This invention relates to a control circuit for energizing a relay coil or the like, and which may be operated by human contact with an antenna and is a continuation-in-part of application Serial No. 284,532, filed May 31, 1963, now abandoned.

A primary purpose of the invention is a circuit of the type described utilizing a minimum of components.

Another purpose is a simplified touch control circuit which may be operated with one or more touch surfaces.

Another purpose is a control circuit of the type described utilizing a solid state rectifier, preferably a silicon controlled rectifier.

Another purpose is a simplified silicon controlled rectifier circuit for use in connecting a load to a source of power.

Another purpose is an inexpensive reliably operable touch control circuit.

Another purpose is a control circuit of the type described including means to bias the rectifier against stray operation.

Another purpose is a control circuit of the type described including means to remove relay chatter.

Another purpose is a control circuit of the type described utilizing one or two antennas which activate the circuit when they receive an electric potential.

Other purposes will appear in the ensuing specification, drawings and claims.

The invention is illustrated diagrammatically in the following drawings wherein:

FIGURE 1 is a circuit diagram of one form of control circuit.

FIGURE 2 is a further form of control circuit.

FIGURE 3 is yet a further form of control circuit.

FIGURE 4 is a modified form of control circuit, and

FIGURE 5 is another form of control circuit.

The invention may be described generally as a control circuit suitable for actuating a relay coil whose contacts perform a control function. The signal for actuating the circuit may come from an antenna. The antenna may have a surface positioned for and adapted for human contact so that the potential of the body applied to the antenna is sufficient to operate the circuit. In the alternative, there may be two adjacent antennas positioned such that human contact bridges or shorts the two antennas together to thereby connect a previously established source of voltage to operate the circuit. In still another form of operation, human contact at the touch surface may be effective through a momentary contact shorting arrangement to apply a predetermined voltage to an antenna to operate the circuit. Such a circuit would be particularly useful when the person contacting the touch surface is wearing gloves. In another form of operation, there may be any number of separate antennas positioned at different points, with the application of a potential to any one of these antennas being sufficient to operate the circuit. For example, it may be desirable to turn on an electric light from any one of a number of different locations. Each location would have an antenna and the antennas would all connect to a common point so that the application of a potential to any one of the antennas would be effective to turn on an electric light or perform some other type of control function.

In FIGURE 1, lines 10 and 12 may be connected to a suitable source of power, for example 117 volts A.C., as is conventional in home wiring. Line 12 connects to the cathode 14 of a silicon controlled rectifier 16. The anode 18 of the rectifier 16 may be connected to one side of a coil 20 forming part of a latching relay indicated generally at 22. The other side of the coil 20 is connected to line voltage by line 10. Gate 24 of the rectifier 16 may be connected by a suitable high resistance 26, for example 10 megohms or the like, to a touch surface or antenna indicated diagrammatically at 28. The touch surface may take any physical form that is satisfactory for human contact, and in some applications may be remote from the circuit components. It is preferred, although not necessary, to place a biasing resistor 30, which may be variable, between the gate 24 and the cathode 14 of rectifier 16.

The biasing resistor will be set to insure that the rectifier 16 is always biased below cut-off.

Relay 22 may have an armature 32 which moves between contacts 34 and 36. Contact 36 is connected to one side of the load and the other side of the load is connected by a wire 38 to line voltage.

In operation, latching relay 22 will have its armature 32 in contact with either contact 34 or contact 36. Relay 23, through any suitable mechanical or electrical arrangements not a part of the present invention, will hold armature 32 in either one of these two positions. The next time coil 20 is energized, the armature 32 will move to the other position and will remain in that position until the coil is again energized. The invention should not be limited to latching or holding relays as other types of relays may also be satisfactory. The invention is directed generally to a control circuit for energizing a relay coil.

The invention works perfectly satisfactorily with a single antenna. However, in some applications, particularly in damp areas of a home, a second antenna as indicated at 40, is desirable. Antenna 40 may be connected by a suitable high resistance 42, again 10 megohms as a practical value, to the anode 18 of the rectifier 16. When two antennas are used, they may be located quite close together.

FIGURE 2 shows a modified control circuit particularly suitable for operation with a long antenna or connection from the touch surface to the rectifier. The cathode 14 which in this case may be connected to the hot side of the line is connected through a biasing resistor 46, a diode 48 and a second biasing resistor 50 to the gate 24. Resistors 46 and 50 may be either fixed or variable. A portion of the negative half of the A.C. input will be applied to the gate to prevent operation of the rectifier due to a stray voltage picked up on the lead-in from touch surface 28. The size of resistors 46 and 50 will be set to compensate for the length of the lead-in.

The circuit of FIGURE 2 will also work satisfactorily with two antennas in a manner similar to FIGURE 1. A second antenna 52 may be connected through a suitable high resistance 54 to the diode 48.

In FIGURE 3, a coil 56 of a latching relay is connected on one side to cathode 58 of an SCR 60. The anode 62 of the rectifier is connected to a set of contacts 64 and 65, there being a relay armature 68 movable between these contacts. An antenna 70 is connected to gate 72 of the rectifier 60. Although not shown, a suitable high resistance may be placed between the antenna 70 and the gate 72. A suitable D.C. source is connected to the relay armature 68 and to one side of coil 56. A second relay armature 74 is positioned to be movable between contacts 76 and 78. It should be noted that relay armatures 74 and 68 are connected together for simultaneous operation.

When antenna 70 receives an electric potential, rectifier 60 will conduct and armature 74 will move from one contact to the other. As armature 74 moves, armature 68
will also move to break the circuit through rectifier 60. This has the advantage of momentarily interrupting the circuit and to permit it to recover from D.C. saturation and to cut it off.

In the circuit shown in FIGURES 4 and 5, only the coil of the relay has been illustrated. It should be understood that the contacts of the coil may be arranged to connect a load and a source in the same manner as shown in FIGURES 1 and 2, or in any other satisfactory manner.

FIGURES 4 and 5 illustrate a control circuit for operating a relay in which the relay coil is connected in a bridge circuit. An SCR 90 may have its anode 82 connected to one side of a suitable A.C. source. The cathode 84 of rectifier 80 may be connected to one terminal of a full-wave bridge rectifier connected generally as 86. Gate 88 of rectifier 80 may be connected through a suitable biasing resistor 90 to terminal 92 of bridge 86. Antennas 94 and 96 are connected through suitable resistances 98 and 100 to the gate 88 and to anode 82 of rectifier 80.

Coil 102 of the relay is connected between terminals 92 and 104 on the bridge. boyfriend and there are four diodes indicated at 106 which make up the bridge.

Whenever surfaces 94 and 96 are contacted, rectifier 80 will conduct to connect bridge 86 to the source. Current will always flow through coil 102 in the same direction. This has the advantage of preventing relay chatter. The relay will function like a D.C. relay.

FIGURE 5 is substantially the same as FIGURE 4 with a single addition. A current limiting resistance 108 and a capacitor 110 are in series across coil 102. The capacitor 110 has the advantage of further removing relay chatter.

The method by which the SCRs are cut off or placed in a non-conductive state is important. In FIGURES 1, 2, 4 and 5, the SCR is cut off because of the changed polarity applied by the A.C. source to the anode. In the circuit of FIGURE 3 the SCR is cut off by breaking the circuit through armature 68. It is desirable to provide a cut-off for the SCR as once the relay coil has been activated and the armature moved, the switch has performed its function. The SCR does not have to be placed in a conducting condition until it is desired to again operate the switch.

The use, operation and function of the invention are as follows:

Control circuits of the type described have a variety of applications. One application is in turning lights on and off in the home. The present circuits are designed for such an application, but the principles disclosed herein are readily applicable to other types of circuits in which it is desired to connect a load to a source of power by means of the body touching control surfaces or by means of a potential being applied to an antenna in some other manner. The type of load and the source of power may vary widely.

When using a single touch surface or an antenna, the application of a small amount of voltage, either A.C. or D.C. from the human body will apply a signal to the gate of the silicon controlled rectifier. The gates, in any of the circuits shown, may be biased below cut-off by means of a suitable biasing resistor, although this is not necessary. Application of a voltage from a single touch surface will permit the silicon control rectifier to conduct the coil of the relay connected thereto. Assuming that there is no current to the load, for example as illustrated in FIGURES 1 and 2, when the coil is energized, the armature will move into a position so as to connect the load to line voltage. The armature will remain in this position until the antenna again receives a small potential. The silicon controlled rectifier will again conduct and the armature will move to the other contact and the load will no longer be connected to line voltage.

The operation of a circuit utilizing two contact surfaces is somewhat the same. In order to operate such a circuit, both surfaces must be contacted by a person at the same time. The resistors normally in series with the contact surfaces are of a sufficient size, for example 10 megohms or the like, to protect the person contacting the touch surfaces from any possible shock due to line voltage. Touching of the surfaces provides a signal to the gate of the silicon controlled rectifier to open the rectifier and permit the coil to be energized. The armature of the relay will then move as described.

When using two touch control surfaces, it is not necessarily the potential of the body that is applied to the gate. Rather it is the potential from the line applied through current limiting resistors and that portion of the body touching the contact surfaces, which is effective to overcome the negative bias applied to the gate. For example, in the circuit of FIGURE 1, the gate is positive at the same period as the anode is positive and the silicon controlled rectifier will conduct. In the circuit of FIGURE 2, the anode is connected to the ground side of the line and the silicon controlled rectifier will conduct when the gate is positive and the anode is at ground potential.

In some applications, a further bias may be supplied between the anode and gate. This bias which may be termed bias to conduct, as against bias to cut off from the cathode, provides increased sensitivity.

Although a silicon controlled rectifier has been specified, other solid state rectifiers may also be satisfactory.

The invention should not be limited to operating latching type relays. As can be seen, the particular circuits shown can be utilized to energize any coil or to operate any type of relay. Both mechanical and electric or magnetic latching relays may be used.

In any of the circuits shown, the hot side of the line may be connected to either the anode or cathode of the rectifier. When the cathode is connected to the hot side, the rectifier is more gate sensitive as the gate has a higher impedance to ground.

Any number of antennas may be connected to the same SCR for operation from a variety of remote locations. At each location, the antenna may receive a potential from the human body or from momentary contact shorting arrangement.

Whereas the preferred form of the invention has been shown and described herein, it should be realized that there are many modifications, substitutions and alterations thereto within the scope of the following claims.

I claim:

1. In a control circuit, a control member having contacts for performing a control function, a silicon controlled rectifier having an anode, cathode and gate connected to a power source, a biasing resistor connected between the gate of said rectifier and said power source, said control member having a coil connected to opposite terminals of said bridge rectifier, and the terminals of said bridge rectifier not connected to said coil being connected to said silicon controlled rectifier and said power source, said control member having a coil connected to opposite terminals of said bridge rectifier, and the terminals of said bridge rectifier not connected to said coil being connected to said silicon controlled rectifier and said power source, said control member having a coil connected to opposite terminals of said bridge rectifier, and the terminals of said bridge rectifier not connected to said coil being connected to said silicon controlled rectifier and said power source, said control member having a coil connected to opposite terminals of said bridge rectifier, and the terminals of said bridge rectifier not connected to said coil being connected to said silicon controlled rectifier and said power source.

2. The circuit of claim 1 further characterized by and including a second antenna and a high resistance connection between said second antenna and said rectifier.

3. In a control circuit for connection to an A.C. source of power, a control member having contacts for performing a control function and a coil, a silicon controlled rectifier having an anode and cathode connected directly in series with said coil, one side of said rectifier being connected directly to the A.C. source and one side of said coil being directly connected to the other side of the A.C. source, an antenna arranged for human contact and a high resistance connection between said antenna and the gate of said rectifier, a biasing resistor connected between the gate and cathode of said rectifier for biasing...
said rectifier below cut-off, a second antenna arranged for human contact and a high resistance connection between said second antenna and said cathode, human contact with both antennas being effective to apply an operating potential from the A.C. source to the gate to operate the rectifier, with said rectifier reverting to a cut-off condition on the next half cycle of the A.C. source.

4. The circuit of claim 3 further characterized by a diode in series with the biasing resistor connected between the gate and cathode.

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