

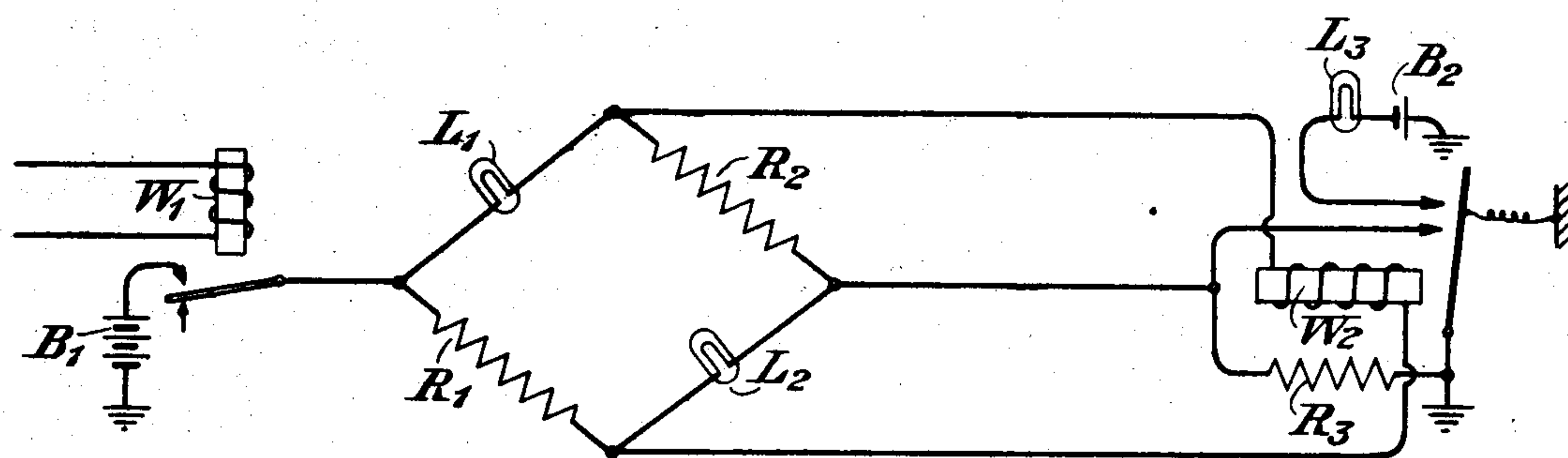
June 3, 1941.

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2,244,058

INTERRUPTER CIRCUIT

Filed Oct. 31, 1939



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UNITED STATES PATENT OFFICE

2,244,058

INTERRUPTER CIRCUIT

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Application October 31, 1939, Serial No. 302,256

6 Claims. (Cl. 175-373)

This invention relates to arrangements for interrupting electrical circuits. This invention also relates to timing circuit arrangements. The invention further relates to arrangements for producing interrupted current of controllable periodicity.

In telephone systems it is often necessary to provide a flashing signal. One well known form of circuit for producing such a signal comprises three relays which may be of the slow-operate or slow-release type and arranged to be operated in a predetermined order. After the three relays have operated in the desired order, a signal lamp controlled thereby will be illuminated. After this has occurred, all of the relays will be released in the same order and the signal lamp will be extinguished. This series of steps will then be repeated and the signal lamp light will be flashed at regular intervals.

It has been determined from experience with the flashing or interrupting arrangement above described that it is expensive and that it requires considerable space to house the various relays and associated apparatus. It is also unsteady and needs considerable attention and adjustment at quite frequent intervals. The arrangement is therefore undesirable.

It is an object of this invention to provide an improved form of signal flashing or interrupting circuit which will be superior to any now available. Such an arrangement, if built according to this invention, will be of low initial cost and it will require but little if any attention and adjustment from time to time.

In accordance with this invention a Wheatstone bridge is set up having two arms which comprise equal resistors of fixed magnitudes, the other two arms comprising non-linear resistors which vary in impedance with the current traversing them. The two fixed resistors may be connected as opposite arms of the bridge while the two non-linear resistors may be connected as the other two arms of the bridge. A relay winding may be connected as one of the diagonals of the bridge and a source of voltage together with a series resistor connected as the other diagonal of the bridge. The relay will be used to control the magnitude of the series resistor. These are the essential elements of the circuit.

The elements of the Wheatstone bridge are designed so that, when no current is flowing, the bridge is unbalanced and accordingly immediately after the circuit is completed the unbalance in the bridge will allow current to flow in the relay winding and the relay will then be operated.

The closure of the relay contact will reduce the series resistance in the circuit, thus increasing the total current through the bridge. The impedance of the non-linear resistors will accordingly increase until they are approximately equal to the fixed resistors. When this occurs the bridge will be balanced and the relay will release. The release of the relay will be accompanied by an increase in the magnitude of the series resistor, the impedance of the non-linear resistors will decrease and the bridge will again be unbalanced. This will happen again and again. A lamp or other indicating device controlled by the armature of the relay will be operated periodically as the current traversing the arms of the bridge varies from time to time.

This invention, together with its other objects and features, will be better understood from the detailed description hereinafter following, when read in connection with the accompanying drawing illustrating one embodiment of the invention merely for the purpose of illustration.

Referring to the drawing, the reference characters L_1 and L_2 designate two equal non-linear resistors (or impedances) which may be, for example, tungsten filament lamps of well known construction. The resistors or lamps L_1 and L_2 are two of the opposite arms of a Wheatstone bridge. The other two arms of the bridge, designated R_1 and R_2 , may be two equal stable resistances of any well known type. The terminal common to the lamp L_1 and resistor R_1 is connected to ground through a circuit comprising the armature and make contact of a relay W_1 and a battery B_1 . The terminal common to lamp L_2 and resistor R_2 is connected to ground through a resistor R_3 . The battery B_1 and the resistor R_3 are, therefore, connected as one of the diagonals of the Wheatstone bridge when the relay W_1 is operated. The winding of a second relay W_2 is connected as the other diagonal of the bridge. When the relay W_2 is operated, its armature and lower contact will complete a circuit in shunt with the resistor R_3 . At the same time the upper contact of the relay W_2 will complete a circuit including a lamp L_3 and a battery B_2 , the lamp L_3 being a signal lamp of any well known construction.

Assume that a substantial current traverses the line connected to the winding of the relay W_1 . The operation of the relay W_1 will connect the battery B_1 to the bridge, and this battery will supply current to the various arms of the bridge, as is well understood in the art. This current

will flow through the lamps L_1 and L_2 which are initially at low temperature. The impedances of these lamps will therefore, be at very low values when compared to their impedances when the lamps are hot. These impedances at the low temperatures, moreover, are considerably lower than the impedances of resistors R_1 and R_2 . Under these conditions, the bridge will be unbalanced and a substantial current will flow through the winding of the relay W_2 . Hence relay W_2 will operate, its upper contact completing a circuit for illuminating the lamp L_3 . The closure of the lower contact of relay W_2 will complete a circuit which will shunt the resistor R_3 out of the system.

The bridge will remain unbalanced as long as the lamps L_1 and L_2 have impedances which are substantially lower than the impedances of the resistors R_1 and R_2 . During the unbalanced condition of the bridge, the relay W_2 will remain operated.

However, the shunting of the resistor R_3 out of the circuit will cause an increased current to flow from the battery B_1 through the various arms of the bridge. The increased current will gradually increase the temperature of the lamps L_1 and L_2 and hence their impedances will rise by corresponding amounts. After the impedances of the lamps L_1 and L_2 have been raised to values approximating the resistances of elements R_1 and R_2 , the bridge will become balanced and practically no current will then flow through the winding of the relay W_2 . Upon the release of the relay W_2 , the lamp L_3 will become extinguished, and at the same time the shunt around resistor R_3 will be removed.

The re-connection of the resistor R_3 to the circuit will then reduce the flow of current from the battery B_1 through the various arms of the bridge. This will be accompanied by a reduction in the impedances of the lamps L_1 and L_2 as the temperatures of their filaments are lowered. The bridge will then become unbalanced and the relay W_2 will, therefore, be re-operated. The lamp L_3 will become re-illuminated, and again the resistor R_3 will be shunted out of the circuit. This action will be repeated again and again as long as the relay W_1 remains operated.

Thus the relay W_1 , which may be, for example, the control relay of a ringing circuit used in a telephone system, may be employed to initiate the operation of the circuit illustrated in the drawing. The operation of the relay W_1 will cause the lamp L_3 to flash automatically at regular and predetermined intervals. These flashes will cease upon the release of relay W_1 .

Upon the operation of relay W_1 , the flow of current from battery B_1 to the winding of relay W_2 through the bridge will rise almost immediately to its maximum value. The time required to reach the maximum will be determined only by the inductance of the winding of relay W_2 . This current is of course due to the unbalance of the bridge. As the lamps L_1 and L_2 thereafter heat up, the bridge will approach a balanced condition and the flow of current through the winding of relay W_2 will be progressively reduced. When the current traversing the latter relay winding drops below a predetermined value, the relay will release and the lamp L_3 will be extinguished.

It will be apparent, therefore, that the intervals of time during which the lamp L_3 remains illuminated and extinguished will be determined by the characteristics of the lamps L_1 and L_2 as

well as by the currents required to operate and release the relay W_2 . The resistor R_3 , which is connected into the circuit upon the release of the relay W_2 , controls the rate at which the lamps L_1 and L_2 will reach a predetermined high temperature. All of these factors may, of course, be adjusted as conditions may require.

The resistor R_3 may be any stable resistance. If desired, it may be an adjustable resistance the magnitude of which is controlled according to the operation or release of relay W_2 . The insertion of the resistor R_3 into the circuit in effect reduces the effective potential applied to the bridge. Moreover, the resistor R_3 may be replaced by a non-inductive winding mounted on the core of the relay W_2 . The signal lamp L_3 may be replaced by any other indicating device as will be apparent to those skilled in the art.

In one installation, the lamps L_1 and L_2 were of the tungsten filament type and exhibited an impedance of 15 ohms when at room temperature, and approximately 150 ohms when hot. Each of the resistors R_1 and R_2 were of approximately 150 ohms. The battery B_1 was a 10-volt battery. These values are given herein merely for illustrative purposes and are not to be construed as limitations on the invention.

It will be understood that the lamps L_1 and L_2 as well as the resistors R_1 and R_2 may, if desired, be enclosed within a single envelope in any well known manner. These elements may be varied in practice to introduce any desired amount of delay between the successive flashes of the lamp L_3 . By adjusting these elements to different predetermined magnitudes, the periodicity of the pulsating current produced may be changed to any predetermined value.

In accordance with this invention, the lamps L_1 and L_2 may themselves be the flashing lamps of the circuit. These lamps will flash in step with lamp L_3 . In such an arrangement the lamp L_3 may be eliminated if so desired.

If lamp L_3 is thus eliminated and lamps L_1 and L_2 are used as the visual indicators, it will be necessary to adjust the elements of the circuit so that the flow of current through the lamps L_1 and L_2 when relay W_2 is unoperated will be too small to illuminate these lamps. Upon the operation of relay W_2 , however, the flow of current through lamps L_1 and L_2 will be sufficient to adequately illuminate them. In this arrangement the impedance of the lamps will be varied over a wide range and the reliability of the circuit will therefore be improved. This arrangement will be especially suitable if the lamps L_1 and L_2 and resistors R_1 and R_2 are built into a single unit.

While this invention has been shown and described in certain particular arrangements merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. An interrupter comprising a Wheatstone bridge arrangement, two of the opposite arms of the bridge including equal non-linear resistors respectively, the other two opposite arms of the bridge including two stable equal resistors, respectively, a source of voltage connected to one of the diagonals of the bridge, a relay the winding of which is connected to the other diagonal of the bridge, and means responsive to the opera-

tion of said relay for varying the flow of current from said source of voltage.

2. An electrical interrupter comprising four elements arranged as arms of a Wheatstone bridge, two of the opposite arms of said bridge including equal invariable impedances, respectively, the other two opposite arms of said bridge including two equal impedances which vary with the flow of current therethrough respectively, a source of potential connected as a diagonal of said bridge, a translating device connected as the other diagonal of said bridge, and means responsive to the flow of current through said translating device to vary the effective potential of said source.

3. The combination of two equal stable resistors, two equal non-linear resistors, said four resistors being arranged as the arms of a Wheatstone bridge, the opposite arms of which are said two equal stable resistors, a source of voltage, a fifth resistor connected in series with said source of voltage as one of the diagonals of the bridge, a relay the winding of which is connected as the other diagonal of the bridge, and means responsive to the operation of said relay for shunting the fifth resistor out of the circuit.

4. A Wheatstone bridge interrupter circuit comprising two equal tungsten filament lamps which are arranged as opposite arms of the bridge, and two equal stable resistors arranged as the other two opposite arms of the bridge, a relay having its winding arranged as one of the diagonals of the bridge, a source of potential, a vari-

able resistor which is connected along with said source as the other diagonal of the bridge, and means responsive to the operation of the relay for changing the magnitude of said variable resistor.

5. An automatic current interrupter comprising two equal non-linear resistors, two equal stable resistors, said four resistors being arranged as the arms of a Wheatstone bridge, a fifth resistor connected to one of the bridge diagonals for controlling the supply of current to the bridge, a relay the winding of which is coupled to the other of the diagonals of the bridge, said relay being operated when the bridge is unbalanced and released when the bridge is balanced, and means responsive to the operation of said relay for changing the magnitude of said fifth resistor.

6. A circuit interrupter comprising the combination of a translating device such as a relay which may be operated and released, a source of potential, a Wheatstone bridge interconnecting said source and said translating device, said Wheatstone bridge having both linear elements and non-linear elements as its arms, said translating device being operated when the bridge is unbalanced and released when the bridge is balanced, and means responsive to the operation of said translating device to increase the effective potential of said source so as to increase the flow of current through said linear elements and said non-linear elements and to balance the bridge.

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