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SERIES OPERATED RELAY ALARM SYSTEM

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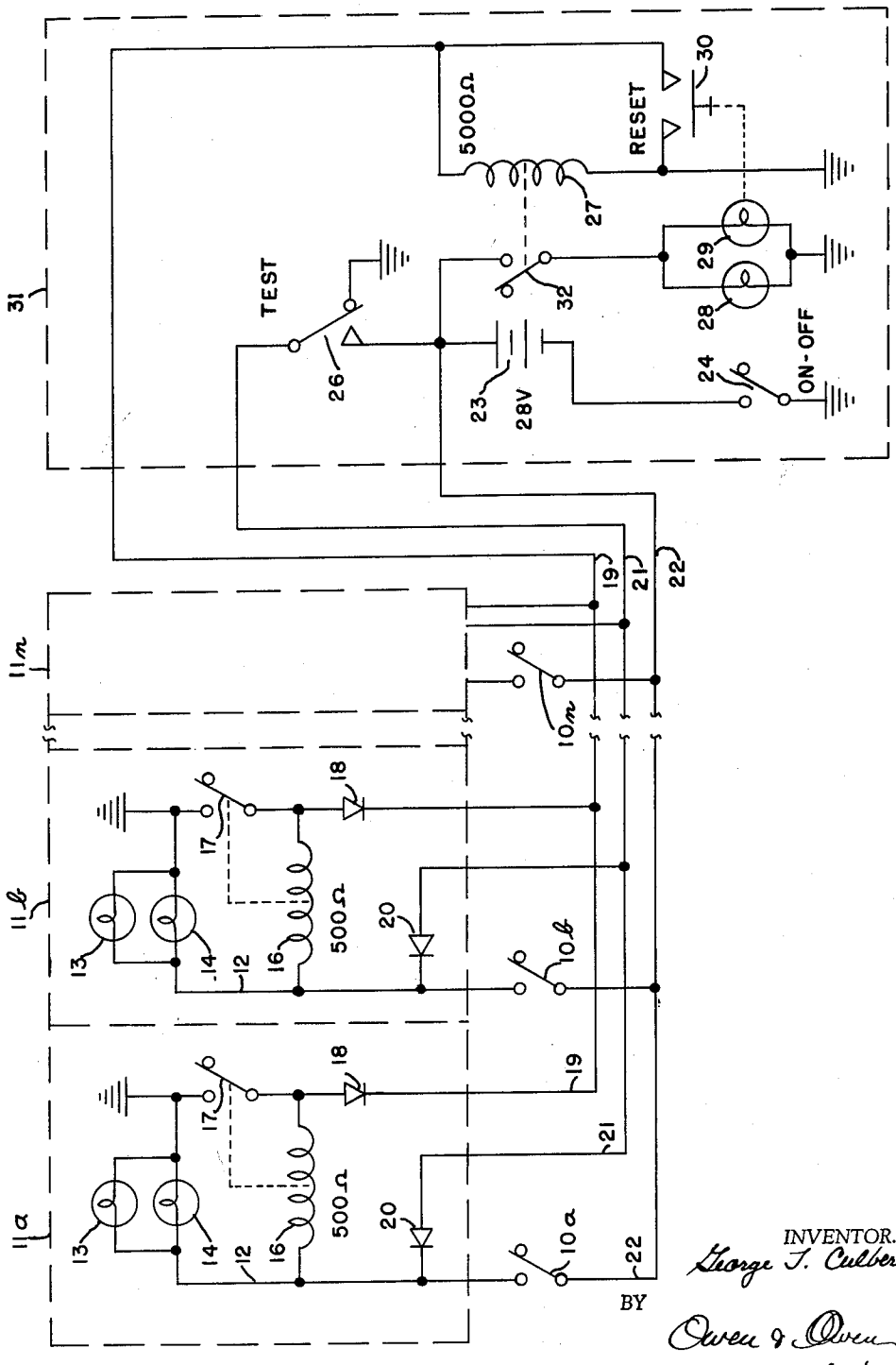

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SERIES OPERATED RELAY ALARM SYSTEM

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This invention relates in general to indicator systems and more specifically to indicator systems operable in response to a predetermined condition.

In defense systems wherein a large number of events are continually monitored by an operator to determine changes in state, it is virtually impossible to keep an adequate vigil with respect to each of said changes in state. A remote display panel may contain several hundred signal or warning lights. For protection against burnout, each signal is displayed by a pair of paralleled lamps which illuminate respective indicator visual sign displays. The lamps and their associated switches, diodes and related circuity are lumped within a miniaturized unit measuring about ½" x 1¼" x 2¼". In addition to the remote panels, a master station has a single indicator device which announces a predetermined condition at a remote location. A switch, termed a fault switch, responds to a predetermined condition at a remote location and causes the appropriate pair of lamps to operate giving a visual indication of the closure of that fault switch. The panel may appropriately have many fault switches which are properly closed lighting their respective lamps. Then, when the operator desires to be notified of the lighting of a further lamp, it is likely that the lighting of a single lamp may go unnoticed. Accordingly, one of the objects of this invention is to assure that the closure of a fault switch will be detected to enable an operator to take an appropriate action. The system of this invention utilizes a single master indicator lamp unit which turns on to signal the operation of a remote fault switch. The operator then may reset the master indicator unit and communicate with the remote panel to take any corrective action that may be required.

The system may find use in ground installations or appropriately in aircraft. In this latter type of application, a great number of events must be registered including as examples, engine temperature, oil pressure, fuel level, fuel tank switched on, wheel conditions, etc. The operator with his other duties may not notice the lighting of one lamp within the large bank. Accordingly, he is provided with a single master lamp directly within his viewing range which operates to signal the remote condition and he may then communicate with the remote panel board to determine if any action is necessary.

An object of this invention is to provide a master indicator system which is simple in its wiring and operation and which may readily be tested during maintenance periods.

In aircraft systems, simplicity and minimization of bulky wiring is constantly sought in addition to attempts to relieve congestion within the immediate operating area. The present invention removes the large bank of indicators to a less crowded remote location.

A further object of this invention is to provide a central or master indicator which may be reset independently of the remote fault switch or indicator.

The novel features of this invention are set forth with particularity in the appended claims. The invention itself, however, with its preferred organization and mode of operation as well as further objects and advantages may best be understood from the following description when read with the accompanying drawing in which the single figure illustrates one embodiment of the invention utilizing relay windings in the remote and master stations.

Briefly, the invention utilizes a series arrangement including a relay winding in a remote station having one value of impedance and a relay winding at the master station having a much greater impedance. When a fixed voltage is applied across such series circuit, the current developed therein is sufficient to energize only the master station relay. Then, when the operator depresses a reset button, the master station relay winding is shunted and the higher current through the remote station relay winding is sufficient to energize that circuit by-passing the master station thereafter when the reset button is released.

Referring now specifically to the figure, there is shown a number of fault switches **10***a*, **10***b*, and **10***n* each associated with a respective remote lamp unit indicated generally as **11***a*, **11***b*, and **11***n*. Although only three remote indicators are illustrated, it is understood that any number of intermediate units may be included depending upon the number of conditions controlling fault switches. Since each of the lamp units **11** contains the identical electrical circuitry, it is sufficient to describe only one. Further, like reference numerals are applied to corresponding parts throughout. Fault switch **10***a* which is caused to close responsive to a predetermined condition completes a circuit over positive line **22** to line **12**. The fault switch **10** may be, for example, a pressure, temperature, resistance or flow operated two position device. Double remote lamps **13** and **14** are paralleled between line **12** and common ground. Relay winding **16** connects through its own contacts **17** in parallel with lamps **13** and **14**. Winding **16** is indicated as having an impedance of 500 ohms. A test circuit isolating diode **20** is connected between line **12** and interconnecting line **21**. Relay isolating diode **18** is poled in its forward direction with its anode connected between relay **16** and its contacts **17** while its cathode is joined to interconnecting line **19**. The connections from lines **19**, **21** and **22** into the remaining units **11** are the same as just described with respect to unit **11***a*.

At the master station **31**, a source of fixed voltage **23** is connected with its positive terminal to line **22**. The 28 volt supply has its negative terminal grounded through an on-off switch **24**. The supply **23** is indicated as a battery although it is understood that any constant voltage source having an adequate current capacity would be appropriate. The test circuit is normally inactive by virtue of line **21** being grounded through test switch **26**. However to test all lamp units, switch **26** may be momentarily closed applying the positive battery to line **21**. The master control relay winding **27** of 5000 ohms impendance has one end joined to line **19** and its other end grounded with a reset switch **30** by-passing the winding. The contacts **32** controlled thereby complete a circuit from positive battery through lamps **28** and **29** to ground.

In operation, when on-off switch **24** is closed, it prepares a circuit over line **22** so that when a fault switch closes, the remote lamp unit will become energized. Considering switch **10***a* as typical, when closed it permits the battery voltage across lamps **13** and **14** and enables the lamps to become ignited signaling the fault switch condition. Contacts **17** are normally open permitting a circuit to be traced from switch **10***a*, line **12**, 500 ohm winding **16**, forwardly poled diode **18**, line **19**, and 5000 ohm winding **27** to ground. With a fixed voltage applied essentially across windings **16** and **27** in accordance with their respective impedances, nearly the full voltage is applied to winding **27**, which pulls in its contacts **32** energizing the master signal lamps **28** and **29**. The ratio of impedance is arranged to assure energization of the master relay while preventing pull-in of the remote relay. This condition signals the operator who maintains a

careful watch on lamps 28 and 29 that a fault has occurred so that he may communicate with the remote panel and take any appropriate action dictated by the closure of fault switch 10*a*.

The operator may then momentarily depress reset switch 30 which shunts winding 27 applying nearly the full battery voltage across winding 16 resulting in the closure of contacts 17. Then, when reset switch 30 is released, relay 27 remains dropped out with the master station lamps off due to the establishment of the path through contacts 17 to ground which effectively prevents the reappearance of an operating voltage at relay 27 until another fault switch closes. The system is then ready for a further indication resulting from the closure of another fault switch. Diodes 18 prevent sneak circuits through the remaining lamp units. Occasionally, a fault may cure itself in sufficient time to warrant no action. The circuit permits the remote and master lamps to turn off when that condition prevails since both indicators complete their circuits through switches 10. When one lamp of any pair burns out, it may be easily identified and replaced when the test circuit is energized. Switch 26 puts positive battery voltage through forward diodes 20 to momentarily energize all lamps. It is understood that the fault switch may be located in the negative side of the line by simply reversing the battery and the direction of all diodes 18 and 20.

While the invention has been disclosed in conjunction with a specific circuit, it will be appreciated that numerous other modifications will be apparent to those skilled in the art. Such changes may be made without departing from the spirit and scope of the invention as defined in the claims.

What I claim is:

1. An indicator system of the type described comprising: at least one remote station having a fault switch responsive to a predetermined condition, a remote indicator device for each said fault switch energized in response to said predetermined condition, and a first relay having a first relay coil, a master station having a source of supply voltage common to said master station and said at least one remote station, a single master indicator device energized in response to said predetermined condition, and a second relay having a second relay coil included in a series circuit with said first relay coil across said source of supply voltage when said fault switch operates, said second relay coil having a greater impedance than said first relay coil whereby said second relay is operated to energize said master indicator device while said first relay remains in a de-activated state.

2. An indicator system as defined in claim 1 wherein said master station includes a test circuit for completing a voltage supply path to operate the said indicator device at each said remote station and at said master station.

3. In an indicator system of the class described comprising at least one remote station having a fault switch responsive to a predetermined condition, a remote indicator device in series with said fault switch, a master station having a master indicator device and means connecting said master station in parallel with all of said remote stations, whereby said master indicator is operated whenever a circuit to any of said remote indicators is closed, the improvement comprising a relay coil at each remote device and a relay coil at said master station in series therewith through isolating diodes at each remote station, the impedance of said master relay coil being such that its associated armature is actuated upon closure of a fault switch and the impedance of said remote relay coils is such that their associated armatures are not actuated so long as said series relationship with said master relay coil exists, and reset means to increase the voltage across said remote relay coil to a level sufficient to actuate its associated armature, said reset means being disposed to simultaneously open the circuit to said master indicator, and means establishing a holding connection for said remote indicator by actuation of the armature of said remote relay.

4. In an indicator system of the class described comprising at least one remote station having a fault switch responsive to a predetermined condition, a remote indicator device in series with said fault switch, a master station having a master indicator device and means connecting said master station in parallel with all of said remote stations, whereby said master indicator is operated whenever a circuit to any of said remote indicators is closed, the improvement comprisnig a relay coil at each remote device and a relay coil at said master station in series therewith through isolating diodes at each remote station, the impedance of said master relay coil being such that its associated armature is actuated upon closure of a fault switch and the impedance of said remote relay coils is such that their associated armatures are not actuated so long as said series relationship with said master relay coil exists, reset means to shunt out said master relay coil whereby the voltage across said remote relay coil is increased and its armature is actuated, and means establishing a holding connection for said remote indicator by actuation of said last-named armature.

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