its opposite terminal connected to the power line 191 and thus the closure of switch 212 causes the actuation of one of said magnets depending upon the position of the scanning arm 159. A magnet coil 214 is connected directly between the switch 212 and the power line 191 and is thus actuated each time that one of the magnets 213 is actuated. This magnet corresponds to magnet 158 in the Wilcox patent and serves to start the operation of the machine when the first selection signal is received and to continue such operation to play as many records as have been selected. While the magnets 213 and 214 have been shown separated from the phonograph mechanism in the drawings for sake of convenience, it is to be understood that they form a part thereof.

The invention has been described in one of its preferred forms, the details of which may be varied by those skilled in the art without departing from the scope thereof as defined by the appended claims.

The invention claimed is:

1. In a receiver for a remote control system operated by modulated carrier signals received

on an alternating current power line, the sub-combination including an electron valve having a cathode, an anode and a control electrode, a rectifier receiving energy from said power line, an anode-cathode circuit receiving direct current energy from said rectifier, an electrical device to be controlled included in said circuit, connections between said rectifier, said cathode, and said control electrode normally applying a biasing voltage to said control electrode to prevent current flow in said anode-cathode circuit, apparatus responsive to said carrier signals and associated with said control electrode to change the potential thereof sufficiently to permit current flow in said anode-cathode circuit when a modulated signal is received, a relay connected to receive at least a part of the biasing voltage of said control electrode and adapted to be actuated only when said biasing voltage has been established at a predetermined amount, and a switch in said anode-cathode circuit operated by actuation of said relay, said switch being open to prevent operation of said circuit when said relay is deenergized.

2. In a receiver for a remote control system operated by modulated carrier signals received on an alternating current power line, the sub-combination including a pair of electron valves each having a cathode, an anode, a control electrode, and an anode-cathode circuit, a rectifier receiving energy from said power line, and supplying direct current energy to both of said anode-cathode circuits, an electrical device to be controlled included in each of said circuits, a grid biasing connection for each of said control electrodes, connected to said rectifier and normally applying a biasing voltage to said control electrodes to prevent current flow in said anode-cathode circuits, a pair of tuned receiving circuits each responsive to signals of a different predetermined carrier frequency and each associated with one of said control electrodes and adapted to change the potential thereof sufficiently to permit current flow in the corresponding anode-cathode circuit when a signal of the predetermined carrier frequency is received, a relay associated with said grid biasing connections and receiving at least a part of the biasing voltage and adapted to be actuated only when said biasing voltage has been established in a predetermined amount, and switching means controlling both of said anode-cathode circuits and operated by said relay to prevent current flow in said circuits unless said relay is energized.

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