June 27, 1933. L. J. GORMAN 1,915,854

THERMAL RELAY

Filed Oct. 10, 1928 2 Sheets-Sheet 1

Fig. 1.

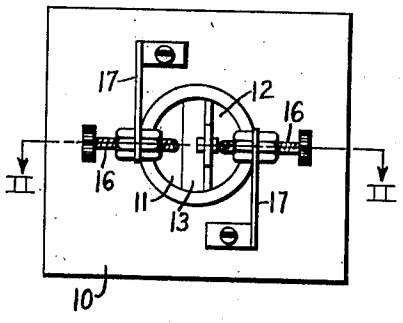


Fig. 3.

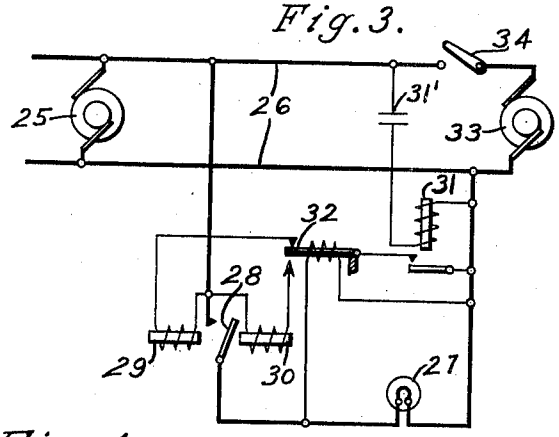


Fig. 4.

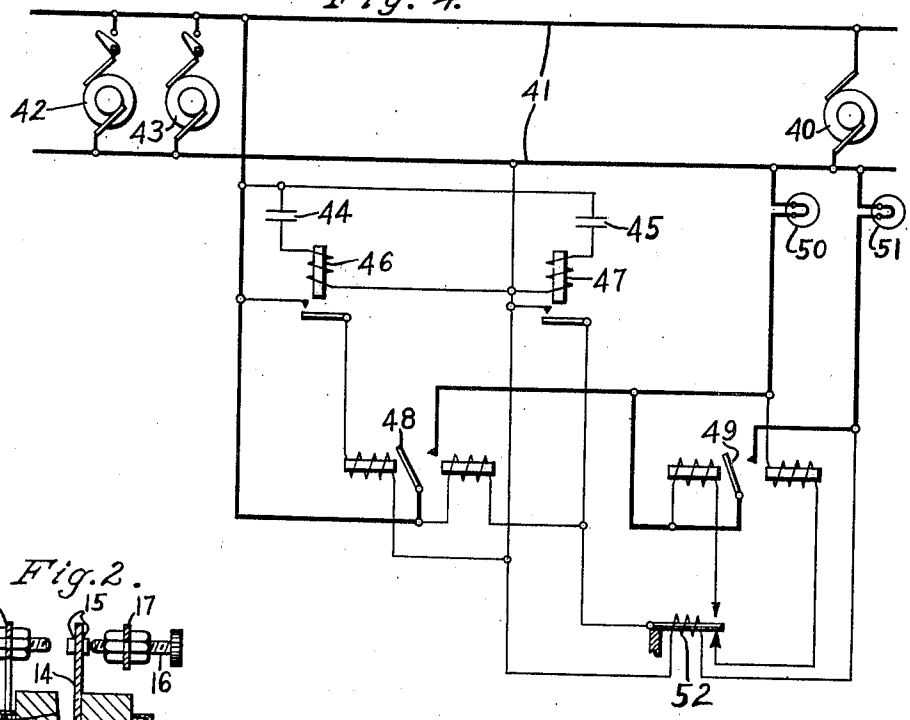
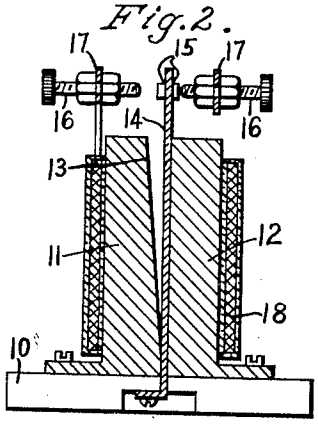


Fig. 2.



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Fig. 5.

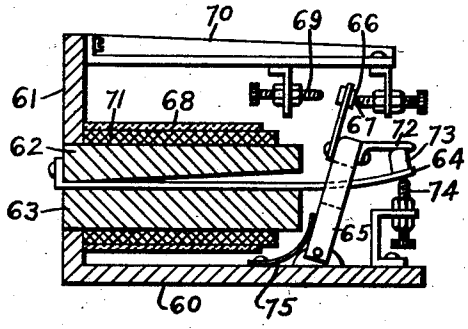


Fig. 6.

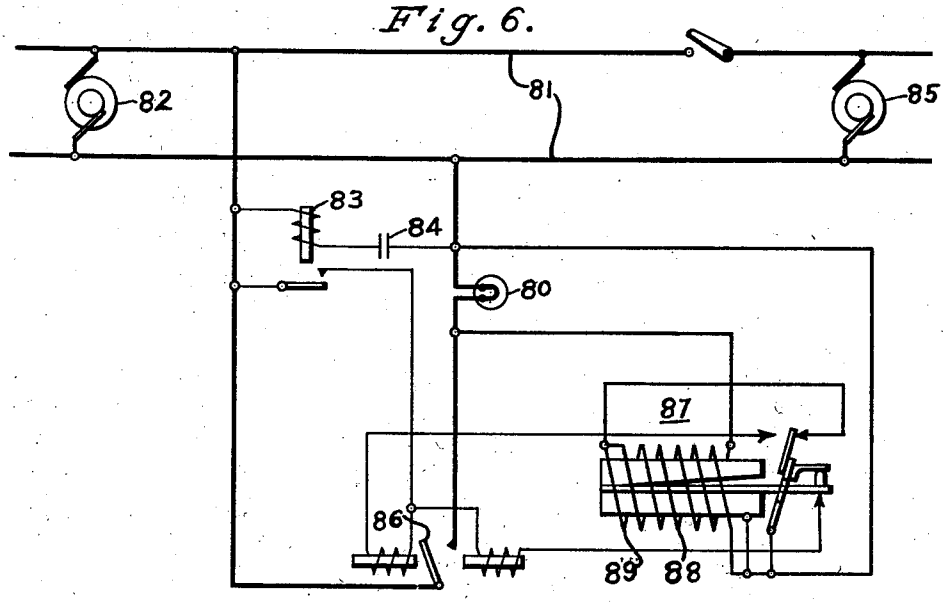
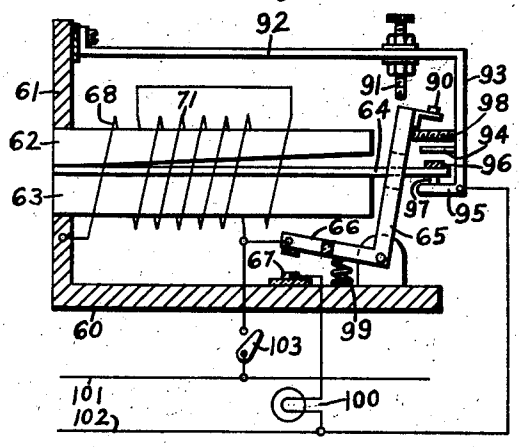


Fig. 7.



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UNITED STATES PATENT OFFICE

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THERMAL RELAY

Application filed October 10, 1928. Serial No. 311,540.

This invention pertains to electrical relays and, in particular, to thermally responsive relays.

It has been proposed, previously, to employ thermally responsive elements in conjunction with electrical heating devices to perform certain control operations, and numerous types of thermal relays have been suggested.

It is the principal object of my invention to provide an improved thermal relay having certain advantages which will be explained in detail hereinafter.

It is a further object of this invention to provide a circuit for the control of electrical devices from a distant point. A system of this type has been described in the Electric Journal for February, 1927, pp. 72–77, and it is an ancillary object of my invention to improve upon that system.

In the system described in the publication referred to, tuned relays are employed to control the opening and closing magnet coils of a toggle switch for connecting an electrical device, in this case, a lamp, to a supply circuit. The satisfactory operation of the system, according to the description, involves the superposition of two different control frequencies upon the supply circuit to effect the connection of the lamp to the circuit and its disconnection therefrom.

One of the advantages of the system of my invention is that it makes possible the performance of both the aforementioned functions with a single superposed high-frequency current.

According to a modification of my invention, it is possible to control independently the operation of a plurality of electrical devices using only two control frequencies.

In accordance with my invention, I employ a thermal relay of novel design and connect it in the control circuit so that it is energized when the electrical device is connected to the supply circuit. When the thermal relay is fully energized, which requires some time, it operates to change the circuit connections so that the subsequent superposition of the high-frequency control current on the supply circuit performs a different function.

The nature of my invention and the peculiar advantages resulting therefrom may be more fully understood from a study of the following description thereof, with reference to the accompanying drawings,

Figures 1 and 2 of which are, respectively, a plan view and a vertical section of the thermal relay which I propose to employ;

Figs. 3 and 4 are circuit diagrams illustrating the systems in which the relay of my invention is adapted to function;

Fig. 5 is a view, partially in side elevation and partially in section, of a modification of the thermal relay shown in Figs. 1 and 2;

Fig. 6 is a circuit diagram similar to that shown in Fig. 3, in which the modified relay of Fig. 5 is included.

Fig. 7 is a view, partially in side elevation and partially in section, of another modificaton of my invention and a diagram of the circuit therefor.

Referring to Figs. 1 and 2, the first form of the thermal relay of my invention comprises a base 10, preferably of insulating material. Secured to the base 10 are two semi-cylindrical core members 11 and 12 of metal having a high thermal conductivity. The core members 11 and 12 are slightly spaced apart and one of said members has the flat face thereof machined slightly, as shown at 13 in Fig. 2.

In the space between the core members, a thermally responsive element 14, such as a bi-metallic strip, is disposed. The element 14 is provided with contact points 15 disposed to cooperate with fixed contact screws 16 which are supported by the contact arms 17.

The contact arms 17 are made of a bi-metallic strip, similar to element 14, to compensate for changes in the temperature of the surrounding air. This keeps the relay properly adjusted in spite of the changes in temperature between summer and winter. The bi-metallic strip 14 is so disposed that, when cold, it engages one of the contact screws and, when heated, it is deformed to engage the other contact screw.

Around the core is wound a heating coil

18 the terminals of which may be brought out in any desired manner.

The peculiar construction of the relay of my invention is made necessary in order to interpose a considerable time delay between the energization of the heating coil and the operation of the element 14 to engage its front contact.

The particular application for which this relay was designed necessitated a long time delay and this was obtained by the use of the core 11—12 which serves as a heat reservoir or stabilizing means so that the heat generated in the winding 18 is not effective to influence the movement of the element 14 until the core 11—12 has been uniformly heated.

Fig. 3 illustrates a simple form of the system in which the relay shown in Figs. 1 and 2 is adapted to be used. In Fig. 3, a generator 25 supplies current to a circuit 26 for energizing a lamp 27. The connection of the lamp 27 to the circuit 26 is controlled by a toggle switch 28 having a closing coil 29 and a tripping coil 30. The energization of the closing coil and the tripping coil is controlled by an electro-magnetic relay 31, in a tuned circuit including the condenser 31′, and a thermal relay 32 which is preferably of the type shown in Fig. 1. The contact member of the switch 28 is designed to remain in either the open or the closed position until the proper magnet coil is energized to actuate it to the other position.

A control generator 33 is provided to supply to the circuit 26 an alternating current of a frequency to which the tuned circuit, including the relay 31 and its condenser 31′, is resonant.

The control generator 33 of Fig. 3, as well as like generators of Fig. 4 and Fig. 6, will preferably be connected to their respective circuits through a coupling circuit, comprising capacitance and inductance, which expedient is well-known to those skilled in the art and, therefore, the illustration thereof is omitted from the drawings, since it is not a part of this invention.

In order to connect the lamp 27 or any equivalent load device to the circuit 26, it is necessary only to close the switch 34 to connect the generator 33 to the circuit 26 momentarily. When relay 31 is energized by control current of resonant frequency, it completes a circuit from the lower conductor of the circuit 26, through the armature and front contact of relay 31, the thermal relay 32 and its back contact and the closing coil 29, to the upper conductor of the circuit 26. Upon the completion of this circuit, the closing coil 29 is energized to close the switch 28 to connect the lamp 27 directly across the circuit 26, when the switch 34 may be opened.

It will be observed that the heating coil of the relay 32 is connected in parallel with the lamp 27 so that the heating coil is energized simultaneously with the lamp.

After a time interval, depending upon the design of the relay 32, the bi-metallic strip moves away from its back contact to engage its front contact to set up a circuit to the tripping coil 30.

When it is desired to disconnect the lamp 27 from its circuit, the switch 34 is again closed to operate the relay 31. A circuit is thereby completed to energize the tripping coil 30 which opens the switch 28 and de-energizes the lamp 27 and the heating coil of the relay 32. The thermal element of the relay 32 thereupon returns to its original condition, and the circuit is prepared for a repetition of the closing and the tripping cycle.

Fig. 4 illustrates a modification of the circuit shown in Fig. 3 by which it is possible independently to control the energization of two lamps or sets of lamps by means of only two different control frequencies. This system includes a generator 40 for supplying low-frequency or direct-current energy to a circuit 41 and sources of high-frequency control currents, such as generators 42 and 43, which may be connected to the circuit 41 through any suitable control device. Tuned circuits, comprising condensers 44 and 45 and relays 46 and 47, are connected across the circuit 41. Each of the tuned circuits 44—46 and 45—47 is responsive only to the frequency generated by the source 42 or 43.

Control switches 48 and 49 are adapted to control the connection of lamps 50 and 51 to the supply circuit.

When it is desired to connect the lamps 50 and 51 to the circuit 41, the generator 42 is momentarily connected to the circuit 41 to supply thereto alternating current of the frequency to which the tuned circuit 45—47 is resonant. The relay 47 is energized by alternating current of resonant frequency and its armature engages its front contact to complete a circuit from the upper conductor of the circuit 41, through the closing coil of the switch 48 and the armature and front contact of the relay 47, to the lower conductor of the circuit 41. The switch 48 thereupon closes to connect the lamp 50 across circuit 41 and, at the same time, to complete a circuit from the upper conductor of the circuit 41, through the switch 48, the closing coil of the switch 49, the back contact and thermal element of a thermal relay 52, similar to that shown in Figs. 1 and 2 and the armature and front contact of relay 47, to the lower conductor of the circuit 41. The switch 49 closes, as a result of the establishment of this circuit, and connects the lamp 51 to the circuit 41.

At the same time, the heating coil of the relay 52, which is connected in parallel with

the lamp 51, is energized, and the thermal element of the relay becomes disengaged from its back contact and engages its front contact and this condition is maintained so long as the lamp 51 is energized.

When it is desired to disconnect the lamp 51 from the circuit 41, a second energization of the circuit 41, by control current of a frequency to which the tuned circuit 45—47 is resonant, will cause the operation of the relay 47 to establish a circuit from the upper conductor of the circuit 41, through the switch 48, the tripping coil of the switch 49, the front contact and thermal element of the relay 52 and the armature and front contact of the relay 47, to the lower conductor of the circuit 41.

The energization of the tripping coil 49 opens the switch to disconnect the lamp 51 from its supply source. At the same time, the heating coil of the relay 52 is deenergized, and the thermal element is returned to its original condition in which it engages its back contact.

When it is desired to disconnect the lamp 50 from its supply circuit, it is necessary to supply to said circuit a control current of a frequency to which the tuned circuit 44—46 is resonant, which may conveniently be supplied by the auxiliary generator 43. It is to be understood, however, that, instead of employing two separate generators as sources of control current, it is generally preferable to make use of a single generator driven by a variable-speed motor.

When the relay 46 is energized by current of resonant frequency, it closes its front contact to complete a circuit from upper conductor of the circuit 41, through the front contact of the relay 46 and the tripping coil of the switch 48, to the lower conductor of the circuit 41.

It will thus be apparent that the system shown in Fig. 4 makes it possible to selectively control the operation of two load devices or groups of load devices using only two different frequencies of control current. Such system is useful in street-lighting installations in which it is sometimes desirable to energize all the lamps of the system during the early evening and to extinguish a portion of the lamps at midnight and the remainder at dawn. This system may also be adapted to window lighting and similar applications.

An improved form of the thermal relay of my invention is illustrated in Fig. 5. This modification includes a base 60 having a vertical portion 61 to which is secured a core composed of two semi-cylindrical members 62 and 63, similar to those shown at 11 and 12 of Fig. 1 except that, in the modification of Fig. 5, these members must be of magnetic material, whereas, in Fig. 1, they may be of almost any suitable heat-conducting substance.

The thermal element 64, preferably a bimetallic strip, is secured between the members 62 and 63 to be subject to the temperature thereof.

In addition to the thermal element 64, the relay is provided with an armature 65 adapted to be attracted by core 62—63 when the latter is excited. The armature 65 is provided with an opening for the reception of the thermal element 64.

The armature 65 carries a contact member 66 normally adapted to engage a back contact 67 when the magnet coil 68 is deenergized and to engage a front contact 69 when the coil 68 is energized. The contacts 67 and 69 are supported, on insulating arms, from a bracket 70 secured to the upright portion 61 of the base 60.

The core 62—63 is provided with a heating winding 71 consisting of a coil of high-resistance-wire in addition to a magnetizing winding 68 consisting of a coil of copper wire. The heating winding is placed next to the core.

The armature 65 has a horizontal extension 72 adapted to be engaged by an insulating member 73 secured to the thermal element 64 which is normally in engagement with the back contact 74.

A spring member 75 normally maintains the armature 65 in engagement with its back contact.

The heating and magnetizing windings of the relay are controlled by the contacts thereof in a manner which will be described in connection with Fig. 6 which illustrates a control system in which the relay of Fig. 5 is employed.

The system of Fig. 6 is designed to permit the energization of a lamp 80 from a circuit 81 which is supplied by a generator 82 under the control of a relay 83 in a tuned circuit including the condenser 84 connected across a circuit 81, in response to high-frequency control currents supplied from any suitable source, such as a generator 85. The connection of the lamp 80 to the circuit 81 is controlled by the switch 86 in connection with the thermal relay 87, and the method of operation is as follows:

In order to cause the lamp 80 to be connected to the circuit 81, it is necessary to connect the generator 85 to the circuit 81 to supply control current of a frequency to which the circuit 83—84 is resonant, to energize the relay 83. This relay, when energized, closes its front contact to complete a circuit from the upper conductor of the circuit 81, through the armature and front contact of the relay 83, the closing coil of the switch 86, the back contact and thermal element of the relay 87, and the core of the relay, to the lower conductor of the circuit 81. The

switch 86 is thereupon closed to connect the lamp 80 to the circuit 81.

Simultaneously, the heating coil 88 on the relay 87 is energized, since it is connected across the lamp 80 through the back contact of the armature of the relay 87. A limited current circulates through the heating coil, but, because of its high resistance, the current is too small to magnetize the core of the relay 87 sufficiently to cause it to attract its armature. After a short time delay, however, the heat generated in the heating coil traverses the core of relay 87 and causes the thermal element of the relay to be disengaged from its back contact and actuate the armature of the relay so that the latter is also disengaged from its back contact.

The movement of the thermal element from engagement with its back contact interrupts the circuit for the closing coil of the switch 86, and the operation of the armature by the thermal element interrupts a normally closed shunt circuit around the magnetizing winding 89 of the relay 87. When the shunt is removed from the winding 89, the latter is connected in series with the heating coil 88, and the additional magneto-motive force supplied by the magnetizing winding is sufficient to so magnetize the core of the relay 87 that it attracts its armature into engagement with its front contact.

The disconnection of the lamp 80 from the circuit 81 may now be effected by the second energization of the relay 83. In the system of Fig. 6, as in that of Fig. 3, a single source of high-frequency control current is used to cause the connection to, and the disconnection from, the supply circuit.

The second energization of the relay 83 completes a circuit from the upper conductor of the circuit 81, through the armature and the front contact of the relay 83, the tripping coil of the switch 86 and the front contact and armature of the relay 87, to the lower conductor of the circuit 81. The switch 86 is thereby opened and the lamp 80 disconnected from the supply circuit. At the same time, the heating and magnetizing windings of the relay 87 are de-energized and the armature and thermal elements thereof return to their normal positions.

The principal advantage of the thermal relay shown in Fig. 5 is that a quicker action of the relay contact is obtained than in the straight thermal relay. This is important in any instances where the slow action of a thermal relay controlling a system, such as that shown in Figs. 3 and 4, would cause considerable interference with adjacent communication systems.

A further advantage of this thermal relay is the cutting in of an additional coil having a certain amount of resistance, thus reducing the current through the heating winding after the relay has functioned. This permits the relay to come to a constant temperature at a lower value than is the case with the straight thermal relay and prevents the danger of overheating.

Another modification of the relay of my invention is illustrated in Fig. 7. The modification of Fig. 7 is similar to that of Fig. 5, in general. The heating and magnetizing windings 68 and 71, however, are permanently connected in series and, instead of two separate windings, I may employ a single winding of appropriate resistance and number of turns.

The armature 65 is provided with a contact arm 66 insulated from the armature proper. The contact arm 66 is adapted to engage a contact 67 mounted on, but insulated from, the base 60. The armature 65 is also provided with a contact 90 adapted to engage an adjustable fixed contact 91 supported on a flexible arm 92. The arm 92 is secured to, but insulated from, the vertical portion of the base 60 and is provided with a vertical portion 93 having horizontal projections 94 and 95. These projections are adapted to be engaged, respectively, by an insulating member 96 and a contact point 97. An insulating stop member 98 is secured to the arm 92 to limit the movement of the armature 65 under the influence of a spring 99.

The modification of Fig. 7 is especially designed for use in connection with an electrical device, such as a traffic signal 100, which it is desired to energize and deenergize successively for an extended period of time. It is possible, by the use of a relay, such as that shown in Fig. 7, automatically to energize and de-energize the signal 100 at definite intervals which may be varied between wide limits by the design of the relay and coils. This relay possesses the advantage that the time required for heating the core differs from that required for cooling it. It is thus possible to provide a traffic signal which will be energized for a period of time that is different from that during which it is de-energized. This method of operation is not possible with thermal relays of the type known at present which can function only to flash a traffic signal lamp.

When the relay of Fig. 7 is connected to its supply circuit 101—102 by the closure of a control switch, such as 103, a circuit is completed from a conductor 101, through the heating coil 71, the magnetizing coil 68, one terminal of which is connected to the relay base, the thermo element 64, its contact 97 and projection 95, to the conductor 102.

The energization of the magnetizing coil 68 causes the armature 65 to be attracted, and the energization of the heating coil 71 causes the core 62—63 to be heated. When the armature 65 is attracted, the contacts 90 and 91 are engaged to maintain the energizing cir-

cuit for the heating and magnetizing coils whereas said circuit would otherwise be broken by the separation of contact 97 from the projection 95, as a result of the heating of the core 62—63 and the subsequent bending of the thermo element 64.

When the heating of the core has progressed to a predetermined extent, the insulating member 96 engages the projection 94 and so bends the flexible strip 92 that the contacts 90 and 91 are disengaged. This interrupts the circuit including the heating and energizing coils, and the armature 65 resumes its original position under the influence of spring 99. As the core 62—63 cools, the thermo element 64 also resumes its normal condition, and contact 97 engages a projection 95 to re-establish the circuit for the heating and magnetizing coils.

It will be obvious that the signal lamp 100, or other electrical device, being under the control of the armature 65, through the contact arm 66 and the contact member 67, is energized and de-energized as the armature is attracted and retracted.

The relay of my invention, therefore, may be employed to so control the successive energization and de-energization of a traffic signal lamp or other electrical device that it will be energized during a time interval different from that during which it is deenergized. Such method of operation is advantageous for a traffic signal lamp at the intersection of a minor-traffic thoroughfare with a main highway where it is desirable that the clear signal be displayed on the main highway for a longer period than that during which the stop signal is displayed.

The practical advantages of the control systems which I have shown and described are believed to be apparent, but it is to be noted particularly that these systems permit the remote control of any type of electrical load over almost any distance without the use of pilot wires or other expensive control circuits.

Such control systems obviously have numerous applications and, although I have illustrated only a few modifications thereof, it is obvious that further modifications may be made to meet particular conditions. For this reason, I do not intend to be limited to the systems described except as is necessitated by the scope of the appended claims and the prior art.

I claim as my invention:

1. In an electrical system of control, a lamp, a switch for connecting said lamp to a supply circuit, closing and opening magnets for said switch, a relay connected in a tuned circuit for connecting the windings of said magnets to said supply circuit, and a thermal magnetic relay for controlling the circuit of said windings having a heating coil, a magnetizing coil, a thermal element, an armature and front and back contacts therefor, said heating coil being connected in shunt with said lamp and said magnetizing coil being normally shunted by the back contact of said armature, and means, including the thermal element, for interrupting the circuit having the closing magnet winding and for actuating the armature to remove the shunt around the magnetizing coil to so energize said coil as to cause the armature to close its front contact to prepare a circuit including said opening-magnet winding under the control of said first-mentioned relay.

2. A remote-control system comprising a tuned circuit, a relay in said circuit, a lamp, a switch for connecting said lamp to a supply circuit, closing and opening magnets for said switch controlled by said relay, a thermal magnetic relay for successively connecting the winding of said magnets to said supply circuit having a heating winding, a magnetizing winding, a thermal element and associated back contact for normally preparing a circuit including said closing winding, and an armature having a back contact for shunting said magnetizing winding and a front contact for preparing a circuit including said opening magnet winding, a projection on said thermal element whereby the latter, when heated to open the normally closed circuit, including the closing magnet winding, the thermal element and its back contact, interrupts the shunt around said magnetizing winding to operate said armature to prepare a circuit through said armature and its front contact for said opening magnet winding.

3. In a control system, the combination with a load device, a switch for connecting said device to a supply circuit having opening and closing means and a tuned relay for controlling said means, of a thermal magnetic relay having a heating coil and a magnet coil, an armature with a back contact for shunting said magnet coil and a front contact for preparing a circuit for said opening means, and a thermal element having a back contact for preparing a circuit for said closing means, said heating coil being connected in shunt with said load device, and means whereby said thermal element, when heated, actuates said armature to open its back contact.

4. A system for controlling the connection of a load device to a supply circuit comprising a switch having closing and tripping means, a tuned circuit including a relay for connecting said closing and tripping means to said supply circuit and a thermal magnetic relay having heating and magnetizing windings, contacts controlled by a thermal element and an armature for normally shunting said magnetizing winding and connecting said closing means to said supply circuit, said heating winding being connected

across said load device whereby said thermal element operates, when heated, to disconnect said closing means from the supply circuit and to open the shunt around said magnetizing winding so as to actuate said armature to connect said tripping means to said supply circuit after said switch has closed.

5. In a control system for an electrical load device, a switch for connecting said device to a supply circuit, closing and tripping means for said switch and a tuned relay for connecting said means to one conductor of said supply circuit and a thermal magnetic relay for connecting the closing means to the other conductor of said supply circuit when de-energized, said relay having a heating coil connected across said load device and means, effective when said relay is fully energized, to disconnect the closing means from said supply circuit and for connecting the tripping means thereto.

6. In combination, an electrical circuit, a switch having opening and closing windings for controlling the circuit, tuned relay means responsive to a control current of predetermined frequency having contact members for controlling the energization of the opening and closing windings of the switch, and a thermal relay adapted to selectively connect the contact members of the tuned relay to the closing and opening windings dependent upon the position of the control switch, thereby to provide for alternately closing and opening the control switch in response to successive momentary closures of the contact members of tuned relay means in response to the control current of predetermined frequency.

7. A system for controlling the connection of a load device to a supply circuit comprising, in combination, a two-position switch provided with opening and closing coils for connecting the load device to the supply circuit, a tuned circuit including a control relay connected to the supply circuit responsive to control current of predetermined frequency, said control relay having contact means for closing an energizing circuit for the opening and closing coils of the two-position switch, a thermal relay normally adapted when the two-position switch is in its open position, to connect the contact means of the control relay to the closing coil and, when in its closed position, to the opening coil, thereby to provide for rendering the two-position switch responsive to successive momentary closures of the control relay.

8. A system for controlling the connection of a load device to a supply circuit comprising a connecting switch provided with opening and closing means, a tuned relay responsive to a control current of predetermined frequency transmitted over the supply circuit and operable to close an energizing circuit for the opening and closing means, a thermal relay interposed between the tuned relay and the opening and closing means and having a plurality of contact-making positions, said thermal relay being energized in response to the operation of the connecting switch and disposed when in one contact-making position corresponding to the open position of the connecting switch to render the tuned relay effective, when operated, to close the connecting switch and when actuated to the other contact-making position in response to the operation of the connecting switch to render the tuned relay effective, when operated subsequently, to open the connecting switch.

9. A system for selectively controlling the connection of a load device to a supply circuit by means of a control current of predetermined frequency transmitted over the supply circuit, comprising a connecting switch having opening and closing coils, a tuned relay responsive to a control current of predetermined frequency transmitted over the supply circuit having contact members for controlling the energization of the opening and closing coils, and a thermal relay having its heating coil connected in parallel circuit relation to the load device and adapted when deenergized to connect the closing coil in circuit with the contact members of the tuned relay and when deenergized to connect the opening coil in circuit with the said contact members of the tuned relay, thereby to render the connecting switch responsive to only a momentary energization of the tuned relay by the control current.

10. In combination, a load device, a supply circuit, a switch having opening and closing operating magnets for connecting the load device to the supply circuit, a single temperature-controlled relay adapted to normally prepare an operating circuit for one of said operating magnets and adapted when energized to prepare an energizing circuit for the other operating magnet of the connecting switch, and tuned relay means responsive to control currents of predetermined frequency for closing either of the prepared circuits for the operating magnets, said temperature controlled relay being controlled by the connecting switch, whereby successive operations of the tuned relay means effects closing and opening operations of the connecting switch.

11. A system for controlling the connection of a load device to a supply circuit, a switch provided with opening and closing coils for connecting the load device to the supply circuit, thermally-responsive means having a heating element controlled by the connecting switch, said thermally-responsive means being adapted when the connecting switch is open to prepare an energizing circuit for the

closing coil of said switch and for preparing an energizing circuit for the opening coil when the connecting switch is closed, and means responsive to current of predetermined frequency for closing the prepared circuits.

12. A system for controlling the connection of a load device to a supply circuit, a switch provided with closing and opening means for connecting the load device to the supply circuit, a thermal relay having a plurality of contact-making positions and a heating coil, the energization of said heating coil being controlled by the connecting switch whereby the thermal relay functions when the connecting switch is in the open position to prepare an energizing circuit for the closing means of the connecting switch, and to prepare an energizing circuit for the opening means when the connecting switch is closed, and a tuned relay operable in response to a control current of a predetermined frequency transmitted over the supply circuit for completing the prepared energizing circuits for the opening and closing means of the switch.

13. In combination, a supply circuit, a control switch having closing and opening coils, tuned relay means connected to the supply circuit and responsive to a control current of predetermined frequency for controlling the energization of the closing and opening coils, an electrical thermal relay adapted when in a normally deenergized condition to render the closing coil responsive to the first operation of the tuned relay means to close the control switch and adapted when energized to render the opening coil responsive to the second operation of the tuned relay means, said thermal relay being energized in response to the closure of the control switch.

In testimony whereof, I have hereunto subscribed my name this 2nd day of October 1928.

LAWRENCE J. GORMAN.