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(54) Fire alarm systems

(57) A fire alarm system has a main unit R and a plurality of sensor terminals D in accordance with a polling system. The plurality of sensor terminals D are divided into a plurality of groups. When a given sensor terminal D of a given group is accessed and transmits digital data as

response data indicating a smoke concentration or a temperature to the main unit R, and the response data exceeds a first reference value thereby indicating that a fire has probably broken out, the main unit R accesses other sensor terminals D of the given group. If some of the response data therefrom exceed a second reference value which is equal to or smaller than the first reference value, the main unit R counts the number of such sensor terminals D. When the number exceeds a predetermined number, the main unit R displays information indicating the existence of a fire.

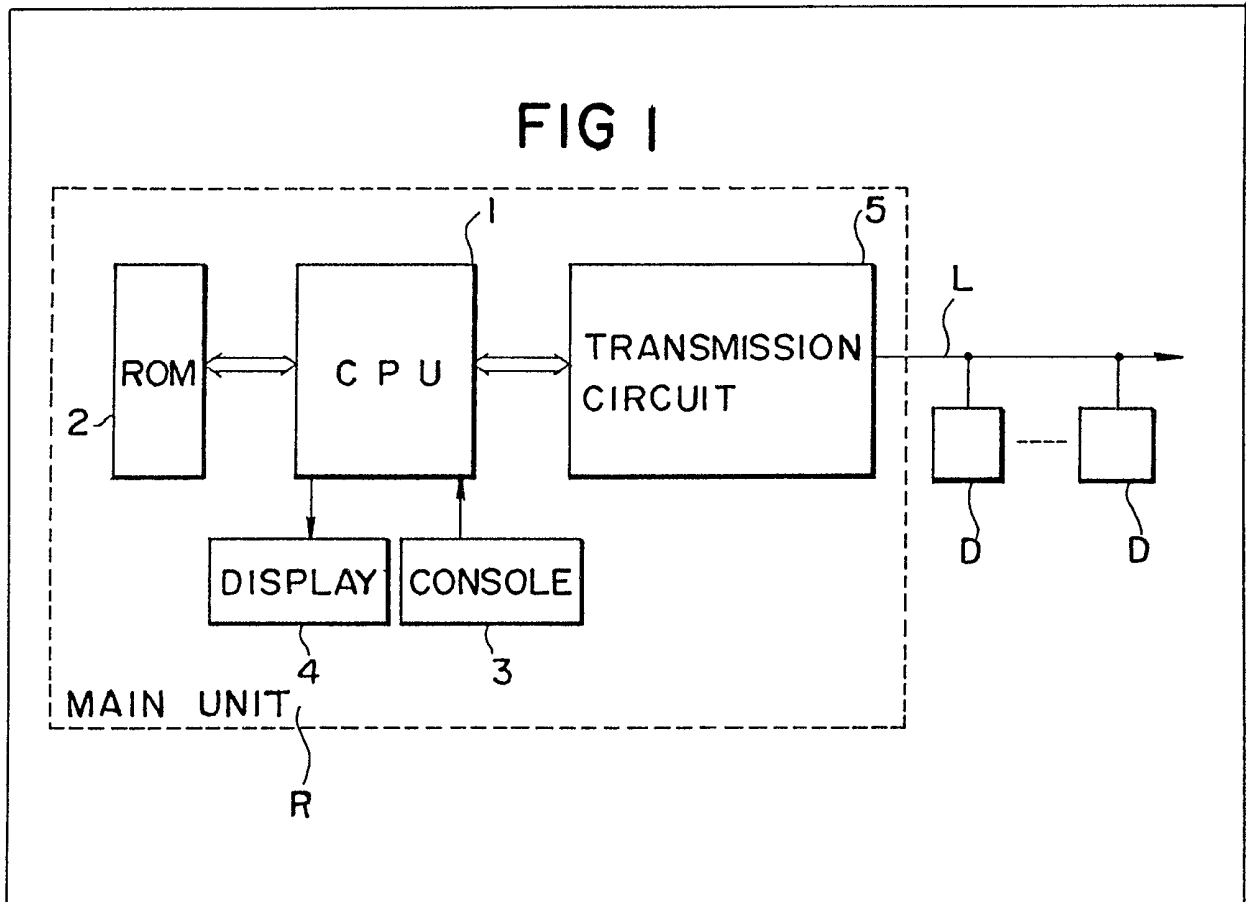


FIG. 1

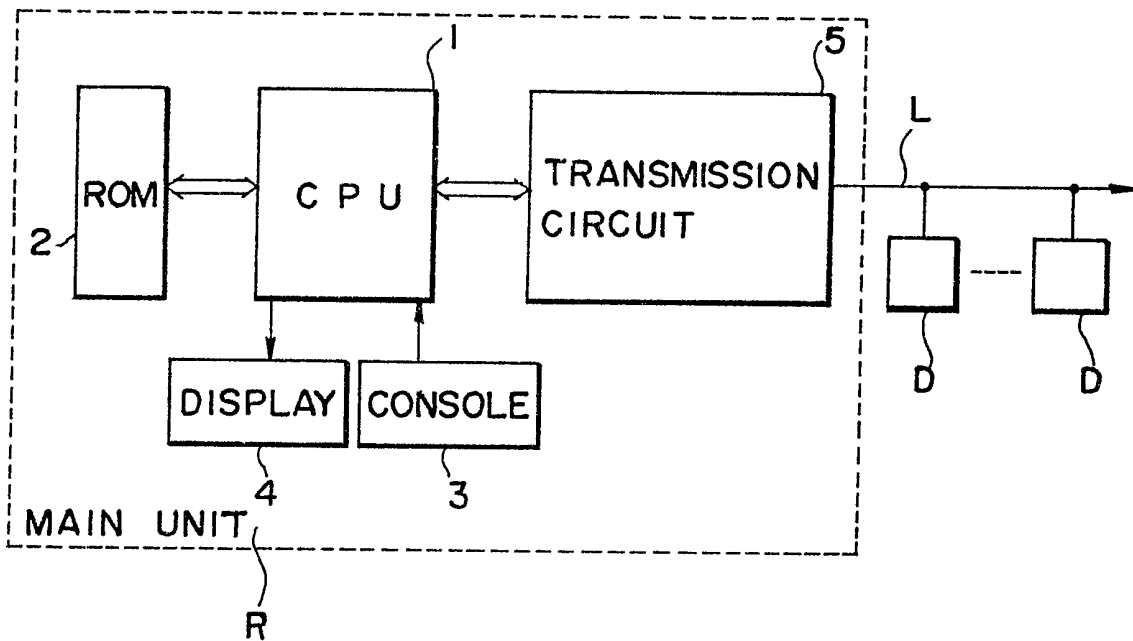
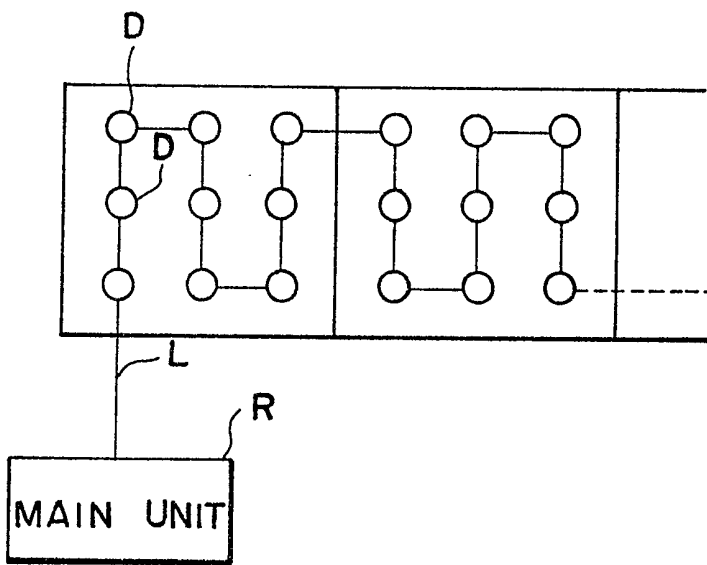


FIG. 2



SPECIFICATION

Fire alarm systems

This invention relates to fire alarm systems.

One known form of smoke sensor is operated
 5 when an analog sensor output corresponding to a
 smoke concentration exceeds a predetermined
 value. In a conventional fire alarm system, a
 plurality of smoke sensors of this type are
 separately connected to a transmission line. When
 10 any one of the smoke sensors detects a fire, this
 smoke sensor is operated to short circuit the
 transmission line, thereby signalling the existence
 of a fire to a main unit (central receiver) connected
 to the transmission line. However, the sensitivity
 15 of smoke sensors often varies, so that an
 erroneous alarm is generated or an alarm is not
 generated when it should be. Logic ANDing or
 ORing of the outputs from two smoke sensors can
 bring about some improvement, but sufficient
 20 reliability cannot be obtained.

In another known system, a sensor terminal
 does not itself determine whether or not a fire has
 broken out, but merely transmits to a main unit a
 digital signal obtained by converting an analog
 25 sensor output. The main unit then compares the
 digital signal with a predetermined value so as to
 detect whether or not a fire has broken out. In this
 case, variations in the sensitivity of the smoke
 sensors make it difficult for the main unit to
 30 perform the detection reliably.

According to the present invention there is
 provided a fire alarm system comprising:
 a plurality of sensor terminals separately
 connected to a transmission line, each of said
 35 plurality of sensor terminals being arranged to
 transmit digital data as response data by
 converting an analog sensor output indicating one
 of a smoke concentration and a temperature,
 when each said sensor terminal is accessed by an
 40 address signal corresponding respectively to an
 address of each said sensor terminal; and
 a main unit, connected to said plurality of
 sensor terminals through said transmission line,
 for cyclically accessing said plurality of sensor
 45 terminals and for comparing the response data
 from each said sensor terminal with a first
 reference value;

wherein said plurality of sensor terminals are
 divided into a plurality of groups, said main unit
 50 compares the response data from a given said
 sensor terminal of a given group with the first
 reference value and compares the response data
 from the other said sensor terminals in the same
 group as said given sensor terminal but excluding
 55 said given sensor terminal with a second reference
 value which is smaller than the first reference
 value when the response data from said given
 sensor terminal exceeds the first reference value,
 and said main unit determines that a fire has
 60 broken out when the number of said sensor
 terminals supplying the response data exceeding
 the second reference value is greater than a
 predetermined number, and thereafter displays
 information indicating the existence of a fire.

65 The invention will now be described by way of
 example with reference to the accompanying
 drawings, in which:

Figure 1 is a block diagram showing the overall
 configuration of an embodiment of fire alarm
 70 polling system according to the invention; and

Figure 2 is a representation showing an
 example of show sensor terminals are grouped in
 the embodiment.

Referring to Figure 1, a plurality of sensor
 75 terminals D are separately connected to a
 transmission line L. Specific addresses are assigned
 to the respective sensor terminals D. A central
 processing unit (CPU) 1 in a main unit (control
 receiver) R is connected to the transmission line L
 80 through a transmission circuit 5. The CPU 1
 cyclically accesses the sensor terminals D in
 response to address signals generated in
 accordance with a program stored in a read-only
 memory (ROM) 2. Each accessed sensor terminal
 85 D causes an analog-to-digital (A/D) converter to
 convert an analog sensor output to a digital signal
 as response data. The response data is
 transmitted from this sensor terminal D to the CPU
 1. The CPU 1 compares the response data with a
 90 predetermined value (reference value) and
 determines whether or not a fire has broken out.
 When the CPU 1 determines that a fire has broken
 out, the CPU 1 causes a display 4 to display
 information indicating the existence of a fire and
 95 to generate an audible alarm. Furthermore, the
 CPU 1 performs subsequent required operations.
 For example, the CPU 1 causes smoke exhaust
 equipment to start operation. The CPU 1 can
 access a specific sensor terminal upon entry of a
 100 command at a console 3, and can perform any
 other required operation. However, it is impossible
 to identify variations in the sensitivity of the
 sensor terminals.

In the embodiment, the sensor terminals D are
 105 divided into a plurality of groups. Figure 2 shows
 the system configuration wherein nine sensor
 terminals D installed in the same room or other
 such space are included in one group. Grouping
 can readily be performed by a reference data table
 110 indicating a correspondence between a group
 number and addresses of the sensor terminals D
 represented by this group number. The reference
 data table can be stored in the ROM 2. In this
 embodiment, in addition to a first reference value
 115 for indicating that a fire has broken out, a second
 reference value is also provided to indicate a pre-
 alarm level. During the period in which the sensor
 terminals D are cyclically accessed by the CPU 1
 and the response data are compared with the first
 120 reference value, when the response data from a
 given sensor terminal D in a given group exceeds
 the first reference value, the CPU 1 checks how
 many response data from the other sensor
 terminals D in the given group exceed the second
 125 reference value. In this case, data of the number of
 sensor terminals D supplying response data
 exceeding the second reference value can be pre-
 stored in the internal memory of the CPU 1 during
 each access operation of a terminal group.

Alternatively, after a sensor terminal D supplying response data exceeding the first reference value is detected, the other sensor terminals D included in the same sensor terminal group can be re-accessed. These two selections may be determined in accordance with different program configurations.

When the number of sensor terminals D in the given group having response data exceeding the second reference value is greater than, for example, three, the CPU 1 determines that a fire has broken out and causes the display 4 to display fire indication information and generate an audible alarm. Furthermore, operation of the smoke exhaust equipment is started. When a fire has actually broken out, the response data exceeding the second reference value is generally obtained from, for example, at least three sensor terminals D, even if variations in sensitivity of the sensor terminals D are present. In practice, the second reference value is pre-set such that the response data exceeding the second reference level is obtained from at least three sensor terminals D. Even if one or more of the sensor terminals D is malfunctioning, at least three sensor terminals D will properly supply response data exceeding the second reference value, thereby preventing the system from non-signalling.

On the other hand, when the response data from only one of the sensor terminals D exceeds the first reference value due to an abrupt or abnormal increase in temperature, the response data from any other sensor terminal D included in the same group will not exceed the second reference value, thereby preventing the system from producing an erroneous alarm. However, the above-mentioned states must be displayed at the display 4 and must be stored in a memory such as a random access memory for maintenance and inspection procedures. Furthermore, when data of the number of sensor terminals D supplying response data exceeding the second reference value is stored in the memory, it can be utilized properly to reconsider the setting of the first reference value.

In the above embodiment, the second reference value is a single predetermined value. However, a plurality of reference values may be used so as to correspond to the respective terminal groups. In the above embodiment, the first reference value is greater than the second reference value. However, the first reference value may be equal to the second reference value.

In this embodiment, when a given sensor terminal D of a given group supplies response data which exceeds the first reference value, the CPU 1 checks how many other sensor terminals D in the given group supply response data exceeding the

second reference value, thereby determining whether or not a fire has actually broken out. As a result, an erroneous alarm and non-signalling can be prevented, so that a highly reliable fire alarm system can be obtained.

CLAIMS

- 1. A fire alarm system comprising:
 - 65 a plurality of sensor terminals separately connected to a transmission line, each of said plurality of sensor terminals being arranged to transmit digital data as response data by converting an analog sensor output indicating one of a smoke concentration and a temperature, when said sensor terminal is accessed by an address signal corresponding respectively to an address of each said sensor terminal; and
 - 70 a main unit, connected to said plurality of sensor terminals through said transmission line, for cyclically accessing said plurality of sensor terminals and for comparing the response data from each said sensor terminal with a first reference value;
 - 80 wherein said plurality of sensor terminals are divided into a plurality of groups, said main unit compares the response data from a given said sensor terminal of a given group with the first reference value and compares the response data from the other said sensor terminals in the same group as said given sensor terminal but excluding said given sensor terminal with a second reference value which is smaller than the first reference value when the response data from said given sensor terminal exceeds the first reference value, and said main unit determines that a fire has broken out when the number of said sensor terminals supplying the response data exceeding the second reference value is greater than a predetermined number, and thereafter displays information indicating the existence of a fire.
 - 85 2. A system according to claim 1 wherein the first reference value is equal to the second reference value.
 - 90 3. A system according to claim 1 wherein said sensor terminals supplying the response data exceeding the second reference value are preset in a memory.
 - 95 4. A system according to claim 1 wherein said sensor terminals supplying the response data exceeding the second reference value are detected after said given sensor terminal in the same group which supplies the response data exceeding the first reference value is detected by said main unit.
 - 100 5. A fire alarm system substantially as hereinbefore described with reference to the accompanying drawing.