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| [33] |           | <b>93291</b>                                 |

[56]

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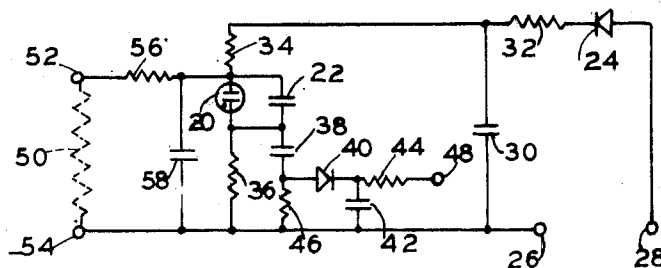
**[54] TOUCH-RESPONSIVE OSCILLATOR-CONTROLLED CIRCUIT**  
**2 Claims, 4 Drawing Figs.**

[52] U.S. Cl..... 317/146,  
307/116, 317/123

[51] Int. Cl. .... H01h 35/00

[50] **Field of Search**..... 317/123 P;  
123 PL, 146; 331/65; 307/116, 125, 118; 200/52;  
340/258

**ABSTRACT:** Electric control device actuated by manual bridging of spaced contacts acting on the capacitance of a relaxation oscillator to block oscillation, and a signal circuit providing a signal voltage only in response to oscillations. Circuit includes a time delay so that variations or interruptions in the manual application of the resistive impedance across the contacts, as by nervous persons will not affect the signal.



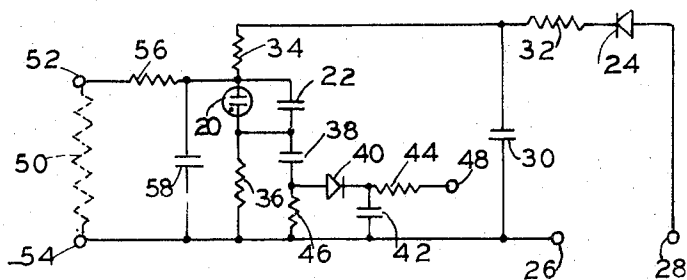


FIG. 1

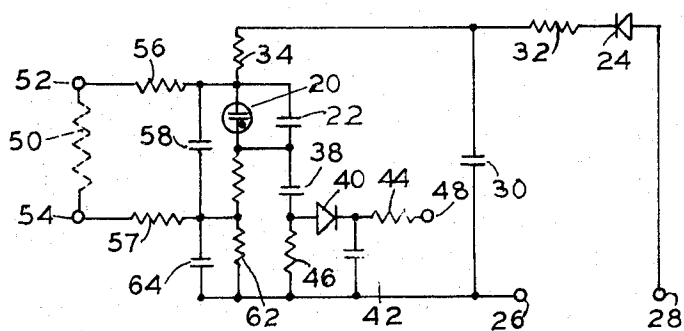


FIG. 2

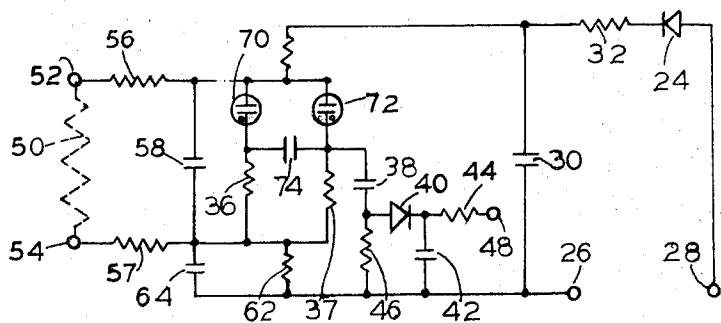


FIG. 3

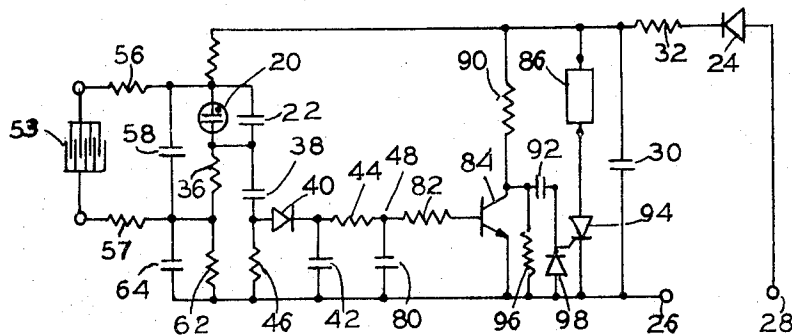


FIG. 4

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## TOUCH-RESPONSIVE OSCILLATOR-CONTROLLED CIRCUIT

The present invention is concerned with electric control devices of the type wherein a variation of impedance, manually created, is transformed by the device into an electric signal, and with applications of the electric control devices in various systems.

The invention has for an object, an electric control device with two sets of input terminals, devised in such manner that a variation of the impedance across the sets of terminals, such as may be caused by the application of the hand, results in the production of an electric signal capable of use for controlling or signalling purposes.

The two sets of input terminals in question may be constituted by interdigital conductors, all the conductors of each set being connected together, or they may be reduced to two conductors situated sufficiently close to each other so that the hand when placed thereon will not fail to shunt the two sets or the two conductors.

The invention has for a further object an electric control device which is triggered by direct application of the hand on its input terminals. It has also for an object, an electric control device which is triggered in an abrupt manner, meaning thereby that when the user places his hand on the terminals of the electric control device, the latter is surely triggered and only once, no matter how long the hand rests on the terminals. Naturally, if the user lifts his hand and places it again on said terminals, the device is triggered anew.

This means in particular that the effect of the hand is not capacitive and does not act from a distance as is often the case with a number of apparently similar and well-known electric control devices. The impedance, i.e., the impedance of the hand, has to be directly inserted across the terminals and may be considered, in the present invention, as a purely ohmic resistor, for all practical purposes.

This also implies that the invention has for its object an electric control device endowed with a certain inertia so that if the user's hand trembles somewhat or is unsteady, this is of no effect on the electric signal produced.

Lastly the invention has for an object an electric control device such as set forth above which has its output coupled with a relay having two states of equilibrium, and proceeding from anyone of its states to the opposite one upon application thereto of an electric signal produced by the electric control device, whatever be the duration of the signal.

Among the known electric control devices there are those in which radiation from neon tubes activate photosensitive devices to deliver an electric control signal, which may be used to trigger a control system. With such devices the light of the neon tube is intercepted or affected by the presence of the hand (capacitive effect) in the vicinity of the set of conductors connected to the neon tube. Unfortunately these devices are rather unstable and somewhat sensitive to parasitic disturbances; the device may be triggered several times instead of one, and untimely. Moreover, too long connections to the input terminals may result in failure of the device to operate.

The device according to the present invention is free from these drawbacks. It makes use of an oscillator, preferably a neon tube oscillator, of the relaxation type, which is wired and connected to its input terminals in such manner that it is normally in a state of oscillation and that the application of the hand to said terminals stops said oscillation; upon which an electric signal is derived from the stopping of said oscillation and triggers a suitable relay.

The above and other novel features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings, wherein like reference characters indicate like parts:

FIG. 1 shows the schematic layout of a device according to the invention;

FIG. 2 shows a modified form of the device;

FIG. 3 shows a further modified form of the device; and

FIG. 4 shows the device in a layout of a control circuit including a relay which may be controlled from a distance.

Referring first to FIG. 1, an essential element of the circuit of the device according to the invention is the neon tube 20 shunted by a condenser 22. To both is applied a direct current voltage furnished by rectification, by means of a diode 24, from the terminals 26 and 28 of an alternating current source of supply. The condenser 30 is used for smoothing out the voltage and resistor 32 protects diode 24 from overload during initial charging of capacitor 30.

When the direct current voltage is applied, condenser 22 is charged through resistors 34 and 36 in series. Consequently the voltage across capacitance 22 rises gradually. When the voltage reaches a value which is equal to the triggering threshold of tube 20, a part of its energy is dissipated in the neon gas. But the neon tube ceases to be conducting as soon as the voltage applied falls below a certain level. The condenser 22 is immediately recharged until the neon tube becomes conductive again. Thus relaxation oscillations are generated; the saw tooth voltages of said oscillations are transmitted via condenser 38 to the rectifying circuit comprising diode 40, condenser 42 and resistors 44 and 46. As long as tube 20 oscillates, a direct current voltage appears across terminals 48 and 26.

The control impedance 50 (in broken lines), which is relatively small, serves as a removable shunt across terminals 52 and 54. Terminal 54 is electrically connected with terminal 26, so that both terminals 54 and 26 are practically at the same potential. Terminal 52 is connected to the junction point of resistor 34 and capacitor 22 through a resistor 56, comparatively small with respect to resistor 34. Resistors 34 and 56 constitute a voltage dividing bridge. If resistor 32 is, for experimentation purposes, a variable one, it appears that as soon as its value falls below a certain level, the voltage difference existing between the junction point of resistors 34 and 56 on the one hand and terminal 26 becomes inferior to the triggering voltage value of the neon tube 20. Consequently the oscillator stops its oscillations and the direct current voltage between terminals 26 and 48 declines down to zero. The level mentioned is a function of the discharge voltage necessary to fire the neon tube and depends upon the relationship of the bridge resistors 34 and 56.

On the other hand, the choice of the values of the resistances of 34, 56 and 36 is made by taking into account the following considerations.

It is quite clear that a low value for resistance 56 would be beneficial to the sensitivity of the control. However the values of resistances 34 and 56 must be high enough in order that the user, when putting his hand across contacts 52 and 54 is not subjected to perceptible electrical current. When contact is made, one is entitled to consider that the resistance 50 established by manual contact is practically negligible as compared to the resistance 56 that shunts resistor 36 and neon tube 20 (the impedance of neon tube 20 is also small as compared to resistor 36). Consequently resistor 56, although rather large, has to be small in comparison with load resistor 36.

The layout of FIG. 1 provides a condenser 58 between the junction point of resistors 34 and 56 and terminal 26 for draining the residual undulations of the feeding voltage.

It is to be noticed that in the diagram of FIG. 1 the terminals 26 and 54 are directly connected together. This is a drawback since when the terminal 26 is poorly grounded in respect to earth, the user risks experiencing a disagreeable shock. This drawback may be avoided by the use of an isolating transformer between the alternating current supply and the terminals 28 and 26. This solution is however rather costly, consequently it is recommended to resort to a layout such as the one of FIG. 2 wherein resistors 62 and 57 are inserted between

terminals 26 and 54. There is thus obtained a second voltage divider, playing a similar role to resistors 34 and 56. The condenser 64 which shunts resistor 62 plays the same role as capacitance 58, in draining the voltage undulation. The other parts of the layout are the same as those in FIG. 1.

FIG. 3 is a reproduction of FIG. 2, with the exception that instead of an oscillator comprising one neon tube 26 there is used a multivibrator with two neon tubes 70 and 72 having resistors 36 and 37 and coupled by a condenser 74. The operation of this layout is similar to the foregoing.

There is no theoretical obstacle to using elements such as vacuum tubes, transistors, and the like for the active parts of the oscillators in a device according to the invention. However neon tubes are preferred in practice because of the simplicity of the layout and also because they offer a relatively large impedance for the oscillator circuit. Every element of the circuit according to FIG. 1, 2 or 3 may be replaced also by equivalent means.

No matter how the basic electronic device is materialized, it may be used for constructing control installations which are capable of fulfilling diverse tasks.

For instance, if the direct current voltage produced across the terminals 48 and 26 is applied to the control electrode of a thyristor, the latter will be conductive as long as the oscillator oscillates. But as soon as a small impedance 50 (inferior to the critical resistance) is inserted across contacts 52 and 54 the thyristor is blocked. If said thyristor is connected to a relay, its armature drops and may close a contact. Such a device finds immediate application in a warning system.

FIG. 4 shows, by way of a characteristic instance, a possible application of the invention, to control the working of an electromagnetic switch only by contact of the hand. Across contacts 52 and 54 are two sets of interleaved interdigital conductors 53 represented in place of two copper wires as may also be provided for placing the hand thereon.

All of the circuitry represented in FIG. 2 is employed. The terminals 48 however is provided with filter elements including capacitor 80 and resistor 82 and an amplifying stage 84 and a relay 86. The latter is preferably of a particular construction such as the one described in the French Pat. No. 1,334,345, its armature is thrown one way or the other at turns at every application of a pulse to the control winding, whatever be the pulse duration.

The voltage that normally appears across terminals 48 and 26 is transmitted to a PNP-transistor 88 through a filter cell made of resistor 82 and condenser 80. This cell provides a sufficient time constant necessary for nervous people with trembling hands.

When terminals 52 and 54 are not shunted, transistor 88 is in a conductive state and its collector, which is connected to the positive pole of the direct current source via resistor 90 is practically at zero potential. Said collector is coupled by a condenser 92 to the control electrode of a thyristor 94 fed by the direct current source through relay 86 in series. In these conditions the resistor 94 admits practically no current.

If terminals 52 and 54 are shunted by the user's hand the oscillator stops oscillating and transistor is rendered nonconductive. At this moment the voltage on its collector rises abruptly. The positive pulse is transmitted to the control electrode of thermistor 94 by condenser 92, and thermistor 94 becomes conductive and admits the discharge of condenser 30 in the relay 86, the contacts of the latter are quickly swung over. Once conductor 30 is discharged, electronic switch 94 is blocked and capacitor 30 is slowly charged again through resistor 32.

Obviously, if the user's hand only lightly strokes the conductors sets 53, and is removed before the condenser 30 can have received any noticeable charge, there is no risk that the relay 86 will be actuated a second time. On the other hand, if the user's hand remains applied for some time on the conductors sets 53, the result will be exactly the same. In the latter case, as the oscillator remains blocked, transistor 84 is not conductive and the collector-emitter voltage of the latter is fixed by the

resistor bridge comprising resistors 90 and 96. The circuit of thyristor 94 and relay 86 allows the passage of current during only a short interval of time. When the user removes his hand, the potential of the collector of transistor 84 comes abruptly back to zero; the impulse produced, which is directed in a sense opposite to the first one, leaks through diode 98.

For illustrative purposes only the particular elements of the circuitry may be as follows:

Diode 24, type SC6D, International Rectifier, peak reverse voltage 800 v., forward current 5 ma.

Diodes 40 and 98 type AN 2927, G. E. peak reverse voltage 25 leak current less than 1 ma.

Capacitor 30—1 mf. 325 volt.

Capacitors 42 and 80—0.22 mf. 50 volt.

Capacitor 46—22 pf. 500 volt.

Capacitor 38—47 pf. 500 volt.

Capacitor 58—5000 pf. 400 volt.

Capacitor 64—100 pf. 1500 volt.

Capacitor 92—0.33 mf. 50 volt.

Resistor 32—15,000 ohm  $\frac{1}{2}$  watt  $\pm 20$  percent

Resistors 44 & 82—10,000 ohm

Resistors 46 & 96—270,000 ohm

Resistors 34, 62 and 96—2,700 ohms  $\frac{1}{2}$  watt  $\pm 20$  percent

Resistors 56 and 57—220,000 ohm  $\frac{1}{2}$  watt

Resistors 36 and 37—2,200,000 ohms

Resistor 82—10,000 ohms

Neon tubes 20, 70 & 72—type NM2L

Transistor 84—type 2N2926 NPN

Thyristor 94—type C5D, G. E. 400v Peak 1 A.

While a single form and modifications of the invention have been illustrated and described and illustrative values for the components set forth, it is to be understood that the invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. Electric control device comprising a relaxation oscillator having a series circuit comprising a first resistor, a neon tube, and a second resistor and a first capacitance connected across the neon tube, a source of direct current potential connected across said series circuit, a pair of contacts adapted to be bridged by manual contact to provide a resistive impedance across said contacts to prevent said first capacitance from reaching the breakdown voltage of the neon tube, and having a third resistance and a second capacitance connected thereacross in series, said second capacitance being connected in parallel with said neon tube and second resistance, and an oscillation sensing device adapted to develop a signal voltage only upon the presence of oscillations, said device comprising a third capacitance and a fourth resistor in series, connected in parallel with said second resistance, and a diode and fourth capacitance connected in series, and across said fourth resistance, and signal indicating terminals connected across said fourth capacitance, whereby upon manual contact bridging of said contacts to provide a resistive impedance, the voltage across said first capacitance is prevented from rising to the breakdown voltage of said neon tube, and oscillations thereof are blocked to thereby terminate the signal voltage at the terminals.

2. Electric control device which is to be controlled by the application of a resistive impedance such as the hand, comprising two input terminals which are sufficiently close to each other so as to be shunted by the application of the hand, an oscillator with two opposite output terminals, resistive means for connecting the input terminals to a corresponding one of the two oscillator output terminals, means for feeding said oscillator so as to make it oscillate when the input terminals are not shunted by the application of a resistive impedance such as the one formed by the hand, means including rectifying means for deriving from the oscillator a DC signal, means including a trigger circuit for deriving from the absence of said

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DC signal an electric control signal, said oscillator essentially comprising a neon tube shunted by a condenser, this shunt combination being connected by one end to one pole of a DC source through a feed resistor and by the other end to the other pole of said DC source through a load resistor, rectifying means connected to the load resistor, an element having a time constant connected to the rectifying means, an amplify-

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ing stage connected to the time constant element, a relay in series with a blocking gate, a condenser loaded by a DC source, and means for connecting the output of the amplifying stage to the blocking element, whereby the blocking element is unblocked when no voltage is applied at the output of the amplifying stage.

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