

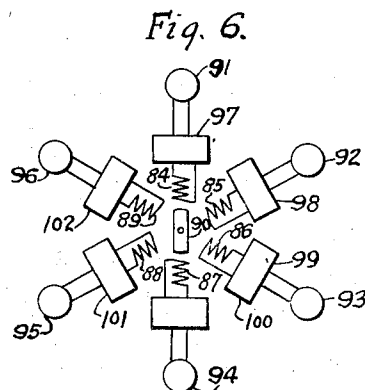
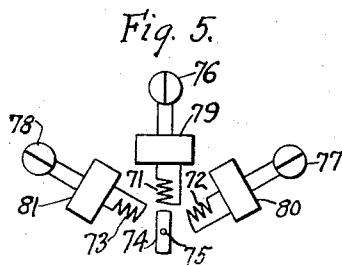
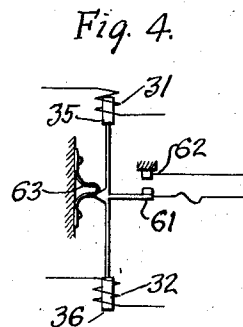
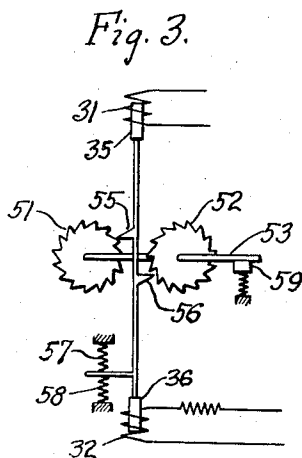
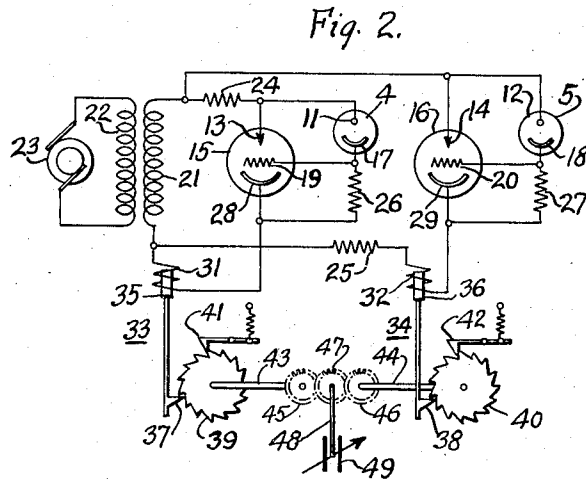
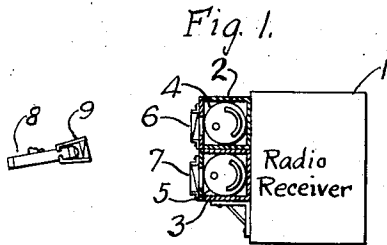
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2,140,368

RADIO RECEIVER

Filed May 19, 1936



WITNESSES:

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RADIO RECEIVER

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Application May 19, 1936, Serial No. 80,502

5 Claims. (Cl. 250—41.5)

My invention relates to radio devices and has particular relation to photo-sensitive relays for operating such devices.

It is an object of my invention to provide means to control a radio device by a relay capable of being operated only by an individual equipped with certain data relative to its operation.

Another and more specific object of my invention is to provide a photo-sensitive relay operated by a combination of light impulses which will afford great convenience in switching and adjusting radio devices such as radio, television receivers, movie, talking picture and phonograph apparatus.

More concisely stated, it is an object of my invention to provide a photo-sensitive relay that shall respond to a predetermined sequence of radiation impulses and only to this combination of radiation impulses to carry out any desired regulation or adjustment of radio or television apparatus.

A more general object of my invention resides in the provision of a very simple system for accomplishing the rotative movement of a shaft from a remote point through the use of light or other radiant energy as the remote controlling agency.

A still more general object is to provide means whereby the rotation of the plane of polarization of a beam of radiation may cause cyclic and successive variations in magnitude of current flow in one or more of associated electric circuits or windings.

Additional objects of my invention will become evident from the following description of the same taken in conjunction with the accompanying drawing, wherein the figures illustrate schematically the preferred embodiment of my invention for accomplishing the above desired results.

It has frequently become desirable to provide some means for controlling the operation of a radio receiver from some remote point in a room such as a comfortable chair located beyond convenient reach of the receiving set; as it has been found to be very inconvenient to give up the comforts of an easy chair to make frequent adjustments to a receiving set.

Various expedients and schemes have been tried whereby to perform some of the operations involved in controlling the operation of the receiving set, which operations involving switching on and off the receiver, adjusting the volume control, varying the tuning of the set, etc.

All of the above schemes with which I am familiar involve some sort of a material linkage between the receiving set and the listener and usually take

the form of a push button control with flexible cord connections or the like.

In accordance with my invention, I eliminate all mechanical linkage between the receiving set and the listener and accomplish this by providing at the receiver, a system responsive to light in such a manner as to produce either forward or reverse movement of a shaft, the particular direction of rotation of the shaft being determined at the will of the listener. It is not necessary to provide the party, who is to control the apparatus, with any push button devices connected through flexible cords to the apparatus at the receiver. A single source of light, such as the standard well known flashlight, being the only accessory with which the party at the remote point need be provided.

The shaft at the receiver which is to be remotely controlled may either constitute a shaft upon which the gang condensers are mounted for tuning purposes or it may be a shaft involved in some volume control device or may constitute the shaft of a switch for turning the receiver on or off.

My invention can be applied with facility in a number of situations. However, in the following discussion, it is specifically illustrated as applied to the control of the operation of a receiving set.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments, when read in connection with the accompanying drawing, in which:

Figure 1 is a view, in side elevation, illustrating a preferred embodiment of my invention,

Fig. 2 is a schematic view showing the electrical circuit for a preferred embodiment of my invention,

Fig. 3 is a schematic view illustrating a modified form of mechanism adapted to be substituted for that part of the arrangement of Fig. 2 which translates electric energy into mechanical motion,

Fig. 4 is a similar view of still another modified form of the mechanism of Fig. 3, and

Figs. 5 and 6 are schematic views of circuit and motive arrangements for carrying out my invention.

In apparatus of this type the radio receiver is equipped with a plurality of containers 2 and 3 wherein the photo-cells 4 and 5 are disposed. The containers 2 and 3 are provided with light-polarizing windows 6 and 7, such as Nicol prisms. The

windows 6 and 7 are so disposed that they are capable of transmitting light polarized in different planes. Thus, one window 6 transmits light polarized at 90° to the light transmitted by the other window 7.

To excite the cells 4 and 5, a flash light 8 is provided that is equipped with a light-polarizing window 9. By properly orienting the flash-light 8, it is possible to excite one cell without exciting the other. As will appear hereinafter, the system is entirely inoperative if the cells 4 and 5 are both excited, that is, if a flash-light not equipped with a polarizing window is utilized.

In Fig. 2, the system whereby the radio receiver tuning condenser is operated is schematically illustrated. The view shows a circuit to be operated by photoelectric cells of the type illustrated in Fig. 1.

The anodes 11 and 12 of the photo-sensitive cells 4 and 5 are connected to the anodes 13 and 14 of a plurality of grid-controlled glow tubes 15 and 16, while the cathodes 17 and 18 of the cells are connected to the control electrodes 19 and 20 of the tubes. Power is supplied to the tubes 15 and 16 from the secondary 21 of a transformer, the primary 22 of which is connected to a generator 23 of suitable structure.

Suitable current-limiting impedances 24 and 25 are connected in the anode-cathode circuit of each tube, while high impedances 26 and 27 are connected between the grids 19 and 20 and the cathodes 28 and 29 of the tubes.

When a difference of potential exists between the anode and the cathode of any one of the tubes, a discharge may be produced therethrough by subjecting the cell associated therewith to light radiation. The tubes are operated from an alternating power supply and, consequently, they become deenergized when the light exciting the cell is removed. However, it is to be noted that, for effective operation, the frequency of excitation of the cell must be small, as compared with the frequency of the power supply.

The current through the tubes 15 and 16 is capable of passing through the exciting coils 31 and 32 of a plurality of relays 33 and 34, of a type that will now be described.

The cores 35 and 36 of the relays 33 and 34 have rods mounted thereon which are equipped, at their lower ends, with pawls 37 and 38 adapted to engage and rotate the ratchets 39 and 40, when the cores 35 and 36 are moved under electromagnetic force of the excited relay coils associated with them. When the coils 31 and 32 of the relays are deenergized, the cores 35 and 36 fall under the action of gravity, and the pawls 37 and 38 are disengaged from the teeth of the ratchets 39 and 40.

The ratchets 39 and 40 however do not return to their original position but are held in their latest angular position by resiliently pivoted levers 41 and 42, equipped with dogs that engage the teeth thereof. As each of the relay coils 31 and 32 is intermittently excited, the corresponding cores 35 and 36 are reciprocated, and the ratchets related thereto are rotated.

The ratchets are centrally supported on shafts 43 and 44 and are rotated therewith. The shafts 43 and 44 have movable gear wheels 45 and 46 mounted near their remaining ends, that are adapted to mesh with a gear 47 which turns the shaft 43. This shaft may move the rotor of a tuning condenser 48 or the radio receiver; or may operate a switch to open and close the filament circuits of the radio tubes; or may vary a volume

control element; or perform other adjustments ordinarily carried out by manual or other voluntary movement of parts of a radio, television, talking movie, or phonograph set.

The mode of operation of the system is as follows. When one of the photo-cells, for example, 4, is excited by turning the light source 8 so that the plane of polarization of its light is the same as that to which cell 4 is transparent, the ratchet is rotated. The core is not moved, of course, because no light passes the Nicol prism 7 to energize cell 5. By turning the light beam of 8 away for an instant, tube 4 is deenergized and core drops again, but ratchet does not turn back because it is caught by the pawl. Turning light beam of source 8 onto cell 4 will then excite it again and rotate ratchet still further, and this may be kept up until the ratchet has turned shaft counter-clockwise as far as is desired.

When it is desired to turn shaft in the opposite direction, i. e., clockwise, the light beam of 8, is turned to the plane for which prism 7 is transparent and prism 6 opaque, and a similar program of repeated flashing of cell 5 followed to that which has just been described for cell 4.

An alternative form of my invention is shown in Fig. 3 in which a pair of oppositely directed ratchets 51 and 52 are adapted to rotate the shaft 53 in opposite directions. When photo-cell 4 is energized by the light beam from source 8, the ratchet 51 rotates the shaft clockwise; because tube then energizes winding 31 which is to be connected in series with it, as in Fig. 2. Winding 32 is connected to tube 5, just as is winding 32 in Fig. 2, and when cell 5 is energized by the beam from source 8, winding 32 operates ratchet 51 and pawl 55 to turn shaft counter-clockwise. Springs 57 and 58 hold the cores 35 and 36 in neutral position when tube 4 and tube 5 are both deenergized. The condenser rotor may then be mounted directly on shaft and tuned either up or down at the will of the prism using light source 8. A friction brake 59 may be provided to prevent rotation of shaft 53 except when pawls 55 and 56 are exerting force on ratchets 51 and 52.

While I have shown the apparatus as controlling the rotation of a single shaft, it is apparent that more than one shaft may be connected to the plunger through a suitable pawl and ratchet mechanism and thus may be susceptible to the control of a listener from a remote point through the expedient of a mere beam of light.

In lieu of employing a two-way pawl and ratchet mechanism for the purpose of translating the movement of the plunger into either the forward or reverse rotational movement of a shaft, it is within the contemplated scope of my invention to provide a single acting pawl and ratchet mechanism at each end of the plunger 35, the operation of the one pawl and ratchet mechanism being utilized for the forward rotational movement of the shaft whereas the other pawl and ratchet mechanism may be so connected as to produce the reverse rotational movement of the shaft. Friction brakes, like 59, would prevent movement of the shaft except when the pawls were exerting force on either one ratchet or the other.

It will be apparent from the above description of my invention that I have provided a very simple means for obtaining control of a receiving set from a remote point and that the means disclosed for accomplishing this involves no mechanical interlinkage between the receiving set

to be controlled and the remote point from which the control is exercised.

While I have disclosed my invention as applied to the remote control of a receiving set, it is apparent that its utility is not limited thereto, since the immediate function of my invention is to control the rotational movement of a shaft and the rotational movement of a shaft may comprise an essential element in a multitude of types of apparatus.

For switching current on and off in the filament circuit of the radio tubes, or in other circuits, the ratchets of Fig. 3 may be dispensed with if desired, and the cores 35 and 36 of Fig. 3 be connected to operate switch contacts 61 and 62 as shown in Fig. 4. A spring 63 or other known snap-action device may be used to insure that contacts 61 and 62 open and close with a snap action.

A modification of my invention which permits of the control of the rotation of a shaft and its direction of rotation without sacrificing the advantages inherent in the use of a light beam as the connecting link between the controlled apparatus and the remote point from which the control is exercised is shown in Fig. 5. Therein, a dynamo-electric structure of well known type embodying a stator having a plurality of windings 71, 72, 73 to be sequentially energized so as to produce rotative movement of a rotor or other element 74 which is influenced thereby. The windings 71, 72, 73 may be arranged in line and influence an attracted or repelled motor element 74 to move in a straight line, if desired; for example, as in rectilinear electric motors used in riveting tools. The shaft, when movement and direction of rotation are to be controlled from a remote point, may either constitute the shaft 75 of this dynamo-electric mechanism or it may be one coupled thereto in any suitable manner. The stator windings 71, 72, 73 are supplied from the output circuit of a photo-cell network, which circuit may comprise a photo-cell, or other photo-sensitive electric elements 76, 77, 78 and suitable amplifier or amplifiers 79, 80, 81. Each of the photo-sensitive elements 76, 77, 78 is made responsive to polarized light in a certain definite plane, the plane of sensitivity for each photo-sensitive element being different from that of the others as indicated by the diametral lines on elements 76, 77, 78 in the drawing. This can be accomplished quite conveniently by positioning each photo-sensitive element behind a Nicol prism or any other device having the characteristic of passing light which is polarized in a certain plane. The windings 71, 72, 73 are preferably positioned with the same sequence in space as the photo-sensitive elements have in space; but reverse motion may be produced if the space sequence of the windings is inverse to that of the photo-sensitive elements.

A source of plane polarized light in the hand of an operator at a remote point may then be directed upon these photocells. The light will predominantly affect only one photocell at a time, the photocell so activated being the one capable of receiving light polarized in the plane of the light directed upon the photocells. This plane of polarization of the beam of light may be conveniently changed, merely through the simple expedient of rotating the source of light and its associated polarizer. This source of polarized light may constitute an ordinary flashlight and a Nicol prism or other well known polarizing means which may be positioned in front of the

flashlight to plane polarize the beam emanating therefrom.

The operator at the remote point therefore has within his control a plane polarized beam of light which he can rotate at will. By suitable rotation of the plane of polarization of the light beam, the operator can from a remote point activate the photocells in any desired order and thus produce impulses of current in the windings associated with the photocells. The creation of these impulses in these windings of the motor will be so controlled, as to sequence, as to produce a movement of the element of the machine in accordance with rotation of the plane polarized beam of light. If the plane of polarization of the light beam be rotated clockwise, then the photocells will be so activated as to the planes of polarization through which the beam passes, as to cause rotation of the motor in, say, a clockwise direction. Once the apparatus has been set up to produce rotation in a certain direction upon clockwise rotation of the plane polarized light beam, it will inherently follow that a counter-clockwise rotation of the plane polarized light beam will produce rotation of the motor in a reverse direction. For best operation, all of the photocells should be grouped so as to be simultaneously covered by the light beam.

Another modification of my invention is disclosed in Fig. 6 of my drawing, and embodies some of the features of the modification disclosed in Fig. 5 in that a stator having a plurality of windings 84, 85, 86, 87, 88, 89 is employed and impulses are created in these windings in the proper sequence so as to produce motion of the attracted element 90 in the proper direction. The particular manner of creating these impulses differs, however, in that polarized light is not relied upon for that purpose. Instead, I utilize an unpolarized beam of light such as one obtained from an ordinary flashlight, and direct it sequentially upon a plurality of photocells or other photosensitive devices 91, 92, 93, 94, 95, 96, each photosensitive device being connected to one of the aforementioned windings, either directly or through an amplifier or amplifiers 97, 98, 99, 100, 101, 102. The photocells should preferably be located behind slits in an opaque screen and should be so disposed that the light beam can strike only one photocell at a time. The operator may then activate the photocells in the proper sequence to obtain rotational movement of the rotor of the dynamo-electric machine. Thus, by moving the beam in a clockwise direction over each of the photocells in order, the attracted element 90 will be caused to move in one direction. Reverse movement of the element may be obtained by causing the light beam to travel over the photocells sequentially in a counter-clockwise direction.

While I have described light as the particular form of radiant energy which energizes the successive electrical circuits, I contemplate that any form of radiant energy, for instance, radio waves or supersonic sound waves, may be employed with suitable response elements instead of photo-electric cells described for light herein; said response elements being polarized with those arrangements described as employing polarized light, and unpolarized with those described as using unpolarized light. I also contemplate that other means than the hand may be used to rotate the plane of polarization of the radiant beam; for example, a stationary polarized light source may be combined with a magnetic field which may be varied

in intensity to rotate the plane of polarization by a correspondingly and synchronously varying amount. If the magnetic field variation is periodic, each of the various photoelectric cells such as 4, 5, will be energized at the corresponding periodicity, and currents of similar periodicity be produced in electric circuits, such as of tubes coupled to their output currents. Since the response of both the beam polarization and the output of photocells and amplifiers is substantially instantaneous to any fluctuation of the magnetic field, such an arrangement is adapted to amplify with fidelity high frequency currents used to generate said magnetic field. It may be desirable where amplification of currents is the desired function to employ only a single photocell and associated winding; but by employing a plurality of photocells and windings as described polyphase currents, adapted to set up polyphase and rotating magnetic and electric fields are obtained.

In Fig. 2, my invention is shown as applied in a circuit wherein grid-glow tubes are utilized. The specific type of tube illustrated should not be regarded as a limitation of my invention. My invention operates equally well with thermionic amplifiers, mercury vapor tubes, hot-cathode grid-glow tubes, photo-glow tubes and other electric-discharge tubes of a similar nature.

Similarly, my invention should not be restricted to a radiation-sensitive device of a specific type. A selenium cell, a thermopile, or any device of the same general nature, is applicable.

While the preferred form of my invention employs polarizing devices or other arrangements such that each radiation-sensitive element is of a type insensitive to radiation in one position or plane of polarization of the latter, it is within the scope of my invention that less than all, or even that only one, of the radiation-sensitive devices shall be of a type thus insensitive.

This application is a continuation in part of my application, Serial No. 471,620, filed July 30, 1930, now Patent No. 2,041,079, assigned to the Westinghouse Electric & Manufacturing Company.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In a radio or television receiver, a circuit control element for an electric circuit therein, a

first winding adapted to produce mechanical movement of said control element in one direction, a second winding adapted to produce mechanical movement of said control element in another direction, a photo-electric cell adapted to control current flow in said first winding, a second photosensitive device insensitive to light polarized in one plane connected to control current flow through said second winding, and a source of plane polarized light adapted to illuminate the second-mentioned photosensitive device with polarized light whose plane coincides with that to which the second-mentioned light-sensitive device is insensitive, and means for rotating the plane of polarization of the light from said source to a plane in which the second-mentioned light-sensitive device is not insensitive.

2. In combination, a plurality of electric windings having axes displaced from each other in space, each said winding being associated with a light-sensitive device adapted to control current flow therein, and means for successively illuminating some of said light-sensitive devices with light to which they are sensitive at time intervals during which others of said light-sensitive devices are not illuminated by light of a type to which they are sensitive.

3. In combination with a plurality of electric windings having axes displaced from each other in space, each said winding being associated with a radiation-sensitive device which is insensitive to radiation having one plane of polarization, to have current flow in said winding responsive to said radiation-sensitive device, said planes of polarization being different from each other, and means for intermittently irradiating some of said radiation-sensitive devices with radiation having a plane of polarization to which others of said radiation-sensitive devices are insensitive.

4. Arrangement according to claim 2 in which an element is provided which is adapted to be influenced and/or moved by the electromagnetic fields set up by the current in said windings.

5. In combination with an electric winding, a radiation-sensitive electric circuit-element controlling current flow therein, said circuit-element being less sensitive to radiation having one plane of polarization than to radiation polarized in other planes, a source of polarized radiation and means to rotate the plane of polarization of said radiation relative to said one plane periodically.

FREDERICK W. LYLE.