

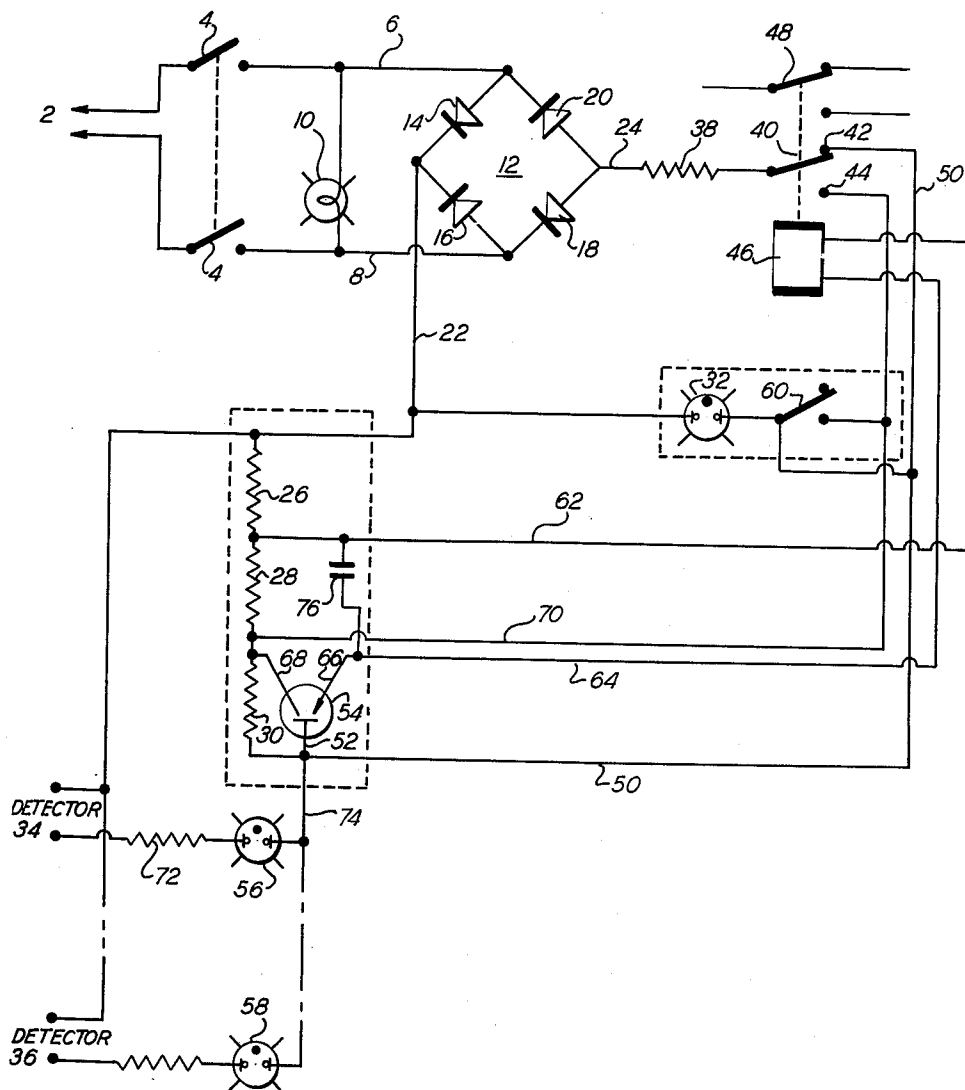
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J. F. HAUCK

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LEAK ANNUNCIATOR UNIT

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INVENTOR.
JON F. HAUCK

BY
A. Friedrich Samann
ATTORNEY

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LEAK ANNUNCIATOR UNIT

Jon F. Hauck, Bethesda, Md., assignor, by mesne assignments, to Allis-Chalmers Manufacturing Company, a corporation of Delaware

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This invention relates to alarm apparatus and more particularly to transistorized amplifier apparatus for indicating the presence of an abnormal condition.

In many industrial and laboratory operations it is desirable to have safety devices or indicating means for notifying operators of the presence of abnormal conditions. To develop a foolproof system for indicating abnormal conditions it is necessary to utilize some aspect of the abnormal condition to trigger the indicating alarm. One example of this would be in a leak detector system wherein it is desired that a leak from a closed system be known to the operator of the system. A specific form of detector capable of discerning a leak in a fluid system and which lends itself to use in connection with the present invention is shown, for instance, in U.S. Patent 2,759,175, issued on August 14, 1956 to T. R. Spalding for Leak Detector for Pipe Joint. Many other types of detecting devices may be used with this invention to indicate an abnormal condition. The alarm system as described here depends only upon the change of electrical currents between two terminals associated with the detector for the operation of the alarm.

It is to the satisfaction of the great need for an inexpensive compact alarm device that this invention is directed. A transistorized control circuit, indicating lights, separate alarm contacts and reset apparatus are all incorporated in this invention.

It is therefore a broad object of this invention to provide an improved alarm apparatus responsive to abnormal conditions.

It is a further object of this invention to provide a transistorized amplifier means for controlling indicators in accordance with the occurrence of an abnormal condition, as represented by a change in electrical current.

It is a further object of this invention to provide an alarm apparatus operative on the stimulus of an abnormal condition whereby a transistorized amplifier controls alarm indications and which incorporates reset means for returning the alarm apparatus to the condition existing before the occurrence of the abnormal condition.

It is a further object of this invention to provide a transistorized alarm apparatus whereby a relay is normally energized but upon the occurrence of an abnormal condition will become de-energized, the alarm having associated therewith manual means for resetting the alarm apparatus to its original condition.

The novel features of the invention are set forth in the appended claims and the invention as to its organization and its mode of operation will best be understood from a consideration of the following detailed description of the preferred embodiment when used in connection with the accompanying drawing which is hereby made a part of the specification and in which:

The single figure is a schematic of the alarm apparatus.

The preferred embodiment of this invention provides for an amplifier which is a fail safe circuit providing an alarm signal and lamp indicator when electrical conductivity in a sensing element deviates from a proper value or abnormal conditions exist in the apparatus itself or its power supply and which has a relay to provide contacts for external alarm circuits and for use with individual indicator lamps for each detector sensing element and including a reset control to re-establish quiescent operation of the alarm apparatus.

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In the following description of the apparatus by which the objects of the invention are realized it should be remembered that the detector sensing element may be of any type which alters electrical current upon the occurrence of an abnormal condition or a condition to be indicated. Referring now to the drawing, the power to operate the alarm apparatus originates with an A.C. power source 2 which conducts A.C. voltage through the off-on switches 4 to the bus conductors 6 and 8. The power "on" lamp 10 and the diode bridge 12 are connected between the two A.C. conductors 6 and 8. The diodes 14, 16, 18 and 20 rectify the A.C. voltage so as to place a positive full-wave rectified D.C. voltage on conductor 22 and a full-wave negative D.C. voltage on conductor 24. The positive D.C. bus 22 is connected to the voltage divider arrangement made up of impedances 26, 28 and 30 and is also connected to the alarm reset lamp 32 as well as to one side of each of the detectors, two of which are indicated as 34 and 36. The negative D.C. voltage on conductor 24 is connected to impedance 38 which in turn is connected to the movable contact member 40 of a relay having a coil 46, and which makes connection with either a first stationary contact member 44 or a second stationary contact member 42 in dependence upon actuation of relay coil 46. Contact switch 48 is provided for external indication of operation of the relay 46. Alarm indication bus 50 interconnects the second stationary relay contact 42 with the base 52 of transistor 54, to one side of impedance 30 and to the annunciator lights 56 and 58. The reset switch 60 is provided to return the alarm apparatus to its normal or quiescent operating state after an alarm has been given and the fault corrected.

The operation of the alarm apparatus is as follows: An A.C. source 2 in conjunction with the rectifier bridge 12 provides positive D.C. voltage to conductor 22 and negative D.C. voltage to conductor 24. Any type of D.C. voltage supply source may be used to energize the two conductors 22 and 24. The pnp type transistor 54 is biased by the divider network 26 and 28 so that current flows from the positive source 22 through impedance 26, through conductor 62 to the relay coil 46, through conductor 64, through emitter 66, base 52, collector 68, conductor 70, contact 44 and switch arm 40 to the negative D.C. supply to maintain the relay 46 in an energized condition. It is thus seen that the quiescent operating condition is that of current flowing through the transistor 54 so that its emitter relay 46 is energized. The detectors 34 and 36 may be of any type responsive to an abnormal condition which will allow the conduction of an electrical current upon the occurrence of such a condition. If for example an abnormal condition occurs which will allow current to flow through the detector 34, impedance 72 and annunciator light 56, the potential on the base 52 will tend to go in a positive direction so as to bias the transistor 54 either to cut-off or to a lower conduction level. With a current flowing through the emitter 66 of a value insufficient to maintain relay 46 energized it becomes de-energized and the negative voltage from the supply is thereupon applied to the alarm reset lamp 32 so as to ignite it. The relay 46 being de-energized, a path is provided through the detector 34 so as to ignite the annunciator light 56.

Any number of detectors with their associated annunciator lamps and current limiting resistors may be connected between the positive D.C. bus and the transistor bus 74.

Depression of the reset switch 60 places a negative D.C. voltage upon the collector 68 of transistor 54 so as to cause the transistor to conduct sufficiently to energize the relay 46. The reset lamp 32 will be energized when the reset button 60 is depressed and will extinguish upon

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release of the switch and return of the apparatus to quiescent condition.

Capacitor 76 is placed across the relay coil contacts so as to prevent the chattering or intermittent operation of the relay due to the fact that a full-wave D.C. voltage is used rather than D.C. with less ripple. Resistor 38 is a compensating resistor to account for variations in line voltage and is approximately 300 ohms.

In the preferred embodiment transistor 54 is of the type 2N269 although other types could just as easily be used.

It is therefore seen that an alarm apparatus is provided for use with detector means whereby indications of an abnormal condition are provided and provisions for external alarms included.

The feature of having a reset indicator and switch facilitates the restoring of the alarm apparatus to its quiescent or normal operating state and prevents restoring of apparatus without recognition. The use of a transistorized amplifier or switch in this case, to control the alarm apparatus allows for a compact unit which may be used with several detectors for the purpose of indicating abnormal conditions.

Generally, the herein disclosed electrical system comprises a load impedance as represented by the relay coil 46; a transistor type semiconductor device, as represented by the transistor 54, which has a first terminal 66 connected to one end of the load impedance; an electric current supply, as represented by the bridge 12, which in the quiescent condition of the system is connected between the other end of the load impedance 46 and a second terminal 68 of the semiconductor device 54; detector means such as indicated at 34 or 36 which are connected to a third terminal 52 of the semiconductor device and are operable to bias said device alternately into high and low conductivity between said first and second terminals; and auxiliary bias control means as represented by the switch 60 and associated connections 50 and 70, which is operable to temporarily bias the semiconductor device into high conductivity between said first and second terminals 66, 68. The alarm reset lamp 32 represents an alarm device which has one terminal connected to the second stationary relay contact member 42, and whose other terminal is connected to the terminal of the direct current supply 12 having a polarity opposite to that of the movable relay contact member 40.

It should be understood that this invention is not limited to specific details of construction and arrangement thereof herein illustrated and that changes and modifications may occur to one skilled in the art without departing from the spirit of the invention; the scope of the invention being set forth in the following claims.

What is claimed is:

1. An electrical system comprising, in combination, a relay having a coil, a movable contact member and first and second stationary contact members alternately engageable by said movable contact member in response to variations of current flow through said coil; a transistor type semiconductor device having a first terminal connected to one end of said coil; a direct current supply connected between the other end of said coil and said movable contact member; a connection between said first stationary contact member and a second terminal of said semiconductor device; a connection between said second stationary contact member and a third terminal of said semiconductor device; detector means connected with said third terminal and operable to bias said semiconductor device alternately into high and low conductivity between said first and second terminals; and a switch having relatively engageable and disengageable contact members connected, respectively, with said third terminal and one of said first and second terminals of said semiconductor device.

2. An electrical system as set forth in claim 1 and further comprising an alarm device having one terminal

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connected to said second stationary contact member of said relay; and a connection between the other terminal of said alarm device and a terminal of said direct current supply having a polarity opposite to that of said movable contact member.

3. An electrical system comprising, in combination, a relay having a coil, a movable contact member and first and second stationary contact members alternately engageable by said movable contact member upon increase and decrease, respectively, of current flow through said coil; a transistor having an emitter connected to one end of said coil, a collector connected to said first stationary contact member and a base connected to said second stationary contact member, a switch having relatively engageable and disengageable contact members connected, respectively, to said collector and base; a direct current supply connected between the other end of said coil and said movable contact member of said relay; and detector means connected between said base and a terminal of said current supply having a polarity opposite to that of said movable contact member.

4. An electrical system as set forth in claim 3 and further comprising an alarm device connected between said second stationary contact member of said relay and the terminal of said current supply having a polarity opposite to that of said movable contact member.

5. An alarm apparatus for use with a detector comprising means for developing positive and negative D.C. voltage potentials; a relay having an energizing coil, first and second stationary contacts, and a movable contact connected to one of said voltage potentials and operable to apply said one voltage potential to said first contact upon increase and to said second contact upon decrease of current flow through said coil; a transistor amplifier including a transistor having its emitter connected to one end of said relay coil, the other end of said coil being connected to the other of said voltage potentials, and said transistor having its collector connected to said first stationary contact and being normally biased to conduction so as to establish relay energizing current flow through said coil; means connecting said detector between said other D.C. voltage potential and the transistor base so as to bias said transistor to nonconduction and deenergize said coil upon the flow of current through said detector; an alarm indicating bus connected with said second stationary relay contact and with said other voltage potential; and reset switch means connected between said first and second stationary relay contacts and responsive to manual closing so as to restore said transistor to its conductive state and disconnect said alarm indicating bus from said one voltage potential if the causation of current flow through said detector is no longer present.

6. An alarm apparatus for use with a detector comprising means for developing positive and negative D.C. voltage potential; a relay having an energizing coil, first and second stationary contacts, and a movable contact connected to one of said voltage potentials and operable to alternately apply said one voltage potential to said first or second contact in response to variations of current flow through said coil; a transistor amplifier including a transistor having a first terminal connected to one end of said relay coil, the other end of said coil being connected to the other of said voltage potentials, and said transistor having a second terminal connected to said first stationary contact and being normally biased to conduction so as to establish relay energizing current flow through said coil; means connecting said detector between said other D.C. voltage potential and a third terminal of said transistor so as to bias said transistor to nonconduction and deenergize said coil upon the flow of current through said detector; an alarm indicating bus connected with said second stationary relay contact and with said other voltage potential; and reset switch means connected between said first and second stationary relay contacts and responsive to manual closing so as to restore said transistor to its con-

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ductive state and disconnect said alarm indicating bus from said one voltage potential if the causation of current flow through said detector is no longer present.

7. An alarm apparatus as set forth in claim 6 and further comprising annunciator means serially connected with said detector between said other D.C. voltage potential and said third terminal of said transistor.

8. An alarm apparatus as set forth in claim 6 and further including an external connection between said second and third terminals of said transistor.

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