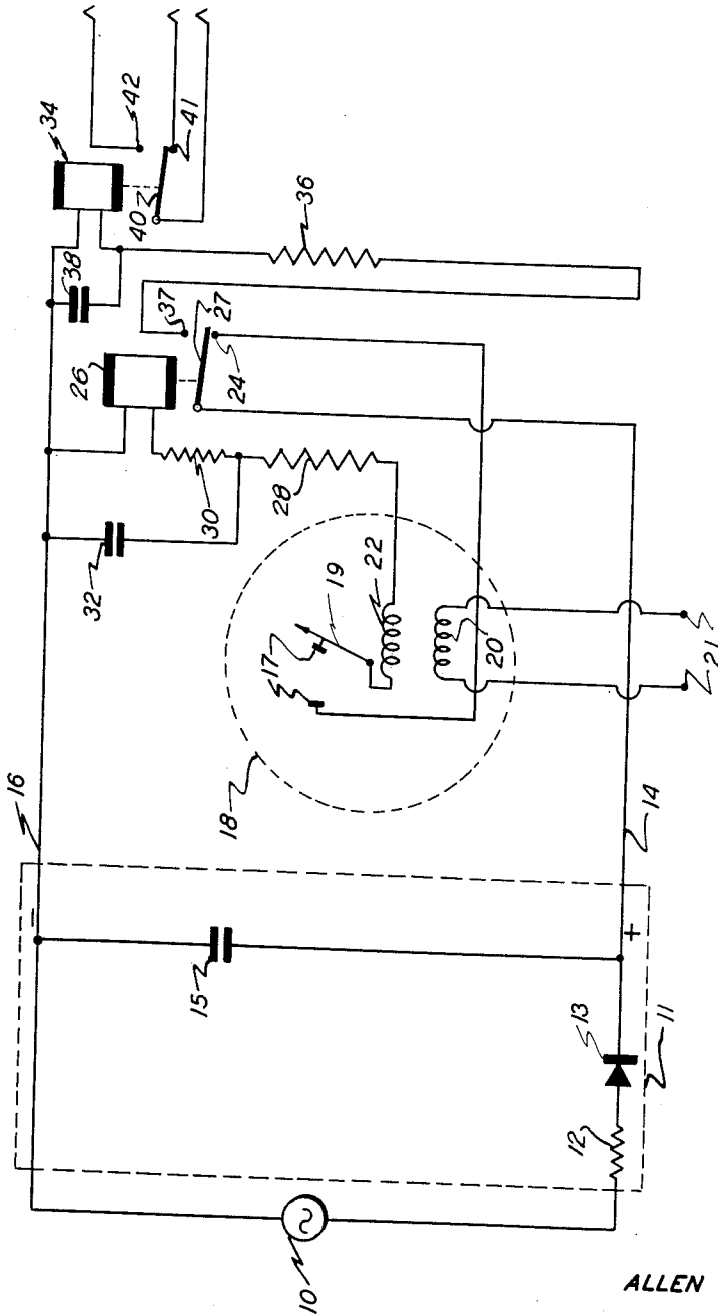


Aug. 2, 1960

A. R. HAMILTON
AUTOMATIC INTERRUPTER CIRCUIT

Filed Aug. 6, 1956

2,947,918



INVENTOR.
ALLEN R. HAMILTON

BY

Christie, Parker & Hale
ATTORNEYS

1

2,947,918

AUTOMATIC INTERRUPTER CIRCUIT

Allen R. Hamilton, Rochester, N.Y., assignor, by mesne assignments, to Consolidated Vacuum Corporation, Rochester, N.Y., a corporation of New York

Filed Aug. 6, 1956, Ser. No. 602,318

7 Claims. (Cl. 317—152)

This invention relates to automatic control circuits which require periodic circuit interruption for automatic reset operation.

A typical control circuit which requires periodic interruption is found in a contact meter using locking type control contacts. The contacts are movable with respect to each other in response to a signal applied to the meter, and the contacts are in a circuit adapted to control the application of power from a power source to a load in response to the signal. When the signal is of sufficient strength to move the contacts together, a self locking coil holds them together to insure good contact. A load relay is energized to control the application of power from the power supply to the load. An interrupter relay continuously interrupts the circuit to unlock the contacts, and as long as the signal is of the required strength, the contacts re-close. The load relay remains energized due to a condenser connected across it. When the signal drops below the required strength, the contacts remain open and the circuit returns to and remains in its original condition, permitting the load relay to de-energize.

In the conventional interrupter circuit, the interrupter relay re-cycles continuously regardless of the position of the control contacts, which are moved in response to the signal intended to control the power supply adapted to be connected to the load. This conventional circuit causes unnecessary wear on the interrupter relay. Furthermore, in the conventional interrupter circuit, the sensitive control contacts are required to energize the relatively high current load relay and also charge the load relay capacitor. If the sensitive contacts are slow acting, or heavily damped, the load relay may open before these contacts reclose after an interruption. Also, since the control contacts must close under load, arcing and erratic operation often occur.

This invention provides an automatic interrupter circuit with a more reliable operation of the interrupter relay and load relay than results from presently used circuits. The more dependable operation of the circuit of this invention is obtained by:

- (1) Reducing the current which passes through the sensitive control contacts;
- (2) Eliminating the need for the control contacts to close the circuit after the initial contact is made;
- (3) Requiring the interrupter relay to function only while the control contacts are closed; and
- (4) Maintaining the flow of current from the power supply to the load relay throughout most of the interruption cycle.

Briefly, the invention contemplates an automatic control circuit for controlling a load in response to an input signal in which the circuit includes a source of power and an interrupter relay adapted to be connected to the source of power. A pair of control contacts are arranged to be operative in response to the input signal to energize the interrupter relay from the source of power. A load relay is connected to be operative in response to the energization of the interrupter relay and thereby control the application of power to the load from the power source.

Thus, with the circuit of this invention, the closing of the contacts energizes the interrupter relay, which in turn energizes the load relay so that the load circuit is closed

2

and opened through the interrupter relay contacts rather than through the sensitive control contacts. The interrupter relay periodically de-energizes itself to provide for automatic reset operation of the self locking contacts.

These and other aspects of the invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawing, which is a schematic circuit diagram of the preferred form of this invention.

Referring to the drawing, a source 10 of alternating voltage is rectified and smoothed through a conventional D.C. power supply 11 which includes a resistor 12 and rectifier 13 connected in series in a positive power supply lead 14, and a capacitor 15 connected across the positive lead and a negative lead 16.

A pair of control contacts 17, which are part of a contact meter 18 having a movable indicator 19, are arranged so that one of the contacts is stationary, but adjustable, and the other is adapted to move with the indicator, which in turn moves in response to current passing through a signal coil 20 adapted to receive an input signal from a pair of terminals 21. A locking coil 22 in the meter holds the contacts together once they have been moved to the closed position by a signal passing through the signal coil.

The stationary contact is connected to the positive lead of the power supply through a first contact 24 of an interrupter relay 26 having a movable armature 27 connected to the positive lead of the power supply. The position of the interrupter relay armature with the interrupter relay de-energized is against the first contact 24, as shown in the drawing.

The movable contact of the meter is connected to the negative lead of the power supply through the indicator 18, the locking coil 22, a limiting resistor 28, a resistor 30, and the interrupter relay coil 26. An interrupter relay capacitor 32 is connected across relay coil 26 and resistor 30. A load relay 34 is connected to the negative side of the power supply and is adapted to be connected to the positive side of the power supply through a load relay resistor 36, which is in turn connected to a second contact 37 of the interrupter relay. A load relay capacitor 38 is connected across the load relay, which is arranged to move an armature 40 between a first load relay contact 41 and a second load relay contact 42 to control the application of electrical power to a load (not shown). The position of the load relay armature when the load relay is not energized is against contact 41, as shown in the drawing.

The operation of the circuit is as follows. The spacing between the two control contacts is set for any desired distance to require a signal of predetermined strength to cause the meter indicator to close the contacts. When a signal of the required strength is applied to the signal coil, the indicator moves to the left so that the contacts close. Current flows through the limiting resistor 28 to interrupter relay coil 26 and also to the interrupter relay capacitor 32. Current also flows through locking coil 22 so that the contacts are held firmly together.

Interrupter relay 26 is energized, moving the armature 27 from the first interrupter relay contact 24 to the second interrupter relay contact 37. This causes current to flow from the power supply to the load relay coil 34, causing it to operate the load relay armature. During this time, relay coil 26 continues to be energized by current discharging from the interrupter relay capacitor 32 through resistor 30. The control contacts, which were unlocked when the interrupter relay armature changed positions, are thrown apart due to spring action and collapse of current in the locking coil 22. If the signal remains sufficiently high, the contacts are reclosed, and under a no-load condition.

Preferably, the interrupter relay is a low current device compared to the load relay, so that the current through the delicate meter contacts is sufficiently low to avoid damage to them.

When the charge in the interrupter relay capacitor runs out, the interrupter relay coil is de-energized for a short period, permitting its armature to return to the position shown in the drawing so that the interrupter relay capacitor is recharged. The cycle then repeats as described above as long as the signal is of sufficient strength to keep the contacts closed. As soon as the signal drops below the required value, the contacts remain open, and the interrupter relay armature returns to and stays in the position shown in the drawing, and the load relay coil is de-energized.

The load relay capacitor and the other circuit components are selected to maintain the load relay coil sufficiently energized to keep the armature 40 against contact 42 while the interrupter relay continues to re-cycle.

From the above description of the operation of the circuit, it will be apparent that the interrupter relay is put into operation only when the meter control contacts are closed, and the sensitive control contacts are required to pass current only to the relatively low current interrupter relay coil and its capacitor 32. The sensitive meter contacts are not required to close the interrupter relay circuit except for the initial closure due to the current in the signal coil. Thereafter, during re-cycling of the interrupter relay, the sensitive control contacts close under a no-load condition. The load relay capacitor is kept charged throughout a large portion of the interrupter cycle, and is required to supply current to the load relay coil only momentarily. Thus, the possibility of the load relay dropping out accidentally during re-cycling of the interrupter relay is practically eliminated. Moreover, a long time delay on the load relay is not necessary, thereby permitting the load relay to follow quickly the operation of the sensitive meter contacts.

I claim:

1. In an automatic interrupter circuit of the class described, the combination which comprises a source of power having first and second terminals, an interrupter relay having an energizing coil, an armature and first and second stationary contacts, means for connecting the armature to the first terminal of the power source, the armature being closed against the first contact when the interrupter relay is not energized and being arranged to be closed against the second contact when the interrupter relay is energized, an electric signal indicator having a stationary contact, a movable contact, a holding coil, a pair of input terminals and means coupled to the movable contact and responsive to a predetermined input signal applied across the input terminal for moving the movable contact into engagement with the stationary contact of the indicator, means for connecting the first contact of the interrupter relay to the stationary contact of the indicator, means for connecting the movable contact and the holding coil of the indicator and the energizing coil of the interrupter relay in series relationship to the second terminal of the power source, the holding coil of the indicator being arranged to hold the movable and stationary contacts of the indicator closed after the contacts of the indicator have been closed by the input signal until the armature of the interrupter relay is disengaged from the first contact thereof, a load relay having an energizing coil and being adapted to control the power supplied to a load, and means for connecting the energizing coil of the load relay between the second terminal of the power source and the second contact of the interrupter relay, whereby the load relay is energized only after the armature of the interrupter relay is closed against the second contact thereof.

2. The combination as defined in claim 1 including a capacitor connected in parallel with the energizing coil of the interrupter relay for energizing the relay coil of

the interrupter relay for a predetermined interval of time after the armature and the first contact of the interrupter relay are disengaged to permit the movable and stationary contact of the indicator to reclose under a no-load condition in response to the predetermined input signal.

3. In an automatic control circuit for controlling a load in response to an input signal the combination which comprises a pair of terminals adapted to be connected to a source of power, an interrupter relay having a first pair of normally open contacts, a second pair of normally closed contacts and a first energizing winding, an electric signal indicator having a third pair of normally open contacts and second and third energizing windings, the indicator being arranged to close the third pair of contacts in response to the application of a predetermined signal across one of the second and third windings, means for connecting the first and second windings, and the second and third pair of contacts in series relationship, between the pair of terminals, means for connecting the load and the first pair of contacts in series relationship between the pair of terminals and means for applying the input signal across the third winding to close the third pair of contacts when the input signal reaches a predetermined value whereby the first and second windings are energized to close and open the first and second pair of contacts, respectively, and hold the third pair of contacts closed until the second pair of contacts are opened.

4. The combination as defined in claim 3, including a capacitor connected in parallel with the first winding for energizing the interrupter relay for a predetermined interval of time after the second pair of contacts are opened.

5. The combination as defined in claim 4 wherein the first and second pair of contacts comprise a movable armature and a pair of spaced stationary contacts.

6. The combination as defined in claim 4 wherein the load comprises a load relay having an energizing winding connected in series relationship with the first pair of contacts between the pair of terminals and a capacitor connected in parallel with the energizing winding of the load relay.

7. In an automatic control circuit for controlling a load in response to an input signal, the combination which comprises a pair of terminals adapted to be connected to a source of power, an interrupter relay having a first pair of normally open contacts, a second pair of normally closed contacts and an energizing winding, an electric signal indicator having a third pair of normally open contacts and an input circuit, the indicator being arranged to close the third pair of contacts in response to the application of the input signal to the input circuit thereof, means for connecting the energizing winding of the interrupter relay and the second and third pair of contacts in series relationship between the pair of terminals, and means for holding the third pair of contacts closed in response to a predetermined current flowing through the second and third pair of contacts to maintain the third pair of contacts closed until the second pair of contacts are opened and means for connecting the load and the first pair of contacts in series relationship between the pair of terminals.

References Cited in the file of this patent

UNITED STATES PATENTS

2,208,125	Feingold	July 16, 1940
2,254,039	Kovalsky	Aug. 26, 1941
2,272,914	Keeler	Feb. 10, 1942
2,473,683	Hines	June 21, 1949
2,530,749	Yardeny	Nov. 21, 1950
2,576,371	Thompson	Nov. 27, 1951

FOREIGN PATENTS

566,048	Germany	Dec. 9, 1932
---------	---------	--------------