

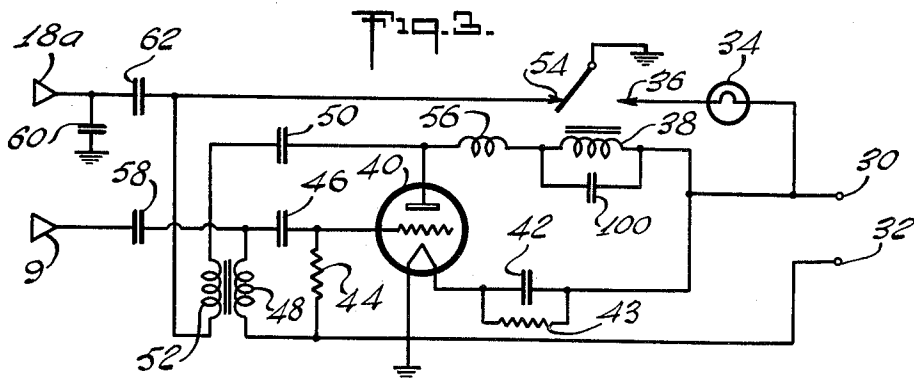
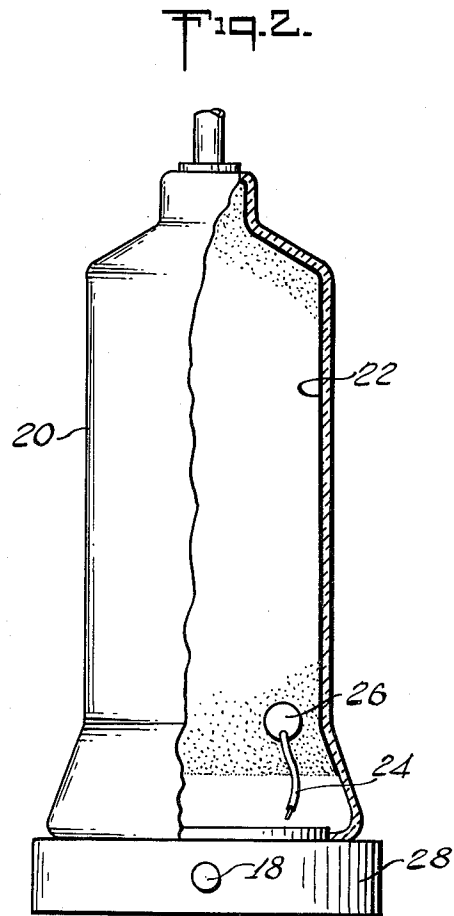
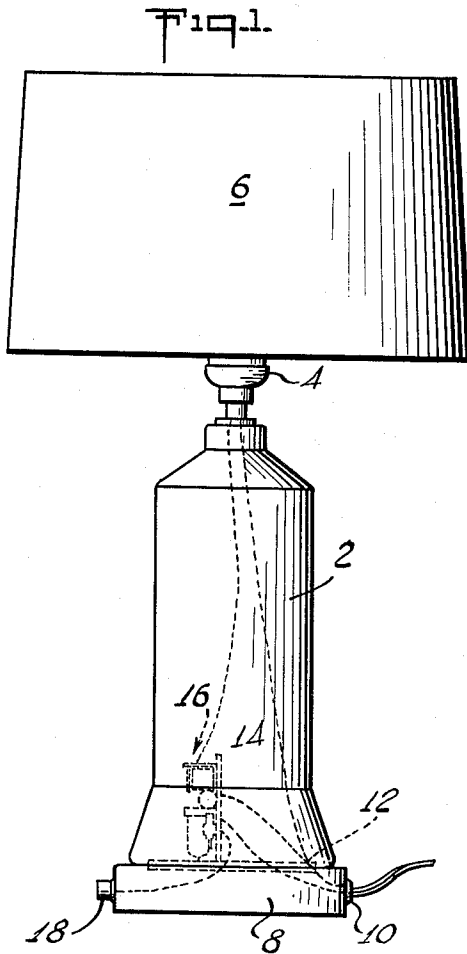
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TOUCH CONTROL CIRCUITS

3,171,066

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Fig. 4.

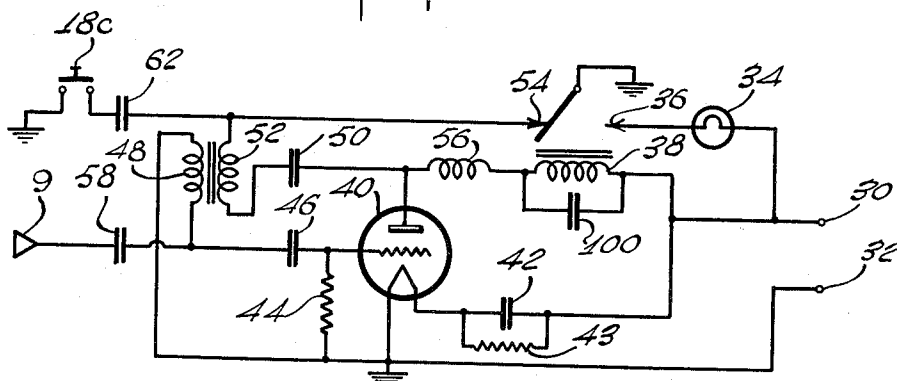


Fig. 5.

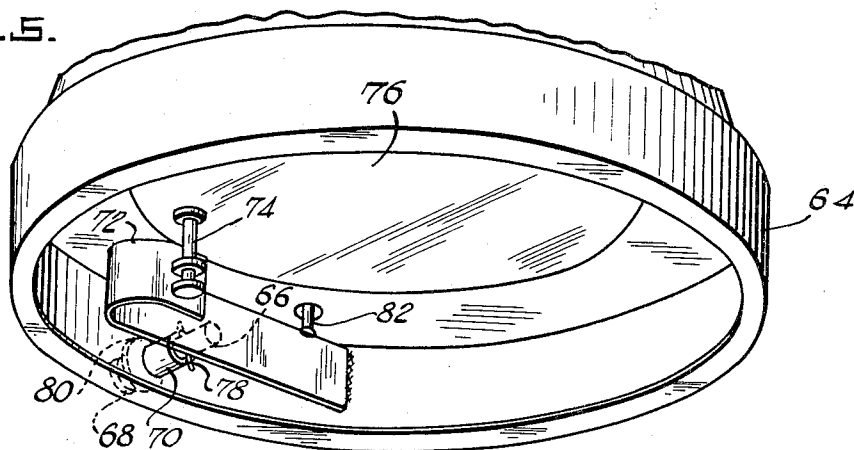
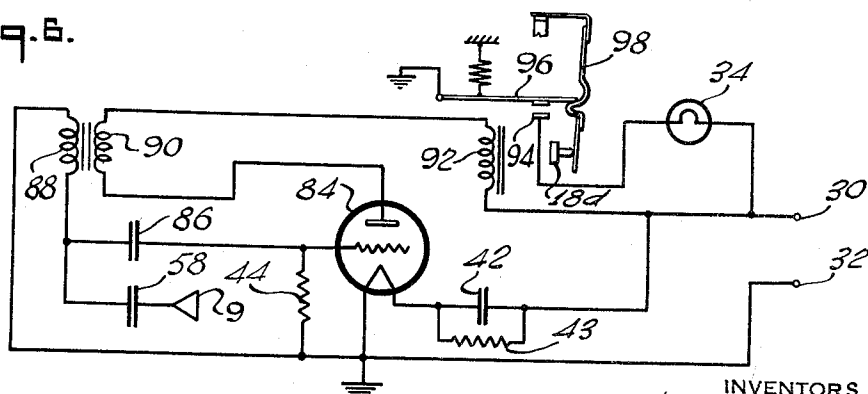


Fig. 6.



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Fig. 7.

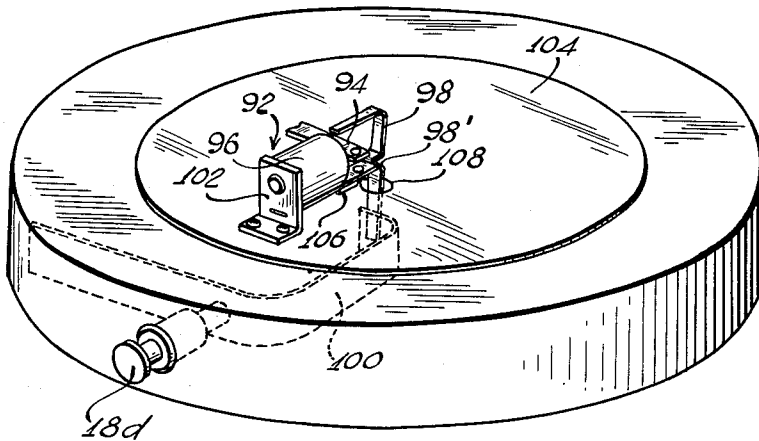
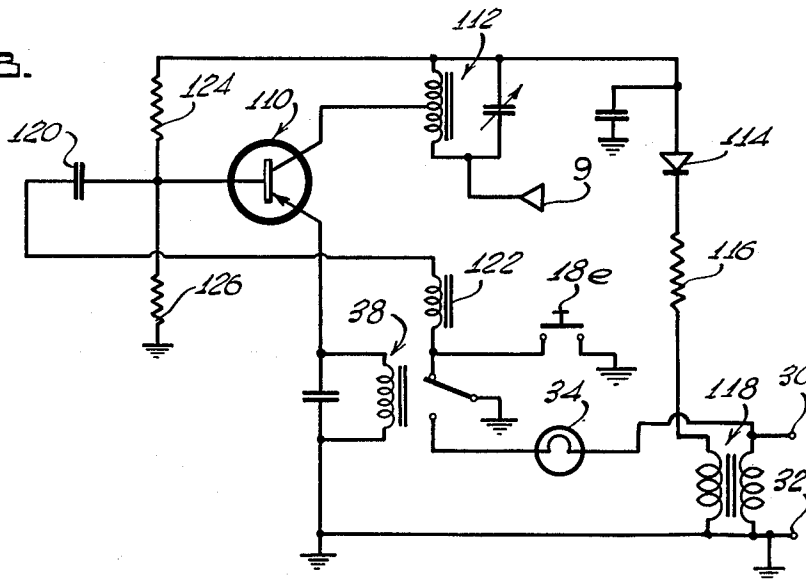


Fig. 8.



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TOUCH CONTROL CIRCUITS

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4 Claims. (Cl. 317-146)

The present invention relates to touch control systems and more particularly to electrical or electronic circuits controllable by touch of an individual. While the invention is adapted for use in control of a variety of types of circuits it is particularly useful for control of lighting circuits, as for example for control of table and floor lamps, and will therefore be described with reference to such type of control.

When a table lamp, for example, is to be lighted in a darkened room the invention provides means whereby a relatively large area of the lamp housing or support, when touched by the hand, causes the lamp to be lighted. It is desirable that once the lamp has been lighted a second touching of the large area will not extinguish the lamp. Accordingly, the control circuit of the invention insures against inadvertent opening of the lamp circuits by providing a locked condition of the circuit once the lamp has been lighted. Additional means, in the form of a small button on the lamp base, or elsewhere, to be touched or pushed is provided for opening the lamp circuit and restoring the circuit to initial conditions. A feature of the invention is the low standby current required for the circuit and consequently low heat generated in the device and longer tube life. Another feature of the invention is the means affording adequate protection against electric shock to the operator.

Briefly, the circuit of the invention comprises a radio frequency oscillator which is coupled through an isolation mechanism, such as a blocking condenser or a radio frequency transformer, to the area to be touched when oscillation is to be stopped. The oscillator, when stopped, passes sufficient current to energize a relay which over its contacts controls the lighting circuit of the lamp. When the lamp is to be extinguished the original condition of the circuit is restored either by restoring oscillation of the circuit by capacitive coupling through the operator or by momentary completion, as by a push button switch, of part of the oscillator circuit which has opened upon energization of the relay, or by manual tripping of an interlock coupled to the relay armature.

For a better understanding of the invention and of circuits embodying the same reference may be had to the accompanying drawings of which:

FIGS. 1 and 2 are side views, partly broken away, of table lamps equipped with the touch control system of the invention and illustrative of a type of fixture that may be readily controlled;

FIG. 3 is a circuit diagram of a circuit embodying the invention and representing one arrangement for touch control of both closing and opening a lamp circuit;

FIG. 4 is a diagram showing a modification of the circuit of FIG. 3 and representing push button means for opening the lamp circuit;

FIG. 5 is an enlarged perspective view of the bottom of a table lamp such as that of FIG. 2 equipped with the push button switch of the circuit of FIG. 4.

FIG. 6 is a circuit diagram representing an embodiment of the invention wherein the relay is provided with a mechanical interlock.

FIG. 7 is a perspective view of the bottom of a table lamp equipped with the circuit of FIG. 6 and illustrating a suitable location of the relay for push button release of the interlock thereof; and

FIG. 8 is a circuit diagram of a circuit embodying the invention and utilizing a transistor instead of an electronic tube in the oscillatory circuit.

In FIG. 1 a table lamp is shown as having a ceramic or other type hollow body 2, a socket 4 for the lamp bulb, and shade 6. In accordance with the invention the body 2 is provided with a conductive annulus 8 which may form the pedestal for support of the lamp body 2. The annulus 8 is provided with a suitable hole 10 in its periphery for introduction of the leads from the alternating current household supply. The annulus 8 supports an insulating disc 12 of plastic material which has mounted thereon a bracket 14. The circuit elements for control of the lighting circuit are carried on the bracket 14. The ungrounded lead-in conductor from the alternating current supply is connected to one terminal of the socket 4 and the other terminal of the socket 4 is connected to the control unit, indicated generally at 16, as are also both of the lead-in conductors. Also mounted on the lamp in any readily accessible location is a button for use in extinguishing the light. In the particular embodiment illustrated in FIG. 1 the button is shown as insulatedly mounted on the annulus 8 and identified by the reference numeral 18. This button is connected internally of the annulus and body to the unit 16 and may be a touch control or a push button depending upon the particular circuit within the unit 16. Various suitable circuits to be incorporated in the unit 16 are shown in FIGS. 3, 4, 6 and 8.

The area to be touched for causing illumination of a lamp need not be a metal surface such as the annulus 8 of FIG. 1, as it is the introduction of high frequency energy into the person's body that loads the oscillatory circuit and stops oscillation thereof and such energy can be transmitted to the body capacitatively as well as conductively.

FIG. 2 illustrates a table lamp adapted for control by the circuit of the invention and having a hollow ceramic body 20 the inner surface of which is rendered conductive by a coating 22 of "Aquadag" or other conductive material. When a lead 24 is fastened to a silver coating 26 on the coating 22 and suitably connected at its other end to the control unit (not shown in FIG. 2) within the lamp body, capacitive coupling to a person touching any part of the surface of the lamp body 20 transmits high frequency energy to the person to load the oscillatory circuit. The button 18 for extinguishing the lamp may be located on the pedestal 28 of the lamp.

One suitable circuit for the control unit 16 is shown in FIG. 3 in which alternating supply leads from a 60 cycle 110 volt supply are shown at 30 and 32 (line 32 being the grounded lead) and the lamp bulb is represented at 34 with one terminal of its socket (not shown) connected to lead 30 and with the other terminal of the socket connected to the front contact 36 of a relay 38. The relay armature is grounded so that when the relay is energized the circuit for the lamp is closed by the armature. An electronic tube 40, shown as a triode, has its filamentary cathode energized from the alternating current lines 30 and 32 through a capacitor 42, of say one microfarad, bridged by a high resistor 43. The control grid of tube 40 is connected to the cathode and to grounded lead 32 through a high grid bias resistor 44. The control grid is also connected through a capacitor 46 and tank coil 48 to ground. The anode of tube 40 is connected through a capacitor 50 and feedback coil 52 to the back contact 54 of the relay. The anode of tube 40 is also connected through a radio frequency choke 56 and the winding of relay 38 to the supply line 30. The annulus 8 of the lamp of FIG. 1 or the body 20 of the lamp of FIG. 2, shown symbolically in FIG. 3 as an

antenna 9, is connected through a capacitor 58 to the oscillatory grid circuit of tube 40 at a point intermediate the capacitor 46 and coil 48. The element of the circuit of FIG. 3 corresponding to the button 18 of FIGS. 1 or 2, shown symbolically as an antenna 18a, is coupled to ground through a capacitor 60 and connected through a capacitor 62 to the back contact 54 of the relay.

In such type circuit, when low frequency alternating voltage is impressed across the oscillator tube, the circuit will break into high frequency oscillation of increasing amplitude as the anode potential increases during the positive half cycle of the supply lines. During such oscillation electrons from the cathode accumulate in the grid condenser at a rate too high for dissipation through the grid leak resistor. When the grid is driven sufficiently negative by the accumulated electrons oscillation is blocked. When the negative charge dissipates through the resistor, oscillation will resume, if the anode potential is positive. Thus, the circuit oscillates in short bursts of high frequency energy, the repetition rate of the bursts depending upon the time constant of the grid circuit and upon the frequency of the impressed voltage. The frequency, during oscillation, may vary from two to fifty megacycles per second, depending upon the inductance and capacity of the tank circuit as is well known in the art. In the preferred embodiment of the invention, the circuit is designed for one short burst of high frequency energy during each positive half cycle of the supply voltage, the duration of each burst being small as compared to the duration of a half cycle of the supply voltage, for example 10 or 20 microseconds for each burst as compared to over 8 milliseconds for each half cycle of the supply voltage. An example of suitable values for the grid resistor 44 and for the capacitor 46 to provide but one burst of high frequency energy each positive half cycle of the impressed voltage wave are 20 megohms and .005 microfarad, respectively. Preferably the tank circuit is designed for radio frequency energy of the order of 10 megacycles.

While the circuit is operating as above described, the average potential of the grid is so negative that the tube will not pass sufficient current to cause actuation of the relay. These conditions are maintained so long as the antenna 9 is not touched. The average current through the tube may be as low as 20 microamperes although the instantaneous peak current during bursts of high frequency energy may reach as high a value as 400 milliamperes. The low standby current insures long tube life, low generation of heat and low power consumption. During standby conditions as above described the circuit of the lamp is open at the front contact 36 of the relay and the lamp is unlighted. If now a person touches the antenna 9 the oscillatory circuit is loaded as radio frequency energy is transmitted into the person and radiated from him. The circuit, being incapable of supplying this additional energy, ceases to oscillate. The negative voltage across the grid leak resistor 44 then dissipates and the plate current rises to a value sufficient to actuate the relay to close the lamp circuit. This type of oscillator with its short bursts of high frequency oscillation is particularly useful both because the ratio of the current through the tube when the tube is not oscillating to that through the tube during oscillation is high thus insuring positive operation of the relay and because the amount of radiation from this type of oscillator is a minimum and therefore there is little, if any, interference with the operation of other electronic devices. The average idling current through the tube may be as low as 20 microamperes, as above indicated, while the non-oscillating current may be anywhere from 2 to 8 milliamperes.

When the relay is actuated it opens the ground circuit of the anode feedback circuit and thereby prevents resumption of oscillation. To extinguish the lamp the button or antenna 18a is touched to provide a capacitative coupling to ground sufficient to cause the tube to resume

oscillation. Resumption of oscillation causes release of the relay, restores the ground connection for the anode feedback circuit and opens the lamp circuit. Thus, in this embodiment of the invention resumption of oscillation is prevented by an opening of the anode feedback circuit.

The resistor 43 bridging the capacitor 42 in the filament circuit provides means for discharge of the capacitor when the circuit is disconnected from the supply lines and therefore insures against a surge of current through the filament should reconnection to the power lines be made at a time in the voltage cycle when the phase of line 30 is opposite to that which existed when the circuit was disconnected.

Instead of providing a touch control for extinguishment of the lamp and restoration of oscillation of the circuit, a separate ground connection for the anode feedback circuit could be provided under the control of a push button. This arrangement is illustrated in the diagram of FIG. 4 wherein a push button 18c is shown positioned for grounding one side of the capacitor 62 connected to the anode feedback circuit. The other elements of the circuit, being identical with those of FIG. 3, need no further description. The capacitor 62 could be omitted if desired but is preferably provided for protection of the operator.

Alternatively oscillation could be restored by providing means for momentarily shorting the relay, as by a push button, to cause closure of the anode feedback circuit over back contact 54 upon release of the relay.

In FIG. 5 one suitable form of push button for restoring oscillation of a circuit such as that of FIG. 4 is shown mounted on the pedestal 64 of a lamp. A rod 66 having a button head 68 is slidably mounted in a sleeve 70 threaded within a hole in the pedestal. The inner end of the rod engages a hook-shaped leaf spring 72 one end of which is fixed to the inner wall of the pedestal and the free end of which is normally spaced from a stud 74 extending through an insulating mounting plate 76 within the pedestal. A pin extending transversely of the rod 66 limits outward movement of the rod and the head 80 of the sleeve limits inward movement of the rod. The fixed end of spring 72 is connected to a lead 82 which extends through a hole in the plate 76 for connection to the control circuit (not shown in FIG. 5). Lead 82 could be connected above the plate 76 to the grounded power line 32, in which case stud 74 would be connected to capacitor 62, or directly to back contact 54 of the relay. Spring 72 is biased out of engagement with stud 74 but makes contact therewith when the rod is moved inwardly by light pressure upon the button head 68. The relatively simple and light switch above described is entirely suitable for use in the circuit of the invention because the switch need handle no power nor need there be any appreciable potential across its contacts.

In the embodiment of the invention shown in FIG. 6 a push button releasable interlock is provided which maintains the lamp circuit closed once the relay has picked up its armature. This arrangement permits the use of a less sensitive relay, eliminates the necessity for bridging the winding thereof with a condenser and consumes substantially less power than the circuits of FIGS. 3 and 4. As in the circuits of FIGS. 3 and 4 a self-blocking oscillatory circuit is provided comprising a triode 84 with its grid connected through a capacitor 86 and tank coil 88 to ground, its cathode energized from the power lines 30 and 32 through the condenser 42 bridged by resistor 43 and its anode connected to the feedback coil 90. The bias resistor 44 is provided for the grid of tube 84 and antenna 9 is coupled to the grid circuit through capacitor 58 as in the circuits of FIGS. 3 and 4. In this embodiment of the invention the winding of relay 92 is connected in series with the feedback coil 90 between the anode of tube 84 and line 30. The lamp circuit is connected between the front contact 94 of the relay and line

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30. The armature 96 is connected to ground and is spring biased to contact open position. Means, indicated diagrammatically as a spring latch 98, is provided for locking the armature in contact closing position once the relay has been energized to pick up its armature. Push button means, indicated diagrammatically at 18d is provided for tripping the latch for release of the armature when the lighting circuit is to be opened. Suitable physical construction of the interlock and release thereof will be described in connection with FIG. 7.

The operation of the circuit of FIG. 6 differs from the operation of the circuit of either FIG. 3 or FIG. 4 in that oscillation only ceases during the time the tank circuit is loaded by touching antenna 9. Only during such loading is the relay energized by the increased current through the tube, picking up armature 96 to close the lamp circuit. The latch 98 then holds the armature in contact closing position, oscillation resumes with minimum average current through the relay. When the light is to be extinguished the button 18d is pushed to retract the latch 98 and permit the armature to move under its spring bias to contact open position.

With this interlocking arrangement the power consumed by the circuit with its normally unactuated relay is very low. Also, as the relay need not be bridged by a condenser such as is shown at 100 in FIGS. 3 and 4, the circuit of FIG. 6 effects substantial savings as compared to the circuits of FIGS. 3 and 4.

In FIG. 7 the relay 92 is shown mounted, as by a bracket 102 on an insulating platform 104 such as the plate 12 of the lamp of FIG. 1 or the plate 76 of FIG. 5. The armature 96 extends horizontally and is spring biased against a stop 106 insulatedly mounted on the relay core. Also insulatedly mounted on the core is the spring latch 98 having a hook portion 98' which, when the armature is attracted to engage contact 94, rides under the end of the armature and holds it in contact closing position. The end of the latch 98 extends downwardly through a hole 108 in the platform 104. A looped spring member 100, similar to the member 72 of FIG. 5, is positioned to engage the end of latch 98 and push it in a direction to release the armature from the hook 98' when the button 18d is pushed. The member 100 is mounted at one end on the inner wall of the lamp pedestal and has a stretch positioned in the line of movement of the pin portion of the push button.

A transistorized version of the circuit of the invention is shown in FIG. 8. In this embodiment of the invention the oscillatory circuit includes a transistor 110 the emitter of which is connected through the relay 38 to ground and to the grounded alternating current supply line 32 and the collector of which is connected through a tank circuit 112, a rectifier 114, and a resistor 116 to one end of the secondary winding of a transformer 118. The other end of the secondary winding is connected to the grounded supply line 32 and the primary winding is connected across the power lines 30 and 32. The base of the transistor is connected through a capacitor 120 and feedback coil 122 to the back contact of the relay 38. The armature of the relay is grounded and the front contact thereof is connected through the lamp 34 to the ungrounded power line 30. The base of the transistor 110 is also connected through a resistor 124 to the anode of rectifier 114, and through a resistor 126 of larger magnitude to ground. The antenna 9 is connected to the tank circuit 112. For extinguishing the lamp a push button control, indicated at 18e, provides an auxiliary ground connection for the feedback 122. The operation of the above described circuit is as follows. Under idling conditions, that is when the circuit is oscillating and the lamp extinguished, the current in the emitter circuit is insufficient to energize the relay 38. This is because of the low base current during conditions of oscillation which reduces the current in the collector-emitter circuit to a value insufficient for energization of the relay. When, however, the collector tank

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circuit is loaded by touching the antenna 9 oscillation ceases, the current through the collector-emitter circuit increases sufficiently to energize the relay to open the ground connection of feedback coil 118 and complete the circuit of lamp 34. The lamp 34 thereupon lights and a stable non-oscillating condition is established. When the lamp is to be extinguished the push button 18e is manipulated to momentarily provide a ground connection for the feedback coil 118. Accordingly oscillation is resumed, the relay releases and closes the ground connection for the feedback circuit.

The invention has now been described in connection with various embodiments thereof. It will be apparent from the foregoing description that the circuits of the invention could be employed for other than control of the specific type of table lamp shown in FIGS. 1 and 2. The antenna 9 may be considered as any relatively broad area available for touching in a darkened room, as, for example, a wall panel for lighting overhead lamps and the button 18 can be considered as any device, which once there is light, can be readily located for touching or pushing as, for example, an insulated button set into the wall panel. The circuits of the invention, as heretofore indicated, consume relatively small standby wattage. The provision in the circuits of FIGS. 3, 4 and 6 of the reactive impedance comprising capacitor 42 permits the cathode of the electronic tube to be energized directly from the alternating current lines and to consume therefrom but a small wattage of the order of one-half watt.

A further advantage obtained by the use of the capacitor in the energizing circuit for the filamentary cathode is that the phase of the current in the filament is in quadrature with that of the voltage on the plate. Accordingly during the half cycles when the tube conducts there will be substantially no voltage drop across the filament and maximum current will be available for energization of the relay.

The provision of a self-blocking oscillator in the above described circuits, serves, as heretofore indicated, to yield large change in current through the relay and thus insure positive action thereof. Relatively few parts are required and these, as indicated qualitatively in FIG. 1, can be incorporated in a relatively small space. Other advantages of the invention will be apparent to those skilled in the art.

The following is claimed:

1. A system for controlling energization of a circuit in response to touch of an individual comprising in combination a normally oscillating circuit including an electronic valve, a source of energy, a relay having a winding connected in series with said valve across said source, said valve when the circuit is oscillating, passing insufficient current for actuation of said relay and when oscillation of the circuit is suppressed passing sufficient current for actuating said relay, a normally open circuit to be controlled, means responsive to actuation of said relay for closing said normally open circuit, means for loading said oscillatory circuit to suppress oscillation thereof, said last mentioned means comprising an element coupled to said valve and which when touched by an individual draws energy from the oscillatory circuit, means responsive to actuation of said relay for maintaining closed said controlled circuit irrespective of subsequent touching of said element and separate operator controlled means for releasing said relay, said valve being an electronic tube having an anode, a grid and a control electrode and said normally oscillatory circuit including coupled feedback anode and tank grid circuits, said element being coupled to said grid tank circuit and said relay when actuated opening said anode feedback circuit and said operator controlled means comprising means for completing the anode feedback circuit for resumption of oscillation with consequent release of the relay.

2. The system according to claim 1 wherein said last mentioned means comprises a second element coupled to

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the anode feedback circuit and capacitatively closing such circuit when touched by an individual.

3. The system according to claim 1 wherein said last mentioned means comprises a push button switch in the anode feedback circuit.

4. A system for controlling energization of a circuit in response to touch of an individual comprising in combination a normally oscillating circuit including an electronic valve, a source of energy, a relay having a winding connected in series with said valve across said source, said valve when the circuit is oscillating, passing insufficient current for actuation of said relay and when oscillation of the circuit is suppressed passing sufficient current for actuating said relay, a normally open circuit to be controlled, means responsive to actuation of said relay for closing said normally open circuit, means for loading said oscillatory circuit to suppress oscillation thereof, said last mentioned means comprising an element coupled to said valve and which when touched by an individual draws energy from the oscillatory circuit, means responsive to actuation of said relay for maintaining closed said controlled circuit irrespective of subsequent touching of said element and separate operator controlled means for releasing said

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relay, said valve being a transistor and said normally oscillating circuit including coupled collector tank and base feedback circuits, said element being coupled to said collector tank circuit and said relay when actuated opening said base feedback circuit and said operator controlled means comprising means for completing the base feedback circuit for resumption of oscillation with consequent release of the relay.

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