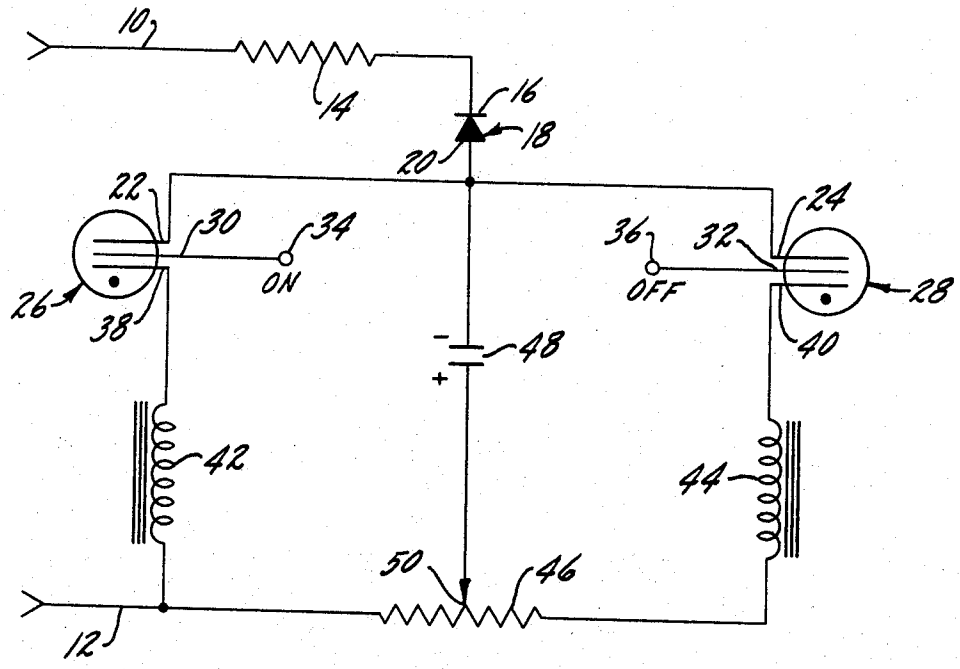
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BISTABLE MULTIVIBRATOR FOR OPERATING A PAIR OF CONTROL COILS

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BISTABLE MULTIVIBRATOR FOR OPERATING A PAIR OF CONTROL COILS

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ABSTRACT OF THE DISCLOSURE

This invention relates to a bistable multivibrator in which each side of the multivibrator includes an operating coil of a control element. The multivibrator consists of a pair of gated gas tubes with each tube being series connected with one of the coils. Each series combination is connected across a capacitor. A gating signal applied to one of the tubes will cause that tube to conduct and the capacitor to discharge through the series combination of a gas tube and coil. The operating current for the coils comes from the capacitor discharge.

This invention relates to a bistable multivibrator, with each side of the multivibrator including an operating coil of a control element.

A primary purpose of the invention is a circuit of the type described which, upon switching from one stable condition to the other, provides an initial surge of current through an operating coil, with the current through the conducting side of the circuit thereafter decreasing to a lower value.

Another purpose is a bistable multivibrator which may be switched from one stable condition to the other, by means of human contact with a touch control surface or antenna.

Another purpose is a control circuit of the type described utilizing a pair of relay coils, with each coil being arranged to hold the relay in a given position.

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

The invention is illustrated diagrammatically in the attached circuit diagram illustrating one form of a control circuit of the type described.

The invention may be described in general as a control circiut suitable for actuating a pair of relay coils whose contacts perform a control function. The signal for actuating the circuit may come from one or more antennas. Each 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, a single antenna may be replaced by two adjacent antennas positioned such that human contact bridges or shorts the two antennas together to thereby connect a previously established voltage, for example from one side of the source, 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 a person contacting the touch surface is wearing gloves. In another form of operation, each antenna may be replaced by a 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 will have an antenna and the antennas will all connect at 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 to perform some other type of control function.

In the circuit shown, there are a pair of relay coils. Each coil may be part of a latching relay or any other type of holding relay. Latching relays are desirable in some situations, but the circuit has broader application. In any event, current passing through either one of the coils is effective to switch the relay from one operative position to another. The relay may be a mechanical latching relay, a magnetically latching relay, or any other type of holding relay which will remain in a certain position once the contacts have been moved into that position.

In the drawing, a typical 117-volt AC source may connect to lines **10** and **12**. The control circuit may include a resistance **14**, which is a timing resistance, and is connected to line **10** and to the cathode **16** of a diode indicated generally at **18**. The anode **20** of the diode **18** may be connected to elements **22** and **24** of tubes **26** and **28** respectively. The tubes **26** and **28** may be gas tubes, for example glow discharge tubes, or any other satisfactory type of tube which will ionize when a certain potential is placed on its gate. An NE–77 is a satisfactory type of tube. Tubes **26** and **28** each have gates **30** and **32** respectively which are connected to antennas or touch contact surfaces **34** and **36**. In some applications it may be desirable to place a high resistance between the antenna or contact surface and the gate of the tube. Elements **38** and **40** of tubes **26** and **28** are each connected to coils **42** and **44**, which coils may be a part of a latching or holding relay. The lower half of coil **42** is connected directly to line **12**. The lower half of coil **44** is connected through a resistance **46** to line **12**. The circuit is completed by a capacitor **48** which is connected to the anode **20** of diode **18** and to the variable intermediate tap **50** of resistor **46**.

When a voltage is initially applied to the circuit, the left-hand side of the bistable circuit will conduct as tube **26** will ionize. The current path from one side of the source to the other, through the left-hand side of the circuit includes only resistance **14**, diode **18**, tube **26** and coil **42**. Whereas, the path through the opposite side of the circuit includes resistance **46**. Because the paths through opposite sides of the bistable circuit are unequal in their total impedance, the left-hand side of the circuit will always conduct when a voltage is initially applied to the circuit. Tube **26** will be ionized and any residual charge on capacitor **48** will discharge through this tube. Thereafter, tube **26** will conduct and a rather low level of current will flow through coil **42**. This low level of current is not of sufficient magnitude to cause the coil to perform any control function. The amount of current necessary for coil operation is more than that supplied from the source. During the period that tube **26** is conducting, capacitor **48** will charge up to a value determined by the combined resistance of tube **26**, the resistance in coil **42** and that portion of resistance **46** in the charging circuit. Even though AC voltage is applied to the circuit, diode **18** will permit tube **26** to remain ionized and capacitor **48** to charge.

After the capacitor has charged up to a predetermined value, which in this case may be on the order of 150 volts considering that the RMS value of the applied voltage is about 117 volts, if contact **36** receives an operating potential, tube **28** will ionize and capacitor **48** will discharge through tube **28** and coil **44**. The initial surge of the capacitor as it discharges will provide sufficient current to actuate coil **44** and to cause it to perform a control function. After the capacitor has discharged, tube **28** will remain ionized, but the current flowing through the coil will now be at a substantially lower level, this current only being caused by line voltage. While tube **28** is still ionized and conducting, capacitor **48** will again

charge, with the value being determined by the resistance of tube **28**, the resistance of coil **44** and that portion of resistance **46** in the charging circuit. Thereafter, if an operating potential is applied to contact **34** tube **26** will ionize and the capacitor will discharge through coil **42** to provide operating current. Subsequent operation of the circuit will be in the same manner in that the circuit will be switched to either the "on" or "off" condition as one tube or the other is ionized. The ionization of a particular tube is accompanied by capacitor discharge through the coil associated with that tube and the discharging capacitor provides the necessary current for operating the coil.

The intermediate tap **50** of resistor **46** places a certain amount of resistance in each side of the circuit. The voltage on this resistance is effective to maintain the nonconducting tube in a cut-off condition. Resistance **46** is variable to compensate for variation in the characteristics of either tube.

The invention should not be limited to gas tubes of the type described as many other types of gated diodes may also be satisfactory. For example, gated semiconductor diodes such as silicon controlled rectifiers may be satisfactory. In like manner, the invention should not be limited to a single relay having two operating coils, as each of the coils shown herein may be used to perform completely separate control functions.

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

What is claimed is:

1. In a bistable control circuit for connection across a source of power, a pair of coils, each of which performs a control function, a pair of gas tubes each having an anode, cathode and gate, each of said tubes being series connected with one of said coils, means for applying an operating potential to each of said gates, a capacitor, each series combination of a coil and tube being connected across said capacitor, a diode connected between one side of said capacitor and one side of the source, and a resistance connected between the other side of said capacitor and the other side of the source, the application of a potential to one gate causing its associated tube to conduct with said capacitor then discharging through said conducting tube and its associated coil to provide operating current for the coil, said conducting tube remaining in an ionized state, but with insufficient

operating current for the coils until a potential is applied to the gate of the other tube, with the capacitor then discharging through the other tube and its associated coil to provide operating current for said coil.

2. The circuit of claim **1** further characterized in that each of said coils forms a part of a holding relay.

3. The circuit of claim **1** further characterized in that the means for applying an operating potential to each of said gates includes a surface arranged for contact by the human body.

4. The circuit of claim **1** further characterized in that the means for applying an operating potential to each of said gates includes a pair of antennas, with each antenna being connected to one of said gates.

5. The circuit of claim **1** further characterized in that one of said coils is connected directly to the other side of the source, with the other of said coils being connected through said resistance to the other side of the source.

6. The circuit of claim **5** further characterized in that said resistance has a variable intermediate connection, with the other side of said capacitor being connected to said variable intermediate connection.

7. In a bistable control circuit for connecting across a source of power, a pair of coils, each of which performs a control function, a pair of gated diodes, each having an anode, cathode and gate, each of said gated diodes being series connected with one of said coils, means for applying an operating potential to each of said gates, a capacitor, each series combination of a coil and gated diode being connected across said capacitor, a diode connected between one side of said capacitor and one side of the source, and a resistance connected between the other side of said capacitor and the other side of the source, the application of a potential to either gate causing its associated gated diode to conduct with said capacitor then discharging through said conducting diode and its associated coil to provide operating current for the coil.

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