

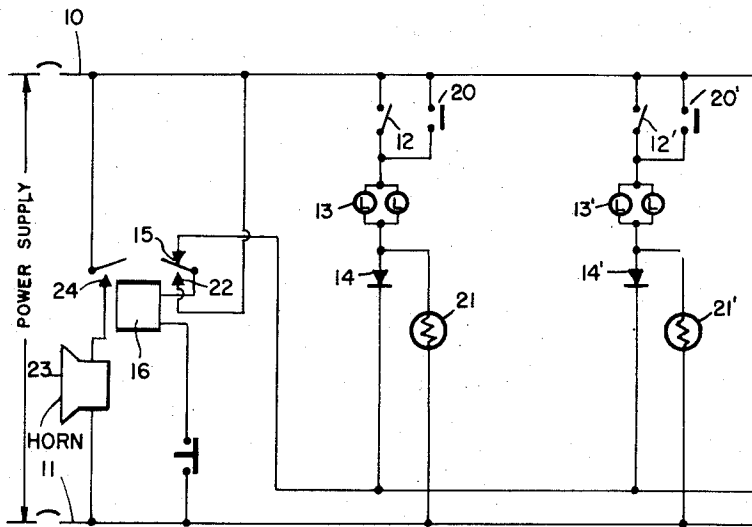
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ANNUNCIATOR SYSTEM

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ANNUNCIATOR SYSTEM

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The present invention relates to an annunciator system. More particularly, it has to do with that type of system which provides one or more indications of the occurrence of an abnormal condition or conditions at various different places.

The trend today is toward automation in industrial plants and processes, and as a result, machinery in large numbers and systems and parts of systems function with but a minimum of attention. This in itself creates special problems, as for example, the absence of personnel in constant attendance to the machinery and systems which would be alerted when abnormal conditions or malfunctioning exists therein and that could then apprise the proper personnel of such conditions. To overcome this disadvantage, annunciator or alarm systems have been developed for use with automatic equipment and that is operative to provide warnings whenever abnormal conditions are present in the equipment. Known annunciator systems for the most part have been custom made to accommodate particular conditions in given installations, and have been complex and quite expensive. There exists then a need for an alarm or annunciator system that is simple in design and relatively inexpensive and that can be made to accommodate a large variety of different equipment installations.

It is, accordingly, the general object of the present invention to provide a new and improved annunciator system which is simple to construct and install, which requires a minimum of maintenance, in which the components are economical and small in size, and in which the amount of necessary wiring is minimized.

It is another object of the present invention to provide an annunciator system which employs a minimum of moving parts and in which the remote parts of the system need not be sealed or otherwise protected against the effects of dust, contamination or corrosive atmospheres.

Another object of the present invention is to provide an annunciator system which is capable of use interchangeably with alternating and direct current power sources.

A further object of the present invention is to provide an annunciator system in which there are no relays at the detecting stations.

A still further object of the present invention is to provide an improved annunciator system in which a single, silenceable, indication device is operated in response to the occurrence of any one of a number of conditions happening at various different places and which, subsequent to providing an indication of the occurrence of one such condition, may be placed in readiness to detect the occurrence of another condition even though the first condition still persists.

In accordance with the present invention, a first utilization device, usually placed at the monitoring station, is responsive only to current of a value within a selected range of values. Also, preferably at the monitoring station, is a second utilization device which is responsive only to current of a value within a predetermined range of values. At a station usually remote from the monitoring

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station is means responsive to the occurrence of a predetermined condition for supplying current to the first utilization device of a value within the selected range of values; subsequent to the occurrence of the condition, means responsive to the continuance of the condition changes the first-utilization-device supply-current to a value without the selected range of values and also effects current supply to the second utilization device of a value within the predetermined range of values.

In a corollary aspect of the invention, additional means maintains the response of the first utilization device subsequent to the occurrence of the condition. Means is included in the system for disabling the response maintaining means subsequent to reduction of the first-utilization-device supply-current to the value without the selected range of values. Thus, the first utilization device is capable of being disabled without effecting the operation of the second utilization device.

The annunciator system of the present invention finds its greatest utility when the system is applied to the detection of any of a number of different possible condition occurrences. In this aspect of the invention, a plurality of means each responsive to the occurrence of an individual one of a plurality of conditions individually supply current to a utilization device of a value within a selected range of values that effect response of the utilization device. There is provided a plurality of means each responsive to the continuance of an individual one of the conditions for individually changing the respective individual utilization-device supply-current to a value without the selected range of values subsequent to the occurrence of the respective individual one of the conditions.

The features of the present invention which are believed to be novel are set forth with particularity in appended claims. The organization and manner of operation of the invention, together with further objects and advantages thereof may thus be understood with reference to the following description taken in connection with the accompanying drawing, in which the single figure is a schematic diagram of an annunciator system incorporating the present invention.

In the embodiment shown in the drawing, for purposes of illustration, either an alternating or a unidirectional current power supply is connected between a pair of power lines 10 and 11. In respective series connection from line 10 to line 11 is a normally open trouble contact 12, indicator lamps 13, a diode 14, a normally-closed contact pair 15, a relay coil 16, and a normally-closed push-button switch 17. Trouble contact 12 is shunted by a normally-open test switch 20. A negative-coefficient thermistor 21 is connected between line 11 and the junction between lamps 13 and diode 14; a normally open contact 22 is connected between line 10 and the junction between contacts 15 and coil 16. An electrically-operated horn 23 is connected in series with a normally-open contact pair 24 across lines 10 and 11. In series connection between line 10 and the junction between diode 14 and contacts 15 is another trouble contact pair 12', another indicator lamp 13' and another diode 14'; contacts 12' are shunted by a normally-open test switch 20'. A negative-coefficient thermistor 21' is connected between line 11 and the junction between lamp 13' and diode 14'.

The inventive circuit includes a first utilization device responsive only to current of a value within a selected range of values; such a device is one that is responsive only to current of a value in excess of a threshold value. To this end, horn 23 is energized upon the closure of contacts 24 by virtue of the passage through coil 16 of a current value in excess of a selected threshold value.

An additional, second utilization device is responsive only to current of a value within a predetermined range of

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values; such a device is one that responds only to current of a value in excess of a predetermined value. This characteristic is present in lamps 13 which affords a visual indication only when the lamp is conducting current; in most instances more than a certain minimum current is required to actually provide an indication capable of being seen by the human eye, although some well-known varieties of lamps will glow upon a very small amount of current conduction.

Also included is means responsive to the occurrence of a predetermined condition for supplying current to the first utilization device of a value within the selected range of values. Thus, upon the closure of trouble contacts 12 by the happening of an abnormal condition, current of a value sufficient to actuate the relay, comprising coil 16 and contacts 24, flows from line 10 through contacts 12, lamps 13, diode 14, closed contacts 15, coil 16, and switch 17 to line 11.

The system includes means responsive to the continuance of the condition for changing the first-utilization-device supply-current to a value without the selected range of values subsequent to the occurrence of the condition and for effecting current supply to the second utilization device of a value within the predetermined range of values to which that device responds; accordingly, closure of contacts 12 impresses a potential across negative-coefficient thermistor 21. It will be observed that thermistor 21 is coupled in parallel with coil 16, the primary or first utilization device, and in series with lamps 13, the secondary or additional utilization device. Upon the continuance of closure of contacts 12, the resistance of thermistor 21 decreases from an initial high value to a comparatively low value. When contacts 12 are first closed, the resistance of thermistor 21 is sufficiently high to permit current flow through coil 16 of a value in excess of that threshold value necessary to close contacts 24. However, subsequent to the closing of contacts 12, the resistance of thermistor 21 becomes sufficiently low that the thermistor effectually shorts coil 16, diverting current therefrom through the thermistor whereupon the current in coil 16 is reduced below its threshold value and contacts 24 open thereby deenergizing horn 23. The current flow through thermistor 21 is also sufficient to effect lighting of the lamp 13 so that a visual indication remains as long as the detected condition persists and contacts 12 thus remain closed. Thus, it will be observed that, as so far described, the detection of a condition results in almost immediate energization of horn 23 and at least very quick lighting of lamps 13, subsequent to the happening of the condition, the increased current flow in thermistor 21 becomes sufficiently large that an insufficient amount of current is available by way of contacts 12 to maintain energization of coil 16 and hence of horn 23.

In accordance with a further aspect of the invention, the response of the first utilization device is maintained subsequent to the occurrence of the detected condition; in addition, this response-maintaining means may subsequently be disabled. Accordingly, contacts 15 and 22 are also actuated upon the energization of coil 16 by current in excess of its threshold value; upon actuation of the relay, contacts 15 open and contacts 22 close, thus providing a holding or seal-in circuit for coil 16. Therefore, as soon as contacts 12 close to effect actuation of the relay, the coil circuit is switched so as to be connected directly between lines 10 and 11 rather than in series with the trouble contacts and the lamp. Thus, horn 23 remains energized even though thermistor 21 decreases in resistance value to a point such that it would comprise a short circuit around coil 16 but for the opening of contacts 15 with effectuation of the holding circuit. Upon subsequent depression of switch 17, as by the action of attending personnel at the monitoring station, the circuit for coil 16 is broken whereupon contacts 24 open deenergizing horn 23, contacts 22 open disabling the holding circuit, and contacts 15 reconnect coil 16 into the trouble contacts, lamp and themistor

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circuit. However, if switch 17 is depressed after thermistor 21 has decreased in resistance value by an amount such that the thermistor forms a low resistance path around coil 16, current in excess of the threshold value is prevented from flowing through the coil. Thus, the relay including coil 16 is not reactuated upon subsequent closure of switch 17 even though coil 16 again is coupled in series with the closed trouble contacts between the power lines. Note that lamps 13 continue to provide a visual indication of the presence of the condition even though the holding circuit has been disabled.

The utility of the invention is enhanced in accordance with another aspect thereof which includes a first utilization device of the above described character and which preferably includes a plurality of additional utilization devices all having the above-mentioned corresponding characteristic of the second utilization device. A plurality of condition-responsive means, each similar to those above described, are individually capable of supplying current to the first utilization device of the required amount. There is also provided a plurality of means each responsive to the continuance of an individual condition for individually changing the respective individual first-utilization-device supply-current value to a value without the selected range of values subsequent to the respective condition occurrence and for individually effecting current supply of the necessary amount to the preferably included individual ones of the additional utilization devices. To this end, closure of contacts 12' upon the occurrence of the condition detected by those contacts completes a supply circuit for coil 16 for supplying current thereto of an amount in excess of its threshold amount in a manner identical to that above described upon the closure of contacts 12. Likewise, thermistor 21' operates in a manner identical to that of thermistor 21 to reduce the amount of supply current available to coil 16 below that necessary for actuation of the relay and for effecting sufficient current flow in lamps 13' to provide a visual indication. It will be observed that there may be any number of the trouble contacts each having a lamp and a thermistor. Diodes 14 and 14' are inserted to prevent interference between the operation of one thermistor circuit with that of the next; for example, without the diodes, a decrease in the resistance of thermistor 21 would establish an effectual short circuit in parallel with thermistor 21' to prevent its operation upon the closure of contacts 12'. However, diode 14 has the effect of disposing thermistor 21 as a short circuit, during closure of contacts 12, only with respect to the circuit of contacts 12 and completely independent of contacts 12'. Thus, the function of the diodes is to permit thermistor 21 to divert away from coil 16 only current flowing through the series coupled contacts 12. Therefore, after an initial detection by contacts 12 effecting actuation of the relay, the subsequent deenergization of the relay upon opening of switch 17 places the circuit of coil 16 back into readiness to receive the current from the circuit of contacts 12' should those contacts be closed while contacts 12 remain closed. Hence, each of the trouble contact circuits is independent and isolated from all of the others, all provide a respective individual visual indication, and any one of them will cause energization of horn 23 if it is not already energized.

Of course, closure of test switch 20 at any of the remote stations to bridge contacts 12 enables a determination by the operating personnel that all is in order. Closure of the test switches causes operation of the circuit in a manner identical with that above described for closure of contacts 12.

Thus, the annunciator system requires a minimum of moving parts; there are no relays necessary at the remote stations. This avoids having to provide hermetically-sealed units and insures extremely long life and durability of the system. It should be noted that this

system may be used interchangeably on either alternating or unidirectional currents; the operation is the same in either case. Such a system is economical to manufacture and install, the cost of thermistors being much less than that of relays usually employed in such systems at the remote stations. Also, the elements employed in the annunciator system need only require a minimum of space and therefore installation is an exceedingly simple problem. Any number of remote stations may be utilized all common to a single horn or the like which may be silenced by a single push-button. If desired, of course, visual indication at the remote station may be dispensed with, the present invention still having great utility in being able to actuate a single, individually silenceable utilization device upon the occurrence of any of a number of conditions at widely-spaced detection points.

While a particular embodiment of the present invention has been shown and described, it would be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects.

I claim:

1. In an annunciator system for signalling changes in condition of a device policed thereby: a relay equipped with a pair of normally closed contacts and with two pairs of normally open contacts one of the latter of which is connected in series with said relay to provide therewith a self-holding relay circuit; an audible signal device connected in series with the other of said normally open contacts and defining therewith an audible signal circuit in parallel with said relay circuit; a visual signal circuit connected in parallel with the aforesaid circuits and comprising a visual signal device, a normally open single-pole, single-throw control switch in series with said visual signal device and adapted to be actuated by such a change in condition, and a negative coefficient thermistor also in series therewith; and a relay energizing circuit in shunt connection with said thermistor and comprising with said relay a diode connected to said visual signal device and poled to permit current to flow therefrom, and said normally closed contact connected between said diode and said relay; said thermistor being characterized by having a resistance that progressively decreases in value as current flows therethrough to a value such that the resultant division of current flow between said energizing circuit and thermistor is preponderant through said thermistor and falls in said energizing circuit to a value less than that required to energize said relay.

2. The annunciator system of claim 1 in which a plurality of visual signal circuits and energizing circuits therefor are provided in parallel with each other; and in which a normally closed, manually operable switch is connected in series in said self-holding relay circuit for deenergizing said relay subsequent to each energization thereof to thereby ready the same for actuation by another of said visual signal circuits.

3. In an annunciator system for signaling change in condition of a device policed thereby: a relay circuit including a relay having contacts in self-holding connec-

tion therewith; a signal device connected with said relay for actuation when the relay is energized; a signal circuit connected in parallel with said relay circuit and comprising a second signal device, a control switch connected therewith and adapted to be actuated by such a change in condition, and a variable resistance device connected to said visual signal device; and a relay energizing circuit in shunt connection with said variable valued resistance device and comprising with said relay a uni-directional current conductor connected to said second signal device; said variable valued resistance device being characterized by having a resistance that progressively decreases in value as current flows therethrough to a value such that the resultant division of current flow between said energizing circuit and resistance device is preponderant through said resistance device and falls in said energizing circuit to a value less than that required to maintain said relay in an energized state.

4. The annunciator system of claim 3 in which said variable valued resistance device is a negative coefficient thermistor.

5. The system of claim 4 in which said control switch is a single-pole, single-throw switch.

6. In an annunciator system adapted for use in signalling a change of condition in a plurality of devices policed thereby: a self-holding relay circuit including a relay and a switch for selectively interrupting the circuit; a first signal device connected with said relay for actuation upon energization thereof; a plurality of signal circuits each having a second signal device therein, a variable valued resistance device connected therewith, and a control switch also connected with said second signal device, each of said control switches being adapted to be actuated by a change in the respective conditions policed by said system; and an actuating circuit for each of said signal circuits and each being connected with said relay for selective energization thereof, each of said actuating circuits including said relay as an element thereof and being selectively connected in shunt with said variable valued resistance devices; each of said variable valued resistance devices being characterized by having a resistance that decreases in value as current flows therethrough to a value such that the resultant division of current flow between it and the associated energizing circuit becomes preponderant through said resistance device and falls in the energizing circuit to a value less than that required to energize said relay.

7. The system of claim 6 in which each of said variable valued resistance devices comprises a thermistor.

8. The system of claim 6 in which each of said energizing circuits includes a uni-directional current flow device.

9. The system of claim 8 in which each uni-directional current flow device is a transistor.

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