

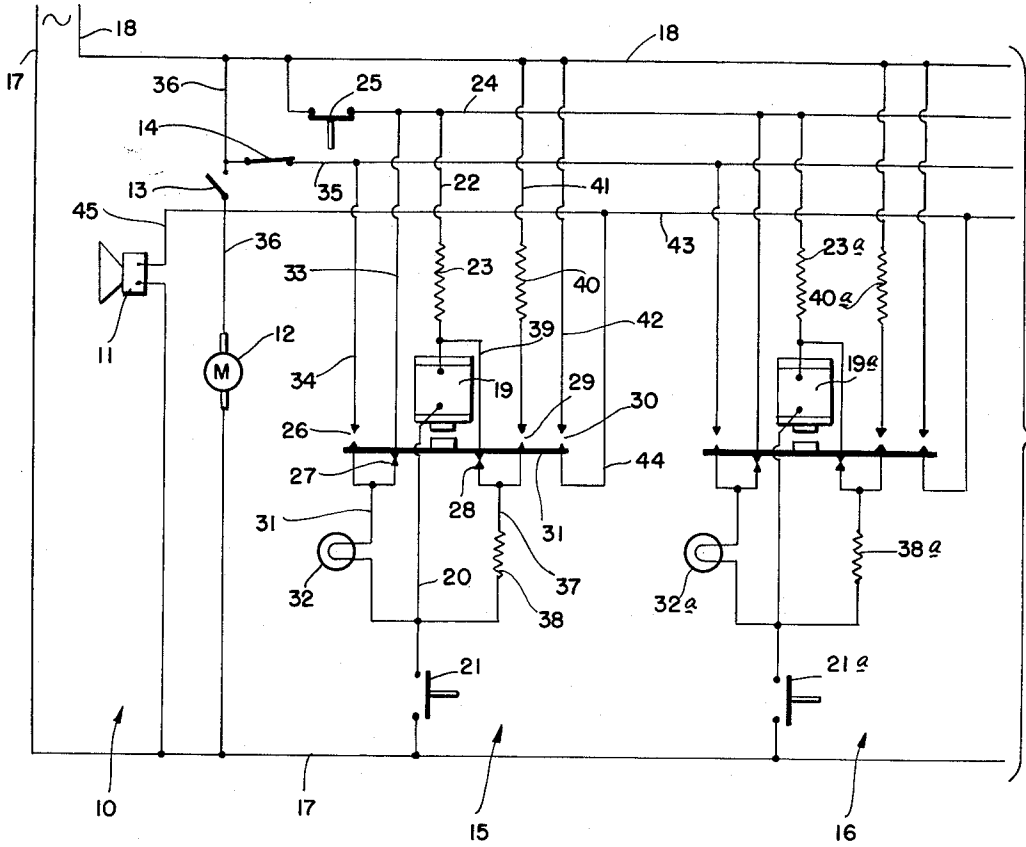
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ANNUNCIATOR SYSTEM

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1

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ANNUNCIATOR SYSTEM

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This invention relates to an annunciator system and more especially to an alarm or signal system particularly useful in conjunction with automatic machinery, systems, etc. to provide warnings whenever abnormal conditions are present therein.

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, an object of this invention to provide an annunciator system that will overcome a number of the important disadvantages that are present in known annunciator systems. Another object of the invention is to provide an alarm system responsive to abnormal conditions developing in machinery and equipment policed thereby and that is operative to provide a plurality of alarm signals upon the appearance of abnormal conditions, and in response thereto, and in which provision is made for discontinuing at least one of the alarm signals while at least one other remains in operation after the appropriate personnel have been alerted so that the alarm signal that has been made inoperative may again be used as an alarm signal for another piece of equipment in the event that abnormal conditions arise therein. Still another object of the invention is in the provision of an annunciator system of the character described, and in which a single relay is employed to control and condition a plurality of alarm devices for operation in the event that abnormal conditions are present in equipment policed by the system, the relay being arranged in a circuit relationship with an impedance element having the characteristics of providing a relatively high resistance initially to the flow of current therethrough, and thereafter providing a relatively low resistance subsequent to a flow of current therethrough, the relay and impedance element being operatively arranged so that energization of the relay places a plurality of alarm signals in operation and these alarm signals remain in operation until the relay is momentarily de-energized manually, and following such de-energization the impedance element effectively shunts out the relay so that it thereafter remains de-energized, certain of the alarm signals being thereby deactu-

2

ated, while certain other of the alarm signals remain in an operative condition until the malfunctioning of the policed equipment is corrected. Additional objects and advantages will appear as the specification proceeds.

5 An illustrated embodiment of the invention appears in the accompanying drawing, wherein the single figure thereof is a schematic circuit diagram.

For purposes of description, the annunciator or alarm system illustrated in the drawing may be divided into 10 three general sections. The first section is designated with the numeral 10 and comprises an audible alarm or signal device 11 which is preferably an electrically actuated horn. The section 10 also includes a circuit interrupter or flasher device 12 which is preferably a motor that when energized is operative to repetitiously and cyclically make and break the flasher switches 13 and 14.

The second and third sections of the annunciator system comprise alarm stations and these are designated respectively with the numerals 15 and 16. The sections or stations 15 and 16 are identical and in the circuit arrangement are in parallel with each other. The section 15 will be made responsive to one system or piece of equipment that is to be policed by the annunciator, while the section 16 will be made responsive to a second or different system or piece of equipment. It will be appreciated that the annunciator system may include any suitable number of stations or sections 15 and 16, and that each additional station will be connected in parallel with the others and will be used to provide an alarm for additional pieces of equipment. The section 10 comprising the audible alarm signal and the flasher unit for the visible alarm signal in each section (to be described later in detail) are common to all of the alarm stations or sections 15 and 16.

Each of the sections of the system are connected across a suitable power source or power supply that may be 110 volts A. C., and that in the drawing is defined by the lines or conductors 17 and 18. The power supply functions to energize the alarm stations or sections 15 and 16 when abnormal conditions exist in the equipment policed thereby, and to energize the audible signal device 11 and the motor 12 when the alarm stations are energized.

The alarm station or section 15 comprises a relay 19 having an energizing circuit defined through a lead 20 connected to the line 17 through a field signal switch 21, and lead 22, having a power resistor 23 interposed therein, and that is connected to the line 18, through lead 24, and a normally closed switch 25 in series therewith. The switch 21 may be of any suitable type and may be actuated by any appropriate means. The switch 21 is responsive to abnormal conditions that exist in equipment or systems, etc. being policed by the annunciator, and when such conditions exist therein the switch is closed to complete the energizing circuit through the relay 19 and between the power supply lines 17 and 18. The switch 21 will be referred to as a field signal switch and might be actuated, for example, by fluid pressure means, mechanical means or electrical means, all depending upon the character of the equipment being policed.

The relay 19 is provided with a plurality of contacts and for identification, these are designated with the numerals 26, 27, 28, 29 and 30. In the drawing, one contact element of each set of contacts is carried by the common bus or bar 31 that is movable between the position wherein the relay 19 is de-energized to an upward position when the relay is energized. It will be noted that when the relay is in a de-energized condition, the contacts 26, 29 and 30 are open, while the contacts 27 and 28 are closed.

70 Connected to the normally open contacts 26 and normally closed contacts 27 through a line 31 is a visible

signal device 32 that may be a simple electric light. It will be noted that at its other end the lead 31 is connected to the lead 20 at a point beyond the field signal switch 21 so that when the switch 21 is open the light or visible signal device 32 is disconnected from the power line 17. One side of the parallel light circuit is connected through the normally closed contacts 27 and line 33 with the line 24 that is normally at the same potential as the power line 18 because of the direct connection therewith through the normally closed switch 25. The other half of the parallel light circuit runs through the normally opened contacts 26 and lead 34 to a line 35 that is connected through the flasher switch 14 with a line 36 that is electrically connected with the power line 18. The line 36 in turn is also connected through the flasher switch 13 and flasher motor 12 with the power line 17.

The normally closed contacts 28 and normally open contacts 29 are connected through a conductor 37 and circuit element 38 with the lead 20 at a point above the field signal switch 21 so that when that switch is open, the circuit through the element 38 cannot be completed. Through the normally closed contacts 28 and conductor 39 the circuit element 38 is in a parallel or shunt relation with the relay 19 for the conductor 39 is connected to the lead 22 at a point between the relay and the power resistor 23. The circuit element 38 is connected directly through the normally open contacts 29 and a power resistor 40 and conductor 41 in series therewith to the power line 18. The circuit element 38 is chosen so as to normally provide a relatively high resistance to the flow of current therethrough, but to provide a relatively low resistance after current has flowed through the element for a short period of time. I prefer to use a resistor having a negative temperature coefficient so that when the temperature of the resistor or element 38 is low the resistance is high and after the element has been heated by a flow of current therethrough, for example, the resistance drops to a relatively low value whereby a large flow of current through the element is readily accommodated.

The normally open contacts 30 of the relay 19 are connected directly between the power line 18 through a conductor 42 and to a line 43 through a conductor 44. The line 43 is electrically connected with the lead 36 adjacent the flasher switch 13 and at the same point with a line 45 that has the horn 11 interposed therein, and that its opposite end is connected with the power line 17.

As has been stated hereinbefore, the sections or alarm stations 15 and 16 are identical and because of this, a detailed description of the elements and circuit connections for the station 16 will not be set forth. In the drawing, those elements which are shown in section 16, since identical with those in section 15, are designated for purposes of identification with the same numerals that identify the circuit elements of the section 15, except that the letter "a" has been added to each of the numerals. For example, the field signal switch in section 16 is identified with the numeral and letter combination 21a, the light or visible indicator is designated 32a, etc.

In operation of the annunciator system, the power lines 17 and 18 are connected to a suitable power source, and the field signal switches 21 and 21a through suitable means, which are well known in the art and that comprise no part of this invention per se, are rendered responsive to equipment or systems, etc. to be policed by the annunciator and which will cause a closing of the switches 21 and 21a if and when abnormal conditions are present in the equipment connected respectively with those switches. The switches 21 and 21a are normally open, while the switch 25, which is preferably a manually operated push-button switch, is normally closed and when pushed or depressed breaks the circuit through the line 24, and when released returns automatically to the closed position shown in the drawing. The switches 13 and 14 are controlled by the flasher motor 12 and are cyclically and repetitiously opened and closed when the motor 12 is energized.

Assuming as a starting condition, the normal state illustrated, the relays are de-energized and as a result the horn or audible signal device 11 is silent, the motor 12 is de-energized, the light or visual indicator 32 in section 15, and 32a in section 16 are extinguished and, of course, the field signal switches 21 and 21a are open. Now if, for example, the equipment to which the switch 21 is responsive begins to function improperly, it actuates the switch 21 which closes or completes the energizing circuit for the relay 19. This circuit can be traced from power line 17 through line 20, power resistor 23, line 22, line 24 and switch 25 to the power line 18. Energization of the relay 19 will close the contacts 26, 29 and 30 and will open the contacts 27 and 28.

Immediately the horn 11 will be connected between the power lines 17 and 18 through the leads 45, 43 and 44, contacts 30 and lead 42. Similarly, the light 32 will be energized through the switch 21, lines 20 and 31, contacts 26, lines 34, 35, flasher switch 14 and line 36. The flasher motor 12 will be energized through the same circuit as the horn 11 and as it operates the switch 14 will be cyclically opened and closed to cause a flashing of the light 32. This condition of the circuit will be maintained and the horn will continue to sound and the light 32 continue to flash until the switch 25 is momentarily depressed to break the energizing circuit through the relay 19.

Although the resistance element 38 is in parallel across the energizing coils of the relay 19, substantially no current will flow therethrough when the relay is initially energized for at that time the resistance of the element 32 will be high. Some current will, of course, flow therethrough between the line 17 and line 18 because the contacts 29 are closed when the relay is energized. As a result, the temperature of the resistance element 38 will begin to rise and the resistance thereof will progressively lower.

After the appropriate personnel have been alerted by the flasher indicator 32 and the horn 11, they will acknowledge the alarm signal and will depress the switch 25, thus breaking the energizing circuit for the relay 19, as has been described. When the relay is de-energized, the contacts 27 will again close and after the push-button 25 has been released, a completed circuit through the indicator light 32 will be established, and the indicator light will burn continuously. Since the contacts 30 are now open, the horn 11 will be de-energized as will the flasher motor 12. Although the contacts 29 are now open, the contacts 28 are closed and current will flow through the resistance element 38. At this time, the temperature of the element 38 will be relatively high and, as a result, the resistance will be quite low. Therefore, even though the switch 25 is released, the element 38 provides, in effect, a short circuit about the relay 19 with the result that insufficient current will flow through the relay so as to again energize it. Substantially all of the current flow then will be through the resistance element 38. This condition will now be maintained until the abnormal functioning of the policed equipment is rectified or until the field signal switch 21 is opened in some manner. In this condition of the circuit the indicator light 32 burns continuously and the horn 11 is silent. This specific arrangement permits the signal audible warning device 11 and the signal flasher 12 to be used in common for a plurality of sections or alarm stations 15 and 16. That is to say, if the section 15 is in the condition just described with the field signal switch 21 closed and the indicator light 32 burning continuously, closing of the field signal switch 21a will energize the relay 19a which through the same circuit arrangement that has already been described in detail, will bring about a flashing condition of the indicator light 32a and energization of the horn 11. Thus, at the same time, the indicator light 32 may be burning continuously while the horn 11 is sounding and while the indicator light 32a

5

is flashing on and off. If the push-button switch 25 is then depressed, the flasher motor 12 and horn 11 will be de-energized in a manner previously described, and the indicator lamp 32a will be changed from a flashing to a continuously burning condition.

The annunciator system is exceptionally advantageous for it permits certain of the warning or signal devices to be used in common with a plurality of alarm stations. Further, through a single relay, the usual sequence of alarm operations can be provided that heretofore have been provided only by the use of a plurality of relays. Thus, the cost of the annunciator system over those now known is considerably reduced, and further, the size of the system may be reduced because of the decrease in the relay elements that are required. In the specific circuit illustrated and described, which is exemplary of alarm sequences generally, and shows specifically a sequence that is used extensively and in by far the greater number of cases, a single relay in circuit arrangement with an element having selected characteristics that permit the element to selectively provide a high resistance circuit in shunt with the relay and a substantially short circuit in shunt therewith accomplish the sequential alarm operation that has heretofore been accomplished only by much more complex and expensive equipment. It will be appreciated that the specific arrangement disclosed may be altered slightly to provide other alarm sequences that are occasionally used.

While in the foregoing specification an embodiment of the invention has been set forth in considerable detail for purposes of adequately disclosing the invention, it will be apparent to those skilled in the art that numerous changes may be made in the details set forth without departing from the spirit and principles of the invention.

I claim:

1. In an annunciator circuit having alarm devices controlled by a relay adapted to be energized in response to an abnormal condition in a system being policed thereby, a relay having an energizing circuit and normally open and closed contacts, at least two alarm devices, one of which is in circuit with both a normally open and normally closed contact, a power source for energizing said relay whenever an abnormal condition is present in said system, a circuit element in shunt with the energizing circuit of said relay through parallel paths including respectively a normally open and normally closed contact and providing a relatively high resistance initially to the flow of current therethrough but a low resistance following a period of current flow therethrough, and means for interrupting momentarily the energizing circuit of said relay to de-energize the same, said circuit element being operative subsequent to said interruption to effectively short out said relay whereby it remains de-energized even though an abnormal condition persists in said system.

2. In an annunciator system, a pair of signal devices, a relay providing normally open and normally closed contacts, a source of power for energizing said devices and relay, said devices being connected to said source of power through said relay, circuit closing means in circuit with said relay for connecting and disconnecting the relay with said source of power, one of said devices being connected to said source of power through said circuit closing means and in parallel through both normally open and normally closed contacts of said relay, a circuit element in shunt with the energizing circuit of said relay in a parallel arrangement through both normally open and normally closed contacts thereof, and switch means for breaking the energizing circuit of said relay, said circuit element having the characteristics of initially providing a high impedance to the flow of current therethrough and following a predetermined period of flow therethrough, a relatively low impedance.

3. In an alarm circuit, an alarm station comprising a relay equipped with a plurality of contacts some of which

6

are normally open and others normally closed, an energizing circuit for said relay, a field signal switch in said energizing circuit for completing the same when actuated, a source of power for energizing said relay, a plurality of signal devices connected to the contacts of said relay and being adapted to be connected to said power source when said relay is energized, one of said signal devices being connected to both normally open and normally closed contacts of the relay whereby that signal device is actuated when said field signal switch is closed irrespective of the condition of the relay, and a circuit element connected in shunt with the energizing coils of said relay through normally closed contacts thereof and with said power source through normally open contacts of the relay, said circuit element when cold providing a high resistance to the flow of current therethrough and when heated providing a low resistance to the flow of current therethrough, whereby when said field signal switch is closed said relay is energized and if thereafter de-energized through the momentary interruption of said energizing circuit said circuit element effectively shorts the energizing coils of said relay to maintain the same in a de-energized state.

4. In an alarm circuit of the character described, a source of power, a relay having an energizing coil connected across said source of power, a field signal switch in series with said energizing coil and being adapted when actuated to complete the circuit therethrough, said relay being equipped with at least one normally open and at least one normally closed contact, a resistance element connected in shunt across said energizing coil through said normally closed contact and being connected across said source of power through said normally open contact and said field signal switch, said resistance element when cold providing a relatively high resistance so that when said field signal switch is initially closed said relay is energized, said resistance element providing also a relatively low resistance when heated so as to effectively short out said energizing coil and forestall the energization of said relay even though said field signal switch is closed, and at least two signal devices connected with said relay to provide actuation of both of the signal devices when said relay is energized but actuation of only one of said devices when said relay is de-energized and said field signal switch is closed.

5. The system of claim 4 in which switch means are provided in series with said energizing coil for providing momentary interruption of the energizing circuit of said relay when said field signal switch is closed.

6. The system of claim 4 in which said resistance element comprises a resistor having a negative temperature coefficient.

7. The system of claim 4 in which one of said signal devices provides an audible signal and is connected to said source of power through normally open contacts provided by said relay, and in which the other of said signal devices is a visible device connected to said source of power through both normally open and normally closed contacts provided by said relay, a flasher device being provided in circuit with the latter mentioned normally open contacts whereby when said relay is energized said visible signal device flashes on and off.

8. An annunciator circuit adapted for use in policing substantially automatic apparatus and being operative to provide a plurality of warning signals when said apparatus is in an abnormal condition, at least one warning signal after response by an operator to the plurality of warning signals and to provide no warning signals when said apparatus is functioning properly, an alarm station equipped with a field signal switch adapted to be actuated when an abnormal condition exists in said apparatus, a relay in circuit with said field signal switch, a source of power for energizing said relay when said field signal switch is actuated, a resistance element connected in parallel with the energizing coil of said relay and when cold

7

providing a relatively high resistance whereby substantially no current is shunted past the relay and providing also a relatively low resistance when heated whereby substantially all of the energizing current for said relay is shunted therepast, and a plurality of warning signal devices connected to said source of power through said relay so that when said relay is energized all of said warning signal devices are actuated, one of said warning signal devices being connected to said relay so as to provide a warning signal when said field signal switch is actuated and said relay is de-energized.

9. The annunciator system of claim 8 in which a manually operable momentary switch is provided in circuit with

8

said relay so as to interrupt the energizing circuit there-through when said last mentioned switch is actuated.

10. The annunciator system of claim 8 in which said element comprises a resistor having a negative temperature coefficient.

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