United States Patent [19]

Killen

[11] **3,778,797**

[45] **Dec. 11, 1973**

[54] **MULTI-STATION SAFETY MONITOR HAVING SHUNT SWITCH**

[75] Inventor: **Gene W. Killen,** Clintwood, Va.

[73] Assignee: **Pyott-Boone, Inc.,** Trazewell, Va.

[22] Filed: **July 10, 1972**

[21] Appl. No.: **270,307**

[52] **U.S. Cl.** ..... **340/227 R,** 340/213 R

[51] **Int. Cl.** **G08b 29/00**

[58] **Field of Search** ..... 340/227 R

[56] **References Cited**

UNITED STATES PATENTS

2,423,649 7/1947 Horvitch ..... 340/227 UX

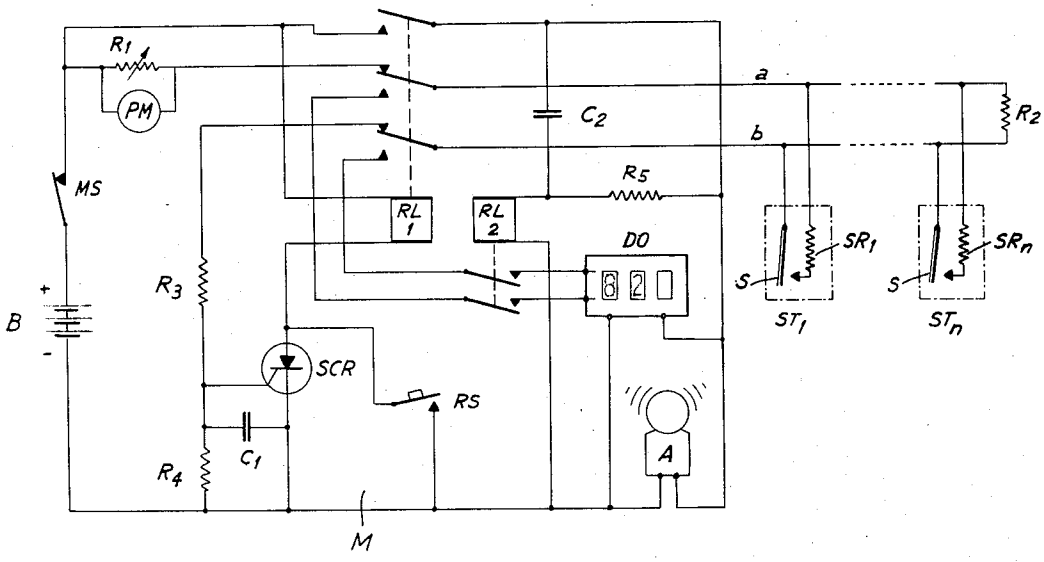
Primary Examiner—Harold I. Pitts

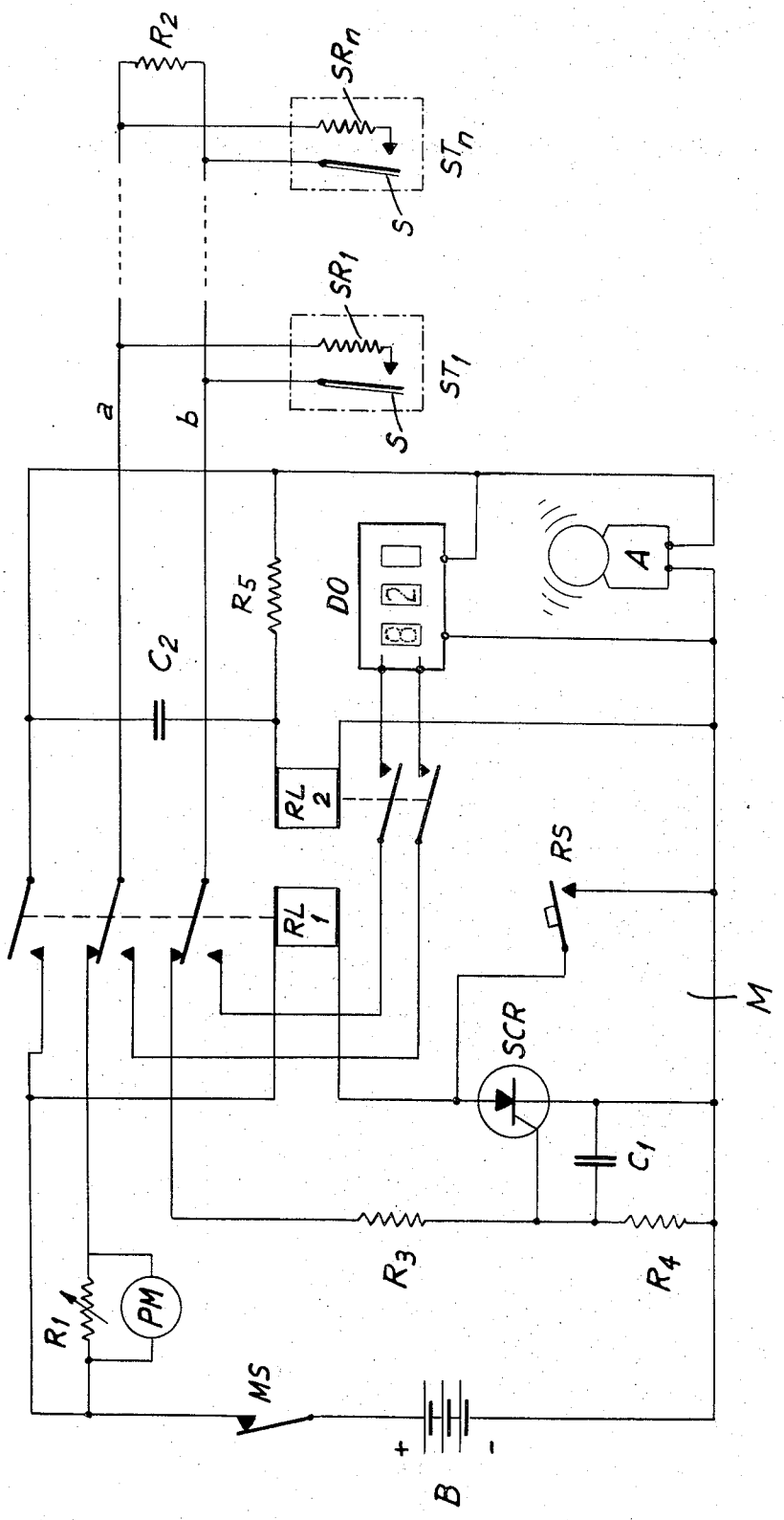
Attorney—Arthur Schwartz et al.

[57] **ABSTRACT**

A device for monitoring a plurality of remote stations for disorders in which a high-impedance station line circuit is shunted by a disorder-responsive station switch with a distinctive lower resistance, whereupon a relay actuates an alarm and switches the station line circuit into an ohmmeter circuit. The storage-type digital ohmmeter indicates the location of the responding station; its readout is blocked after receipt of the first reading.

12 Claims, 1 Drawing Figure




R2
SRn
STn
S
SR1
ST1
S
a
b
R5
DO
A
C2
RL 2
RL 1
RS
M
SCR
C1
R3
R4
R1
PM
MS
+
-
B

MULTI-STATION SAFETY MONITOR HAVING SHUNT SWITCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to remote monitoring devices, and in particular to electronically controlled multi-station safety monitoring devices the purpose of which is to signal to a central monitoring unit the occurrence of an irregular condition at any one of a plurality of remote monitoring stations while at the same time identifying the station involved.

2. Description of the Prior Art

The use for multi-station monitoring and signalling devices is a long-standing one, and numerous solutions have been proposed in the past for purposes such as fire detection, water-detection, break-in detection, etc.

One such prior art solution discloses an automatic fire alarm system wherein several remote stations are monitored for excessive heat development. The electronic circuit used in this case includes in each station a resistor with a characteristic impedance value, all the resistors being connected in series with a DC power source and a meter. Each resistor is normally shunted by a heat-responsive, normally closed switch, so that a maximum current flows under normal conditions. The interposition of the impedance of a responding station lowers the meter reading by a certain amount, thereby indicating the location of the disorder. It may also activate an alarm and/or other automatic responses. This device has the serious disadvantage of a continuous high power consumption, and it does not show the correct location of the disorder, should two or more stations respond before a visual reading on the meter has been made.

Another prior art device serving as a burglar alarm system has a circuit with a pair of parallel resistors at each remote station (point of entry), the station being again connected in series with a power source and a meter. Each pair of resistors is shunted by a normally open movement-responsive switch. Thus, the line current is either reduced, by breaking the line or eliminating a resistor through tampering, or is increased by operating a station switch through the movement of a door or window, etc. This circuit is comparatively complex and suitable only for a limited number of stations. Its power consumption is considerable.

Other prior art devices have been used for remote reading of the displacement positions of a moving part, the stations being located at fixed intervals on the moving part or on a fixed part along its path. Each station includes a resistance in a series circuit with a power source and a meter. A position-responsive reed switch in each station, when actuated, shunts out a given number of resistances characteristic of the location of the station. This circuit requires accurate values for all resistances to avoid cumulative errors.

SUMMARY OF THE INVENTION

It is a primary objective of the present invention to provide an inexpensive, reliable multi-station monitoring device in which the above-mentioned short comings are absent and which is capable of reliably monitoring a large number of remote stations with a minimum of power consumption.

In order to accomplish this objective, the invention utilizes a circuit in which the normal circuit condition requires an extremely small current flow through the station lines, the current being signalled by a microammeter. A response from one of the monitoring stations introduces a discrete resistance in parallel with the station lines via a normally open switch, and the resultant surge in current operates a relay which switches the station lines away from the microammeter circuit to an ohmmeter circuit and simultaneously actuates suitable alarm means.

The ohmmeter in the central monitoring unit preferably gives a digital readout, thereby directly signalling the number of the responding station. A further refinement of the invention consists in the use a storage-type ohmmeter and in disconnecting the station lines immediately after the first station reading is registered on the ohmmeter. This feature prevents a possible misreading of the location of the responding station in the event of two or more stations responding within a short interval, i.e. before the first-received signal could be read on the ohmmeter.

BRIEF DESCRIPTION OF THE DRAWING

Further special features and advantages will become apparent from the description below, when taken together with the accompanying drawing which illustrates, by way of example, an embodiment of the invention.

The FIGURE illustrates, in the form of a schematic circuit diagram, a multi-station safety monitoring device embodying the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The circuit diagram of the preferred embodiment of the invention comprises a central monitoring unit M and a plurality of remote monitoring stations represented by the two end stations ST_1 and ST_n. The monitoring stations $ST_1 \ldots ST_n$ are placed at successive remote locations in a particular system which is to be supervised for spontaneous irregularities occuring in the vicinity of the stations. Among systems susceptible to such multi-station monitoring are, for example, large buildings, complex machinery systems, traffic systems, mining systems and others. The individual stations may be set to respond to either a surge in temperature (e.g. fire), a change in humidity (or water level), a sudden change in light intensity (e.g. interrupted photo-cell beam), a movement of an object (e.g. forced entry), the occurrance of excessive material strain (e.g. overload machinery components), or any other potentially damaging disorder.

The remote stations are linked together by a pair of conductors, station lines *a* and *b*, in a parallel circuit which is fed from a battery B via a main switch MS, a variable resistance R, with a parallel panel meter PM, a line resistance R_2, and two additional resistances R_3 and R_4. Each station includes a normally open switch S and a station resistor of characteristic resistance value SR_1, $SR_2 \ldots SR_n$ which, when connected across stations lines *a* and *b* by a switch S in response to a disorder, places in the line circuit a resistance value from which the location of the responding station can be determined. Number and values of the station resistances $SR_1 \ldots SR_n$ are without influence on the current which is normally consumed by the line circuit. This current is kept to a minimum by a high resistance at R_2, thus greatly increasing the useful life of the battery. The

panel meter PM is a microammeter. Its purpose is to indicate the "on" condition of the line circuit and to visually signal any defect in the station line circuit, should one of the station lines *a* or *b* be interrupted accidentally.

The station line circuit also includes a parallel connection to a silicon-controlled rectifier SCR, the gate bias of which is determined by resistance R_4. A response from one of the monitoring stations, by greatly reducing the station line resistance, increases the bias on the SCR gate which responds by switching the relay RL_1 into the battery circuit. RL_1 is a double-throw relay and its actuation disconnects the station line circuit from the panel meter circuit, connecting the station lines *a* and *b* to a digital ohmmeter DO. The latter, as well as a suitable alarm unit A, are simultaneously switched into the battery circuit by relay RL_1 lines *a* and *b* remain in series with battery circuit through DO. The switching action also charges a capacitor C_2 whose charging current energizes a second relay RL_2. The latter is a single action relay which normally interrupts the station lines between the digital ohmmeter and relay RL_1. Thus, while RL_2 is energized, the battery circuit sends a current through the station lines via the ohmmeter, and the latter shows as a numerical resistance reading the number of the station which is signalling the disorder.

Relay RL_2 quickly falls again and the station lines a and b are disconnected from the central monitoring unit M, while the storage-type digital ohmmeter maintains its reading and the alarm is operating. This feature of the circuit assures that no false ohmmeter reading occurs, if, for some reason, a second station would respond before the alarm is heeded and the number of the first-responding station has been seen and recorded by an attendant. Such a multiple response, in order to be interpretable, would greatly limit the range of resistance values usable for the stations, and it would entail computation to find the location of trouble.

An attendant, called to the monitoring unit by the alarm A, can nevertheless easily ascertain whether the disorder has spread to other stations, by simply pressing the reset button RS. The reset switch actuates relay RL_1 to reconnect the station line circuit to the panel meter circuit. Release of the button RS reverses relay RL_1 again, thereby returning the station line circuit to the ohmmeter DO. Capacitor C_2, having previously discharged over a high-ohmage resitance R_5, is again charging and momentarily closing the relay RL_2 for a new reading by the digital ohmmeter DO.

The use of a digital ohmmeter for the differentiation between station locations gives a direct designation of the station involved. An additional advantage can be gained from its use when, for example in a three-digit ohmmeter, the lowest digit readout is eliminated, thereby allowing greater tolerances for the station resistances SR_1, SR_2 . . . SR_n, while giving a clear, unmistakable reading of the station location.

The two stations shown in the FIGURE of the drawing show, by way of example, bimetallic switches S which are set to close in the event of a temperature surge, caused by fire, for instance. It should be understood, of course, that more than one single kind of disorder may be monitored at any one station. Thus, in a mining installation, for example, each single monitoring station may have separate switches set to respond to heat buildup, to the presence of methane gas, and to water level. These station switches may be arranged in parallel to one another, in connection with a single station resistance, or they may be associated with separate distinctive station resistances, in which case the readout on the central monitoring unit also indicates the kind of disorder occurring. In this case, the last digit of the ohmmeter can be used as a code number for the distinction between the different kinds of disorders being monitored simultaneously.

Another version of the above consists in a station with multiple resistances whose switches are set to respond to different levels of the same disorder, instead of responding to different kinds of disorders.

It should be understood, of course, that the foregoing disclosure relates only to preferred embodiments of the invention, and that it is intended to cover all changes and modifications of the examples herein chosen for the pruposes of disclosure which do not constitute departures from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A multi-station monitoring device for detection of remote conditions comprising:

a. a central monitoring unit, including a power source,

b. a pair of station lines having a high resistance connected across one end and extending from said central unit to a plurality of remote locations and connected at the other end to said power source via two different connecting circuits in a central unit,

c. said central unit including a first connecting circuit having a signal means therein, and a second connecting circuit having an ohmmeter therein,

d. means for switching said pair of station lines from said first connecting circuit to said second connecting circuit including:

1. a first switching means being normally open and having means for closing same upon a current surge across said pair of station lines,

2. a second switching means controlled by the closing of said first switching means for electrically connecting said pair of station lines to said second connecting circuit,

e. a monitoring station at each remote location, each monitoring station including at least one normally open condition responsive station switch and a station resistance of a distinctive resistance value, each of said distinctive resistance values being much less than the value of said high resistance,

f. whereby said second switching means connects said pair of station lines to said first connecting circuit when all said station switches are open, the closing of one of said station switches causing a a current surge across said pair of station lines thus connecting said pair of station lines to said second connecting circuit and providing an indication on said ohmmeter commensurate with the value of the distinctive resistance value at the closed station switch.

2. A device as defined in claim 1, including an alarm unit which is operated when said second switching means switches said pair of station lines from the first connecting circuit to the second connecting circuit.

3. A device as defined in claim 1, wherein the signal means in the first connecting circuit is a sensitive microammeter, and the end resistance on the station lines

is correspondingly high to minimize power consumption when all station switches are open.

4. A device as defined in claim 1, wherein said first switching means in the first connecting circuit is a silicon-controlled rectifier.

5. A device as defined in claim 1, wherein the said pair of station lines lead to more than one type of disorder-responsive station switch, the different switches responding to different kinds of disorders.

6. A device as defined in claim 5, wherein two or more different disorder-responsive station switches are arranged at a single station.

7. A device as defined in claim 6, wherein the different switches in one station are arranged in parallel, controlling the same station resistance.

8. A device as defined in claim 7, wherein each station includes a distinct station resistance for each of its different disorder-responsive station switches, different kinds or levels of disorders thus giving a different readout on the ohmmeter in the second connecting circuit.

9. A device as defined in claim 1, wherein the ohmmeter in the second connecting circuit is of the storage type, and the second connecting circuit further includes means for disconnecting the ohmmeter from the station lines after receipt of a first resistance reading.

10. A device as defined in claim 9, wherein the ohmmeter is a storage-type digital ohmmeter and the distinctive resistance values of the several monitoring stations are chosen to give a numerical reading on the ohmmeter which is directly indicative of the relative location of each station.

11. A device as defined in claim 9, wherein the disconnecting means includes a normally open single-throw relay separating the station lines from the second connecting circuit and a series-connected capacitor closing the single-throw relay for the duration of capacitor charging, which begins when the second switching means connects the second connecting circuit.

12. A device as defined in claim 1, wherein said second switching means is a double-throw relay.

* * * * *