(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 148 949**
A1

(12) # EUROPEAN PATENT APPLICATION

published in accordance with Art. 158(3) EPC

(21) Application number: **84901398.2**

(22) Date of filing: **29.03.84**

Data of the international application taken as a basis:

(86) International application number:
PCT/JP84/00146

(87) International publication number:
WO84/03976 (11.10.84 84/24)

(51) Int. Cl.[4]: **G 08 B 17/06**
G 08 B 17/10

(30) Priority: **31.03.83 JP 53900/83**

(43) Date of publication of application:
24.07.85 Bulletin 85/30

(84) Designated Contracting States:
BE CH DE FR GB LI

(71) Applicant: **Nohmi Bosai Kogyo Co., Ltd.**
No. 7-3, Kudanminami 4-chome Chiyoda-ku
Tokyo 102(JP)

(72) Inventor: **OKAYAMA, Yoshiaki Nohmi Bosai Kogyo Co., Ltd.**
7-3, Kudanminami 4-chome
Chiyoda-ku Tokyo 102(JP)

(74) Representative: **Grieskamp, Johannes Peter**
Patentanwaltsbüro Hannspeter Grieskamp Im Baumgarten 7
CH-8123 Ebmatingen(CH)

(54) **FIRE SENSOR APPARATUS.**

(57) A fire sensor apparatus is provided with a fire sensor which has a built-in microcomputer and in which fire detection levels can be varied according to changes in environmental conditions (noise level) in the area in which it is installed. A signal from a sensor (1) is digitized in an A-D converter (3) and is input to a comparator (12). A CPU (5) determines the current time from a clock (4) and removes from a memory accumulated data on operating leveland noise level at the corresponding time in the past. The CPU (5) sets an operating level for the time concerned by executing a predetermined calculation, and compares this operating level with the signal from the sensor (1). An abnormal state is indicated at (14) or the accumulated data is renewed, according to the result of the comparison. Thus it is possible to set an appropriate operating level according to changes in noise level, and fire detection can be effected with a suitable detection sensitivity.

EP 0 148 949 A1

./...

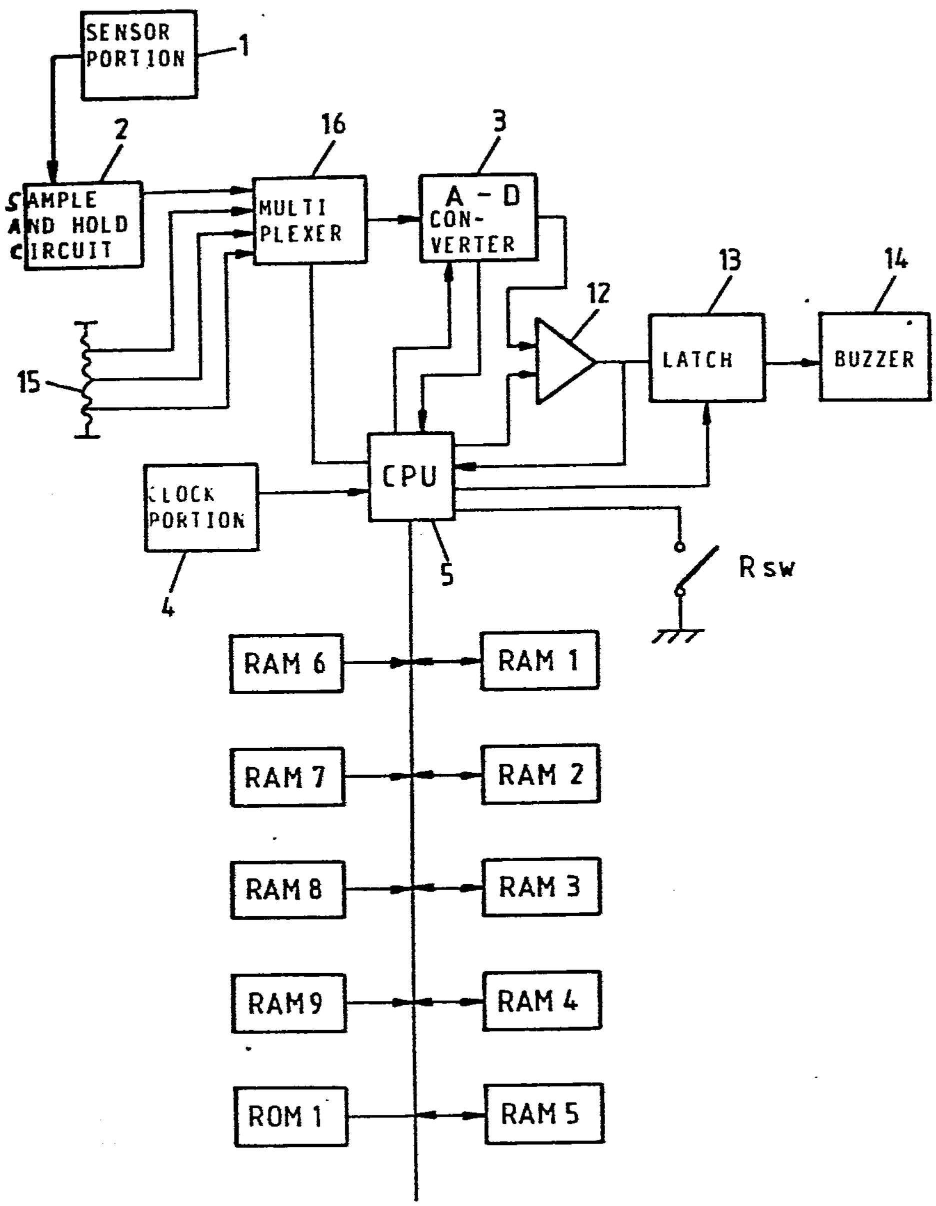

SENSOR PORTION
1
2
16
3
SAMPLE AND HOLD CIRCUIT
MULTI PLEXER
A - D CON-VERTER
12
13
14
LATCH
BUZZER
15
CPU
CLOCK PORTION
5
4
Rsw
RAM 6
RAM 1
RAM 7
RAM 2
RAM 8
RAM 3
RAM 9
RAM 4
ROM 1
RAM 5

FIG. 4

SPECIFICATION

TITLE MODIFIED
see front page

FIRE SENSING APPARATUS

The present invention relates to a fire sensing apparatus, and more particularly it relates to a fire sensing apparatus having a microcomputer built-in to the fire sensing means whereby a fire detecting level is varied in response to variations in the environmental conditions at the installation site so that a fire can be continuously detected with an appropriate fire detection sensitivity.

Environmental conditions at the site of installing a fire sensing means is different according to time period, day of the week or the seasons. In considering this matter in terms of a normal room of an office, where in cotrast to the daytime where people are going in and out causing dust to float in the room, at night there is little dust floating in the room because there is no one in the room. Also, even during the same day, during these times when many people go in and out, such as opening hours, closing hours, lunch time etc. the amount of floating dust is naturally increased compared with times other than these. Further, whereas there is much floating dust in commuting areas during normal work periods from Mondays to Saturdays, the amount of floating dust is remarkably decreased on Sundays because the coming and going of people are few except at weekend resorts. If, as is conventional, a smoke type fire sensing means such as an ionization type or a light scattering type operable, for example, at 10 % smoke density is installed in such a commuting area, this sensing means will operate at a smoke density of about 10 % because there is little floating dust at night or on Sundays in the area, but on the contrary the fire sensing means will actually operate for a smoke density of 10 % down to a few % because there is so much floating dust in the daytime from Monday through Saturday that this amount of floating dust is equivalent to a few % of smoke density, and therefore the smoke density for operating the fire sensing means in the daytime is different from that in the nighttime.

Moreover, when considering seasonal room temperatures, in the summer period, the room temperature is kept at about 25°C by coolers operating in the daytime, but the room temperature rises up to aobut 30°C when the coolers are stopped at night, and in the winter, the room temperature is kept at about 20°C by heaters operating in the daytime, but lowers to mearly 0°C when the heaters are stopped at night. In cases where a fixed temperature type fire sensing means operating at 70°C is set up in such a room, this fire sensing means will operate after an increase of room temperature of about 40°C on a summer night, but an increase of about 70°C is necessary on a winter night.

Thus, regarding a conventional fire sensing means having a fixed fire detection sensitivity, because of the environmental conditions which vary according to time period, day of the week and seasons of the place of installation, its relative fire detecting sensitivity varies from time to time, and it is not able to detect a fire at a continuously constant sensitivity, and consequently, false alarms, delayed alarms or failure alarms will occur. This holds true even for fire sensing means for catching gas, light etc. which are generated besides smoke and heat in case of a fire. Moreover, there is also a conventional fire sensing means having 2 or 3 measuring levels which is used by switching said levels. In this case, however, there are very many problems such as the following. A receiver having a timer is set to a previously scheduled time period such as daytime and nighttime, and set so as to continuously keep the sensitivity by automatically switching the sensitivity with a command signal from the receiver. However, there are very many problems such as even if the sensitivity is previously set for the variation in the environment in which the fire sensing means is to be installed, the best sensitivity level is not always obtained, and when the intended use of the place of installation or the partitioning of the room is changed or when there is remarkable environmental variations such as the seasons and the like, the setting of the sensitivity level must be modified each time. Taking account of such the matters as above, it is an object of the present invention to obtain a fire sensing apparatus which can detect fire with a continuously appropriate fire detecting sensitivity by means of varying fire detection level in response to the variations in the environmental conditions at the place of installation by the computation of a CPU.

For this purpose, the fire sensing apparatus of the present invention has a microcomputer built in, physical amounts of phenomena similar to a fire phenomenon which are noise components periodically measured by the microcomputer, and are stored as accumulated data, and the amount of environmental noise, for example the average of the noise components, being forecast at the moment at each time period or at each time period for the days of the week on the basis of previously stored data, and then the fire detecting level is varied at each time period by determining the set sensitivity corresponding to the average values of said noise components, thereby eliminating the variations in fire detection sensitivity.

Now, one embodiment of the present invention will be concretely explained with reference to the drawings.

Fig. 1 is a block diagram illustrating the basic construction of a fire sensing means according to the present invention. In Fig. 1, the construction of the fire sensing means currently on the market can be employed, and therefore, only a sensor portion 1 of the fire sensing means and an amplifier 1' for properly amplifying its output are described in this figure. In Fig. 1, 1 is a sensor portion for producing an analog output by means of detecting phenomena of a fire such as heat, smoke, light or gas or the phenomena of a fire and temperature change or change in the amount of dust, 1' is an amplifier for properly amplifying the output from the sensor, 2 is a sample-hold circuit by which the analog output as the output value of the amplifier 1' is sampled and held at predetermined time intervals, for example, every 2 seconds, 3 is an A-D converter which converts said sample-held analog signal to a digital signal to be read by CPU 5, 4 is a clock portion, 5 is a CPU which is the main portion of a microcomputer, 6 - 9 are respectively a 1st through a 4th memory, and 10 is a signal generating circuit for outputting a fire signal under control of CPU 5. Here the allocation of the four memories is explained as one embodiment. The 1st memory 6 and the 2nd memory 7 consist of ROMs. Control programs are stored in the 1st memory 6, and a fire recognition lelvel when there is no noise component, or a temporary reference level at the starting time point, are stored in the 2nd memory as the standard value together with the time for storing the data and the time for updating the reference value. Also, the 3rd memory 8 and the 4th memory 9 consist of RAMs, and they are respectively employed as temporary staring memories. The 3rd memory 8 is employed as a memory for storing a reference value which is the fire recognizing level, and the 4th memory 9 is employed as a memory for storing the data classified by a day of the week and time, the storing locations thereof being shown in Fig. 3.

Next, Fig. 2 is a flow-chart for explaining the operation of Fig. 1. When a source voltage is provided to a fire sensing means through some power lines or signal and power lines from a receiver or a transmitter, the fire sensing means having a built-in microcomputer starts its function.

CPU 5 starts the operation according to the steps shown in Fig. 2 by means of control programs in the 1st memory 6. In the 1st step S1, CPU 5 clears the contents of the 3rd memory 8 and of the 4th memory 9, and sets the initial values of the registers and the like in CPU 5.

Next, in the 2nd step S2, the standard value is read out of the 2nd memory 7, and this standard value is stored as the reference value into the 3rd memory 8 for the reference value. By means of this process, the initial reference value of the fire sensing means, namely the initial fire detecting level, is determined. Besides, in case that this fire sensing means is a smoke-type one and its sensor portion 1 consists of an ionization-type one or a light scattering-type one, the standard value is set at 10 % so that the fire sensing means determines a fire if, for example, it is a situation where there is 0 % dust and 10 % smoke.

Moreover, in the 3rd step S3, CPU 5 reads the output data of the sensor 1, so CPU 5 sends a holding instruction to a smaple-hold circuit 2 for the purpose, and the sample-hold circuit 2 samples and holds the output of the sensor 1 according to this holding instruction, and then the hold signal is outputted to CPU 5 after the completion of the holding operation. Next, CPU 5 outputs the converting instruction to an A-D converter 3, and according to this instruction, the A-D converter 3 converts the analog output signal of the sensor portion 1 being held in the sample-hold circuit 2 to a digital signal, and then the conversion completion signal is outputted to CPU 5 after the completion of the converting operation. According to the application of the conversion completion signal, CPU 5 reads the output data of the sensor portion 1 being converted to the digital signal from the A-D converter 3.

Furthermore, in the 4th step S4, CPU reads the reference value from the 3rd memory 8, and compares this reference value with the output data previously read in said 3rd step S3 to determine whether a fire has occurred or not. In case the data is ≥ the reference value, the step shifts to the 5th step S5 in a fire condition, and in case of data is < the reference value, the step shifts to the 6th step S6 by determining that it is a normal condition.

Thus, in case of shifting to the 5th step, CPU 5 outputs the fire signal transmitting instruction to a signal generating circuit 10, and the signal generating circuit 10 outputs the fire signal to a receiver, a transmitter and so on.

Also, when shifting to the 6th step S6, CPU 5 reads the day of the week, time and so on from a clock portion 4 to determine whether or not that time matches the data storing time stored in the 2nd memory 7. If by chance that time matches, in the 7th step S7, CPU 5 stores the output data of the sensor portion 1 read in the 3rd step S3 into a predetermined location of the 4th momory 9 according to the data of the day of the week and time read in the 6th step S6. Fig. 3 shows an example of storing in the 4th memory 9, which is made up so that the data for 4 weeks can be stored every 2 hours of each day of the week. If the current time is 3 o'clock on a Monday, the data of the sensor portion 1 is stored into the 1st week zone of the Monday, 3 o'clock region. At this time, if this storing region is entirely filled up from the 1st week zone to the 4th week zone, the data in the 4th week zone is cleared, and all the data in the 1st week zone through the 3rd week zone is shifted by one week zone, and then the latest data is stored into the 1st week zone. The updating of the data is carried out by this process.

Continuously, in the 8th step S8, CPU 5 reads the day of the week and time from the clock portion 4, and distinguishes whether that time has reached the time for updating the reference value stored in the 2nd memory 7. The times for updating the reference value, for example, the even-numbered hours every 2 hours, are stored in the 2nd memory 7. Namely, switching of the sensitivity is carried out at the even-numbered time so that computing is performed on the basis of the data at 1 o'clock during the interval of 0 - 2 o'clock and on the basis of the data at 3 o'clock during the interval of 2 - 4 o'clock.

Consequently, when the time for updating the reference value arrives, CPU 5 reads from the 4th memory 9 the accumulated data in the past corresponding to the data of the week and time read in the 8th step S8, and computes the latest reference value. For example, if it is 4 o'clock on Monday, the data of the past 4 weeks is read out of the 5 o'clock, Monday memory region in the 4th memory 9, and then the average value during the 4 weeks is computed according to the 4 weeks of data read out. This average value can be obtained, if necessary, by means of a simple average or a weighted average, and this computed result becomes the average value of the noise component during 4 weeks in the past. Next, the standard value is read out of the 2nd memory 7, and the reference value for distinguishing fire in the corresponding time period can be obtained by adding the average value to this standard value.

Finally, in the 10th step S10, the CPU 5 stores the previously described reference value obtained in the former 9th step S9 into the 3rd memory 8 as the latest reference value, and returns to the former 3rd step. The operation is performed by means of such a loop as described above.

Moreover, if the power supply from the power line or the signal/power line is interrupted, CPU 5 stops its operation, and consequently the function of the fire sensing means is stopped.

In the description above, although the reference value to be initially stored into the 3rd memory 8 was set to be the standard value (for example, 10 %) which is the fire sensing level when the noise component is zero, it is also able to determine the initial set value comprizing the noise component being expected beforehand (for example, 12 %) that differs from the standard value, and then this initial set value may also be made to be stored into the 3rd memory 8. Also, in case the sensor portion 1 is a temperature sensor, for example, 70°C can be selected as the initial set value and 50°C as the standard value.

Furthermore, the time for storing the data can be made to be the same time as that for updating the reference value.

Moreover, as the average value, besides a simple average or a weighted average, an average may be obtained by excluding the maximum and minimum data from the accumulated data for the average value and the average may also be obtained by adding the simple average value or the weighted average value to a value α times the difference between the maximum value and the minimum value (constant $\alpha > 0$). Next, Fig. 4 is the constructional diagram of another embodiment, and the portions corresponding to those of Fig. 1 are shown with the same signs. In this case, when the power source is turned on, the operation of the fire sensing means is started by the control program stored in ROM 1 and the set sensitivity for the fire sensing means is stored into a RAM. Namely, since the upper limit set value, the initial reference set value and the lower limit set value are produced by the divided voltage of resistance 15, CPU 5 serially switches the inputs to the multiplexer 16, and these analog signals are respectively converted to digital signals by means of the A-D converter 3, and then they are respectively stored into RAM 1, RAM 2 and RAM 3.

Also, the memory content of RAM 8 storing the accumulated data is entirely cleared, and also the memory contents of RAM 4, RAM 5 and RAM 6 respectively storing the maximum value, the minimum value and the average value are cleared.

Upon the completion of the setting and clearing of these memories, the sensing means starts to read the output from the sensor portion 1 at the predetermined intervals. To continue the description further, the output from the sensor portion 1 is amplified through an amplifier, and the output value is held by the sample and hold circuit 2. This output is converted from an analog signal to a degital signal through the multiplexer 16 which switches the set values described before. The conversion being completed, a conversion completion signal is sent to CPU 5. CPU 5 receives the digital signal from the A-D converter 3 as the data, and inputs the data to the temporary holding memory RAM 9. Still more, in this case, it is assumed that CPU 5 employs 10 memories including 9 RAMs, RAM 1 - RAM 9, and 1 ROM 1. CPU 5 reads the current time and the day of the week from the clock portion 4, and reads the data, as data 8, at the address corresponding to the current time and the day of the week of the memory RAM 8 for the accumulated data.

If there is no accumulated data in the data 8, the initial reference set value is sent to the digital comparator 12 as the signal from RAM 2. In case that there is accumulated data in the data 8, the uppper limit value and the lower limit value of the operation level are respectively read out of RAM 1 and RAM 3 as data 1 and data 3. And also, the maximum value and the minimum value of the environmental noise level are respectively read from RAM 4 and RAM 5 as data 4 and data 5. And in case of data 4 = data 5, the initial reference set value is sent as the signal to the digital comparator 12 from RAM 2. On the other hand, in case data 4 $\neq$ data 5, at first, the ratio between the permissible range of the operating level determined by the upper limit value (data 1) and the lower limit value (data 3) of the operating level, and the maximum noise level based on the maximum value (data 4) and the minimum value (data 5) of the accumulated environmental noise is computed by means of $\left(\frac{\text{data 1 - data 3}}{\text{data 4 - data 5}}\right)$. This result is regarded as data 10. Next, the initial reference set value and the average value of the accumulated data in the past are respectively read from RAM 2 and RAM 6 as data 2 and data 6, and then the current set operating level is determined by the expression "data 2 + β x data 10 x (data 8 - data 6)". This result is regarded as data 11. In this connection, β is a constant ($0 < \beta \leq 1$). By this process, the current operating level can be obtained according to the environmental noise which is anticipated by the accumulated data of the past.

Then, CPU 5 provides the data 11 to the digital comparator 12 as the signal. On the other hand, since the output of the A-D converter 3 is latched and also held to be constant during the processing time by CPU 5, the digital comparator 12 compares the sizes of numbers at this time. In case that the data of the A-D converter 3 is larger than the data 11 which is the computed output of CPU 5, the output of the digital comparator 12 shifts from the level H to the level L, thereby the latch circuit 13 operates to hold the level L. Still more, the latch circuit 13 may be considered to be a switching circuit, and the buzzer 14 to be a receiver, and in this case, the buzzer 14 is sounded to tell of an abnormal condition. Since the output of the digital comparator 12 varied from level H to level L, CPU 5 determines that the operating level is exceeded, the data averaging and the data accumulating are not processed, but the data reading from the sensor portion 1 continues. When the reset switch RSW is turned on, the latch circuit 13 is reset to release the latching operation. Still more, if the output of the A-D converter 3 becomes less than the sensitivity level, the output of the digital comparator 12 returns to level H, so CPU 5 commences the conventional processing in the memory.

When the digital comparator 12 does not change remaining in the H level, CPU 5 determines that the operating level has not been attained, and the data in RAM 9 storing the current data is applied to the averaging memory RAM 7, CPU 5 determines whether or not it is time to totalize the data in the time period according to the data from the clock portion 4, and if it is the totalizing time, data 7 is produced by averaging the data in RAM 7, the data then being read out at the predetermined address of RAM 2 in which the past accumulated data corresponding to the time and the day of the week of the current time point has been entered. And then, these data 8 and data 7 are averaged at a certain weighted ratio, for example at the ratio of 1: 2, and this result is stored into the corresponding address of RAM 8 as the latest accumulated data only when that said result does not exceed the lower limit value stored in RAM 3. If it does exceed, the data of RAM 3 is stored.

Then, after the examination of all the data in RAM 8, the maximum value and the minimum value are respectively stored into RAM 4 and RAM 5. Still further, the control programs, the initial set value, the data totalizing times and so on are stored into ROM 1. In this way, as time passes, since the contents of the accumulated past data are changed, and the maximum value and the minimum value of the environmental noise are varied, the sensitivity level can be appropriately modified for each day of the week and each time period in response to the environment in which the sensing means is installed. Further, Fig. 5 shows the memory map for CPU 5 in Fig. 4. Also, Fig. 6 is the main flowchart of the employed software, Figs. 7a - 7g are flowcharts of the subroutines; Fig. 7a is an example of an initial setting program, Fig. 7b is an example of a sensor input reading program, Fig. 7c is an example of a time reading program, Fig. 7d is an example of a fire operating program, Fig. 7e is an example of a fire restoring program, Fig. 7f is an example of a program for computing the set sensitivity, Fig. 7g is an example of a program for updating the accumulated past data. Finally, Fig. 8 shows examples of the set level with the passage of time; where Fig. a shows the case of a conventional sensing means, and Fig. b shows the case of the embodiment in Fig. 4.

From the description above, by means of the fire sensing means according to the present invention, the set sensitivity at the current time is determined on the basis of the stored accumulated past data of the emvironmental noise where the fire sensing means is installed, and therefore, when the environmental noise varies according to time, the sensitivity is made to be dull if the noise level is high and the sensitivity is made to be high if the noise level is low, so that its own sensitivity is automatically regulated, and therefore the appropriate fire detection sensitivity can alway be maintained by eliminating the influences of the seasons, the surrounding temperature and so on.

Brief Description of the Drawings

Fig. 1 is a block diagram showing the basic consruction of the fire sensing means of the present invention, Fig. 2 is a flowchart for describing the operation of Fig. 1, Fig. 3 is a schematic diagram showing the store locations of the 4th memory in Fig. 1, Fig. 4 is a constructional diagram of another embodiment, Fig. 5 is a memory map for CPU 5 in case of Fig. 4, Fig. 6 is an illustrated main flowchart of the employed flowcharts, Figs. 7a - 7g are respectively illustrated flowcharts for the subroutines, Figs. 8a and 8b are diagrams respectively showing the illustration of the set level with the passage of time according to the conventional manner and that according to the present invention.

In the figures, 1 is a sensor portion, 2 is a sample-hold circuit, 3 is an A-D converter, 4 is a clock portion, 5 is a CPU, 6, 7 are ROMs, 8, 9 are RAMs, 10 is a signal generating circuit, 15 is a resistance for dividing voltage, 16 is a multiplexer, 12 is a digital comparator, 13 is a latch, RAM 1 - RAM 9, ROM 1 are memories.

What is claimed

1. A fire sensing apparatus characterized by comprizing a physical quantities mesuring means for converting the physical quantities of the phenomena of a fire such as smoke, heat, light and so on into digital electric signals, means for storing said measured physical quantities and means for producing accumulated past data from said measured physical quantities, means for determining a set sensitivity at the current point in time on the basis of said accumulated past data, means for comparatively descriminating said determined set sensitivity and the physical quantities currently input, and means for outputting according to the results of said comparative discrimination, whereby the fire detection level is varied in response to variations in the environmental conditions of its installation location and fire can be detected with a continually constant fire sensitivity.

2. A fire sensing apparatus as described in claim 1, wherein the means for storing measured physical quantities includes means for reading said measured physical quantities as information into days of the week and times by a clock portion.

3. A fire sensing apparatus as described in claim 1, wherein the means for determining the set sensitivity at

a current point in time on the basis of the accumulated past data includes means for obtaining physical quantities according to currently anticipated environmental conditions such as an average value by means of a simple averaging computation or a weighted averaging computation of the accumulated past data.

4. A fire sensing apparatus as described in either claim 1 or claim 3, wherein a set sensitivity as a standard value is set to be a fire discrimination level when there is no measured physical quantities of phenomena similar to a fire phenomenon, in other words noise components, and on the other hand, is set to be a fire detection level, when there are existing noise components to be determined as fire, an average value of said noise component being obtained at separated time periods or at separated time periods of the days of the week on the basis of the accumulated past data, and the reference value that is to discriminate a fire at those time periods is produced by adding the average value of said noise component to said standard value.

5. A fire sensing apparatus as described in claim 1, wherein the means for determining sensitivity at a current point in time on the basis of the accumulated past data includes means for providing an upper limit set value, a lower limit set value and a reference set value

between an upper limit value and a lower limit value of an operating level, means for obtaining a maximum value, a minimum value and an average value of the accumulated data from the accumulated data of environmental noise, and means for obtaining the set sensitivity at the current point in time by means of computing $B + \frac{\beta(A - C)}{D - F} \times (X - E)$ (where, β is constant) with the upper limit set value A, the reference set value B, the lower limit set value C, the maximum value D of the accumulated data, the average value E of the accumulated data, the minimum value F of the accumulated data and the accumulated data X corresponding to the current point in time in the accumulated data of the environmental noise which are obtained from said respective means.

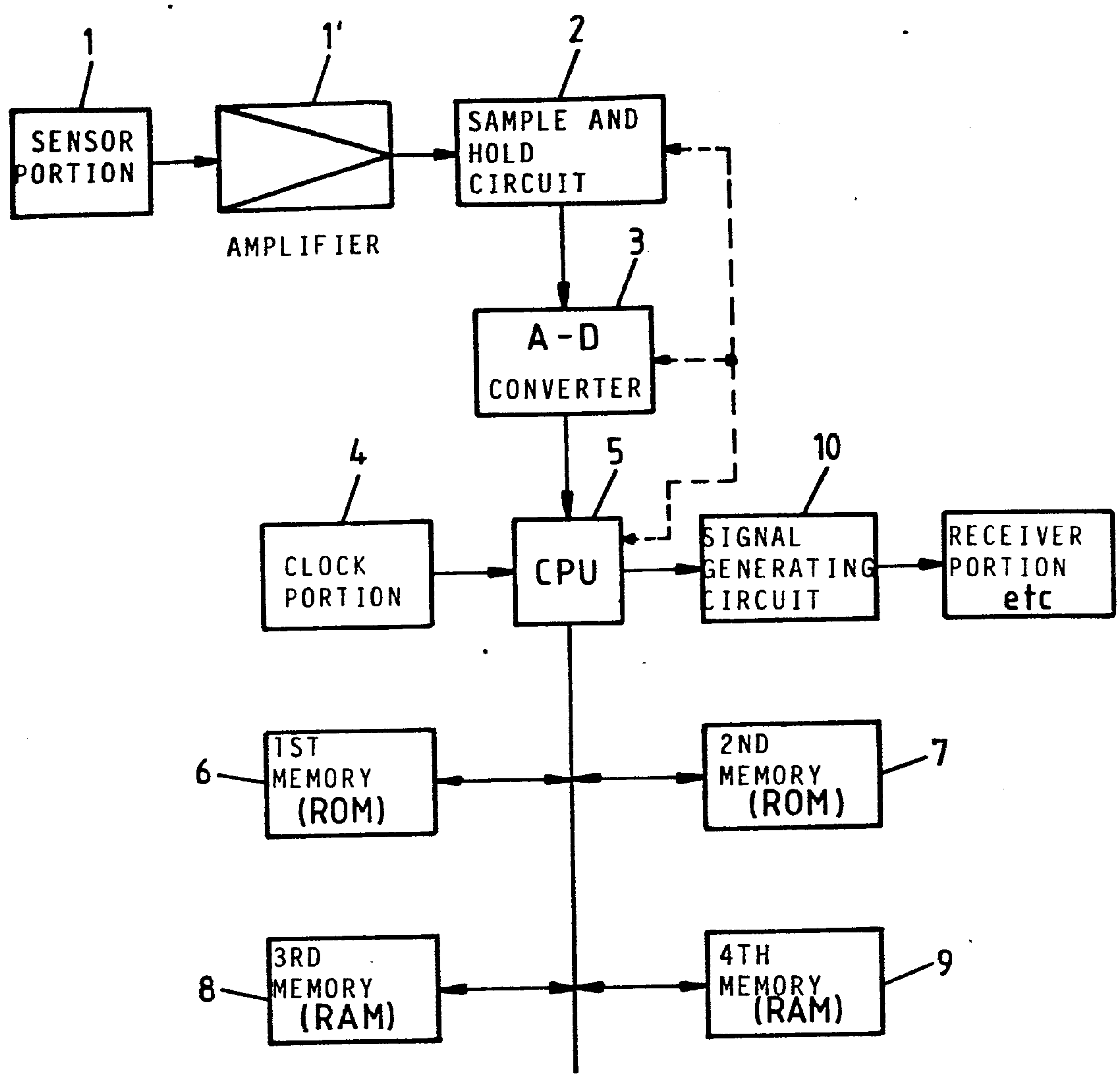

1
1'
2
SENSOR PORTION
AMPLIFIER
SAMPLE AND HOLD CIRCUIT
3
A-D CONVERTER
4
5
10
CLOCK PORTION
CPU
SIGNAL GENERATING CIRCUIT
RECEIVER PORTION etc
6
1ST MEMORY (ROM)
2ND MEMORY (ROM)
7
8
3RD MEMORY (RAM)
4TH MEMORY (RAM)
9

FIG. 1

84-114
0148949

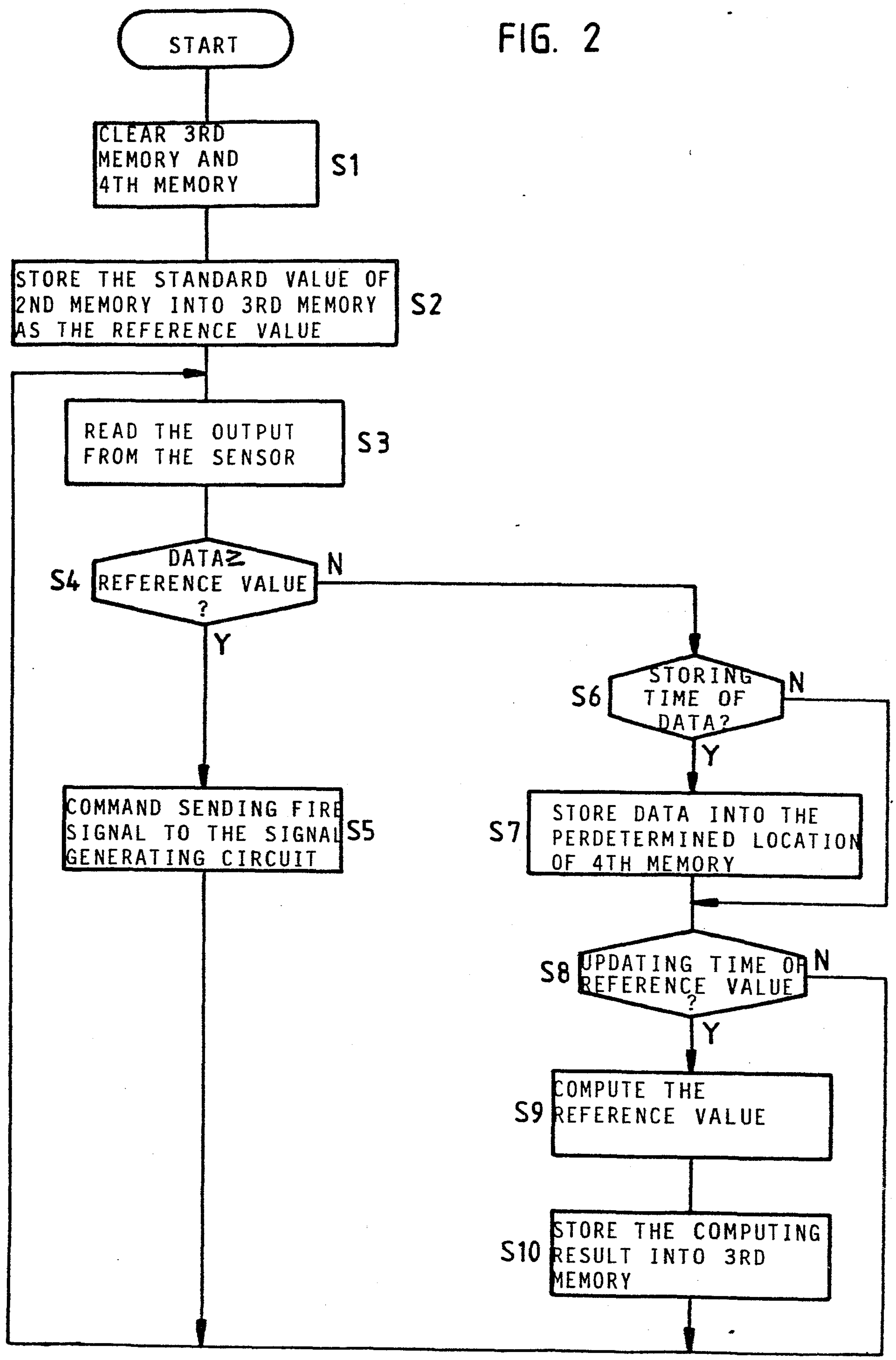


FIG. 2

84-114
0148949

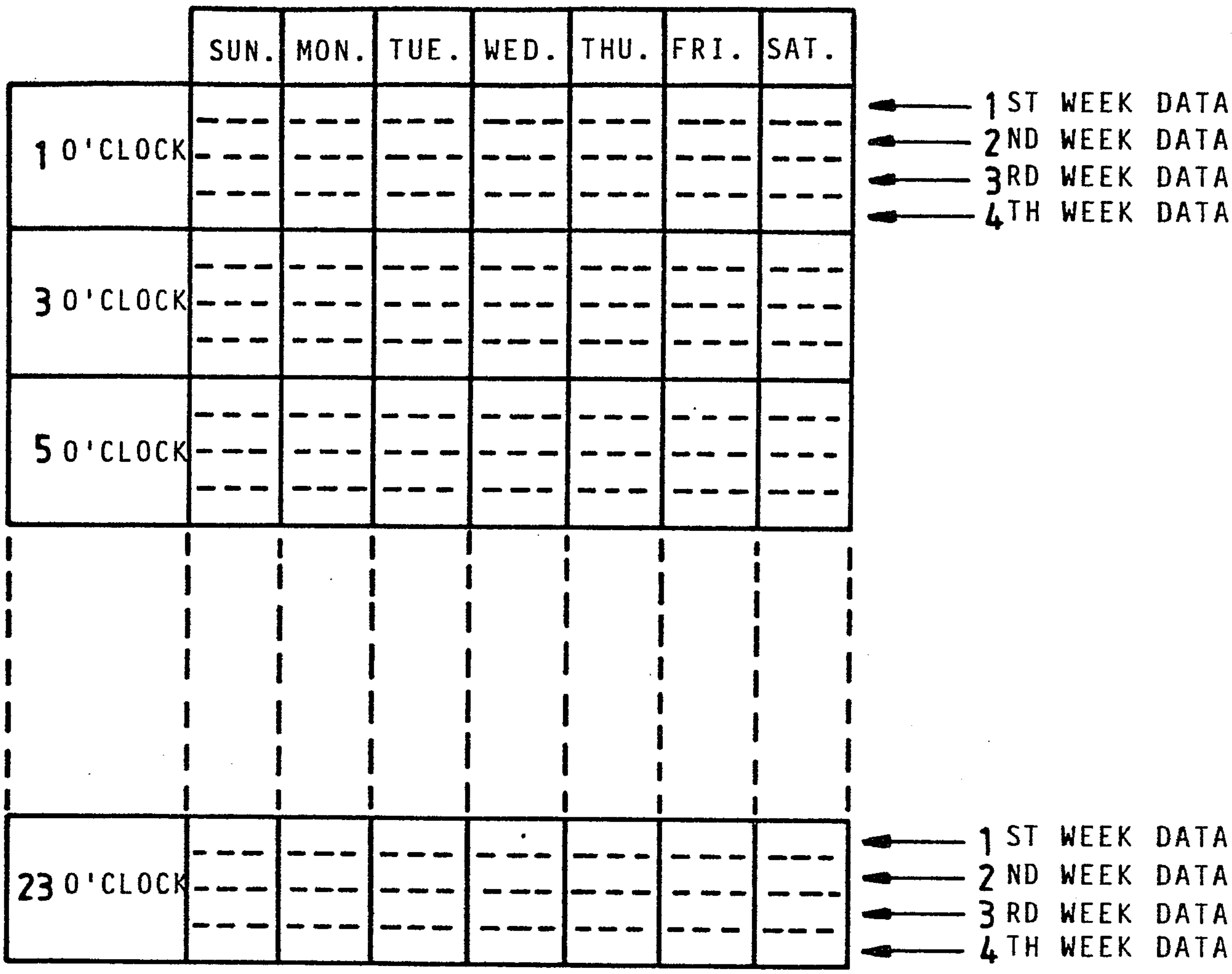


FIG. 3

84-114
0148949

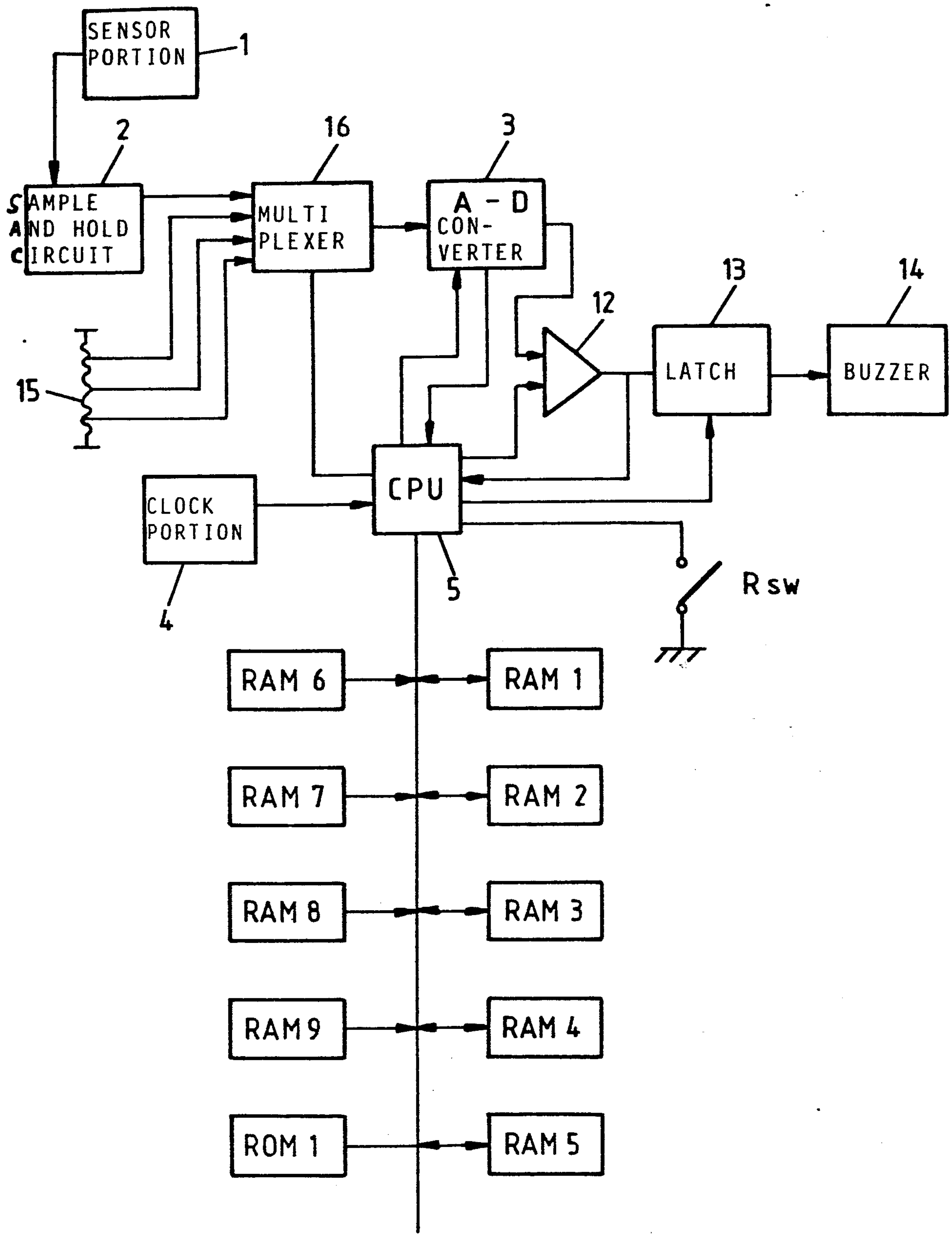


FIG. 4

84 - 114
0148949

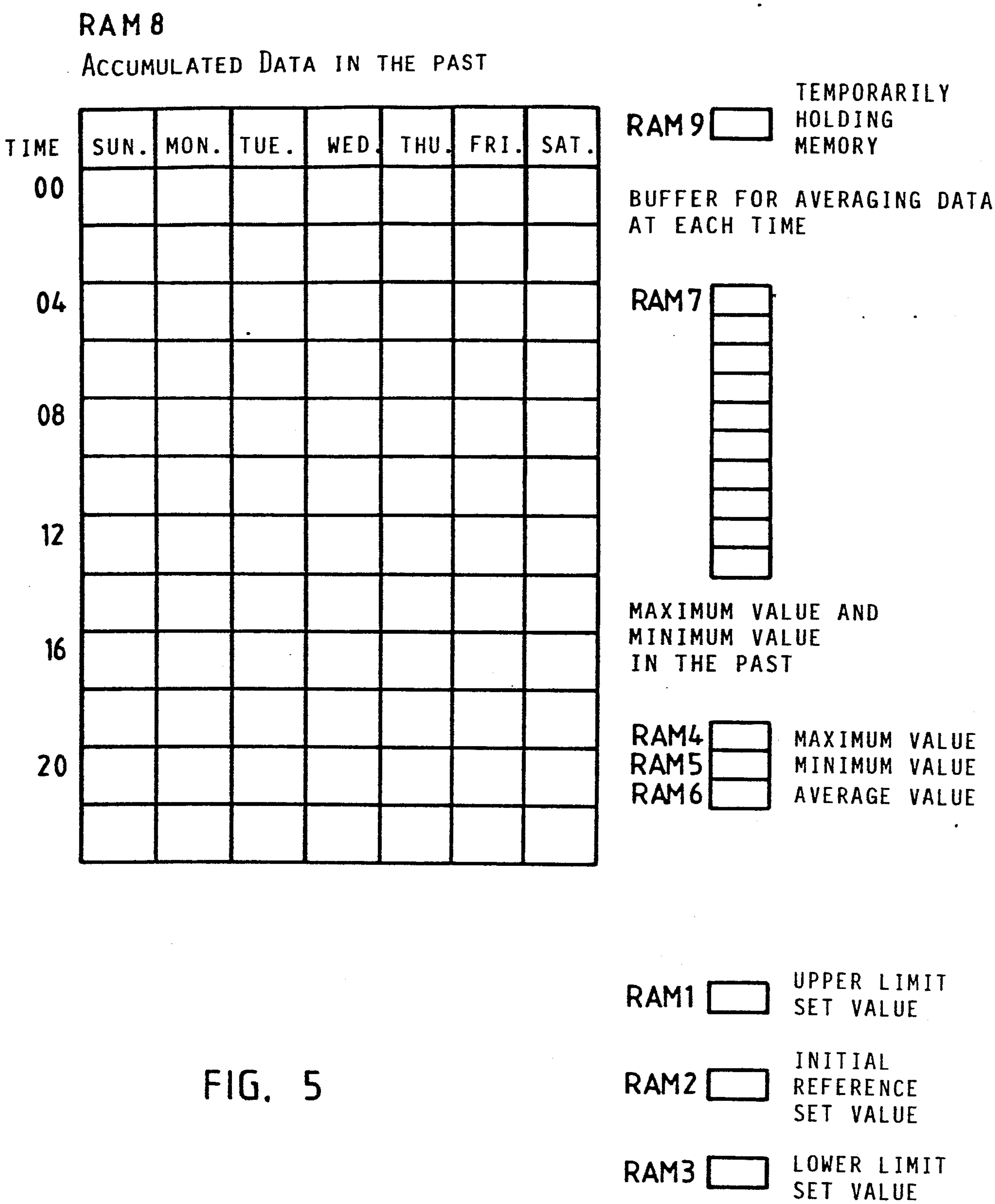
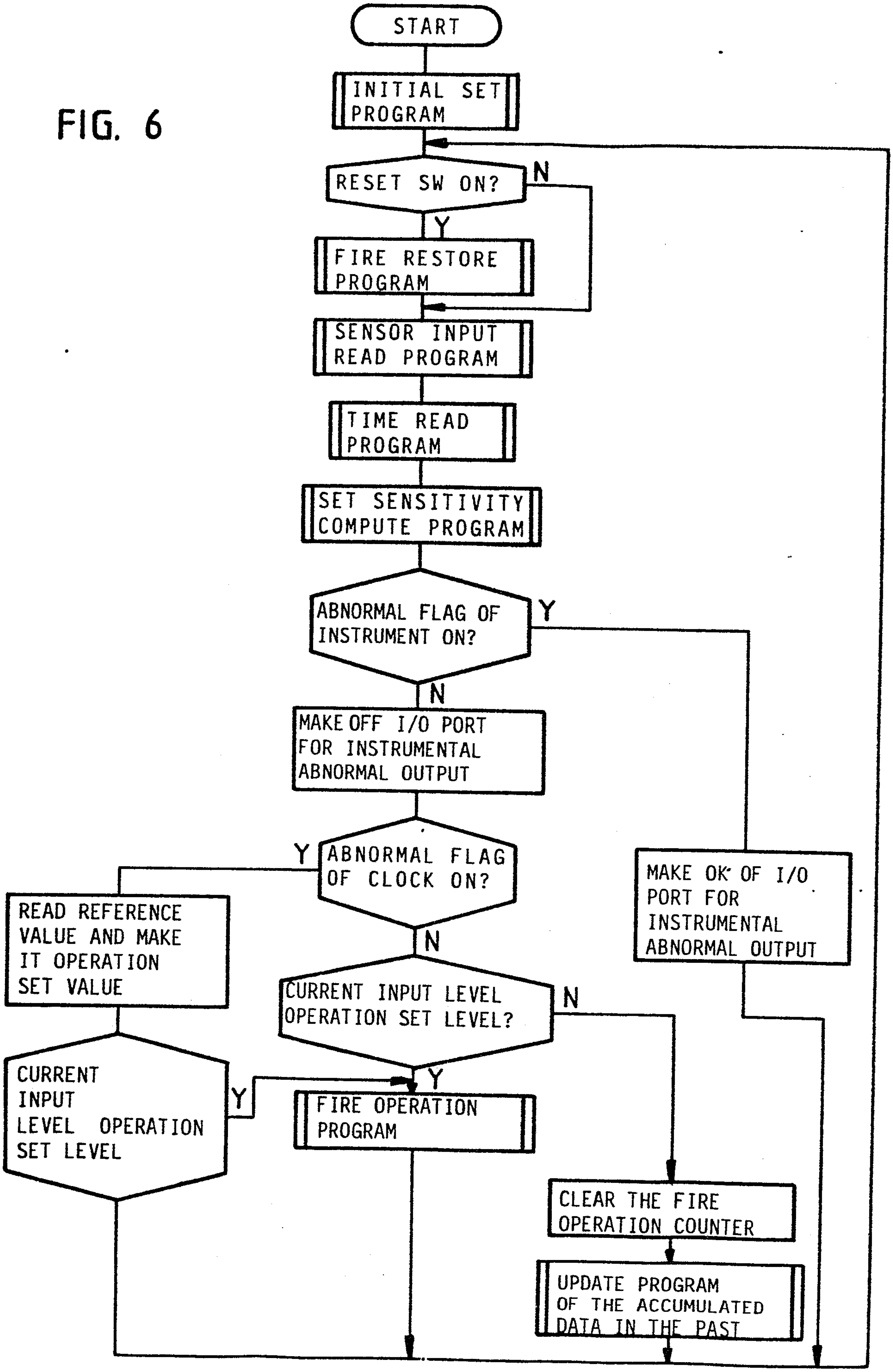


FIG. 5

FIG. 6


START
INITIAL SET PROGRAM
RESET SW ON?
N
Y
FIRE RESTORE PROGRAM
SENSOR INPUT READ PROGRAM
TIME READ PROGRAM
SET SENSITIVITY COMPUTE PROGRAM
ABNORMAL FLAG OF INSTRUMENT ON?
Y
N
MAKE OFF I/O PORT FOR INSTRUMENTAL ABNORMAL OUTPUT
MAKE OK OF I/O PORT FOR INSTRUMENTAL ABNORMAL OUTPUT
ABNORMAL FLAG OF CLOCK ON?
Y
N
READ REFERENCE VALUE AND MAKE IT OPERATION SET VALUE
CURRENT INPUT LEVEL OPERATION SET LEVEL?
N
Y
CURRENT INPUT LEVEL OPERATION SET LEVEL
Y
FIRE OPERATION PROGRAM
CLEAR THE FIRE OPERATION COUNTER
UPDATE PROGRAM OF THE ACCUMULATED DATA IN THE PAST

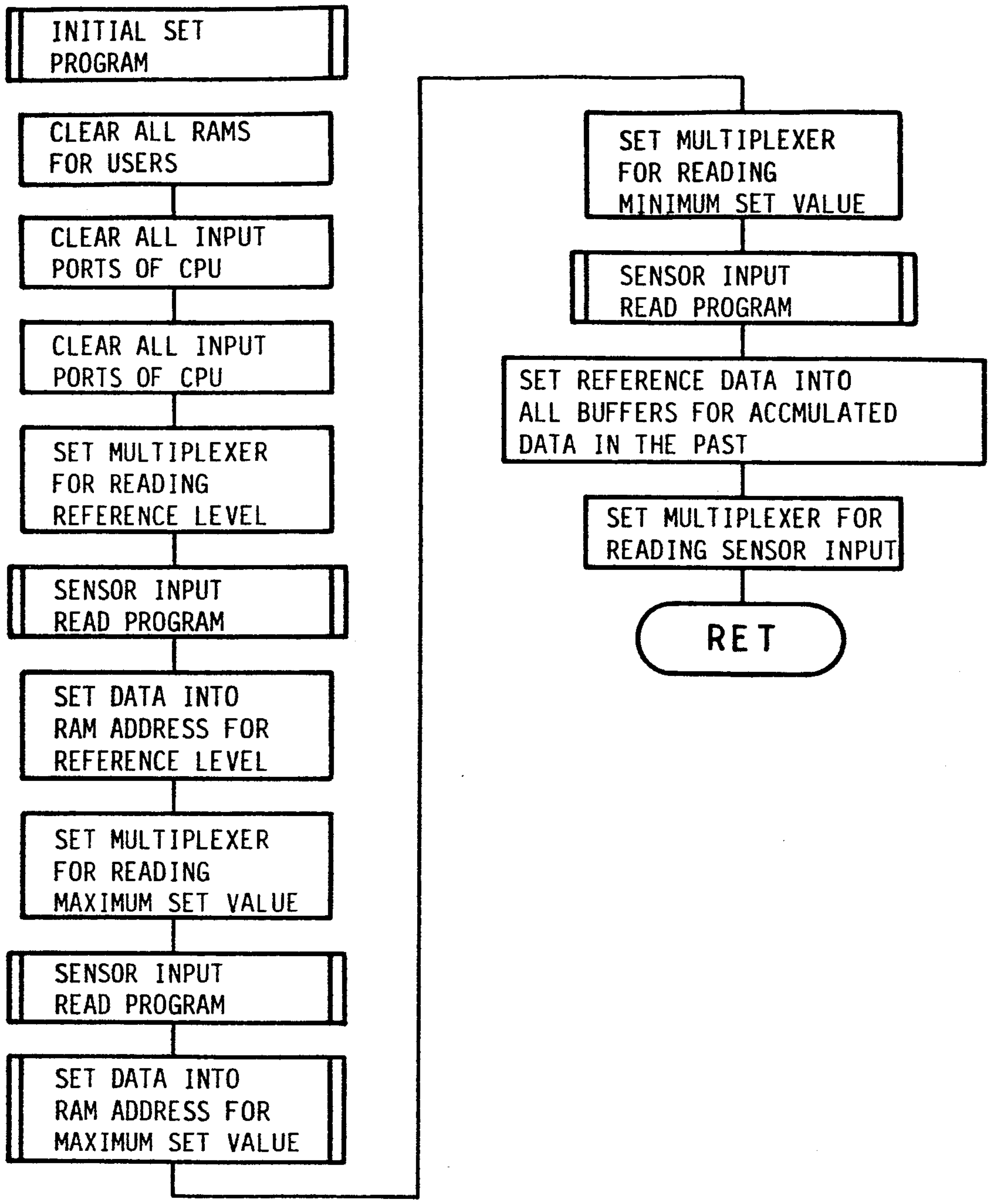

INITIAL SET PROGRAM
CLEAR ALL RAMS FOR USERS
CLEAR ALL INPUT PORTS OF CPU
CLEAR ALL INPUT PORTS OF CPU
SET MULTIPLEXER FOR READING REFERENCE LEVEL
SENSOR INPUT READ PROGRAM
SET DATA INTO RAM ADDRESS FOR REFERENCE LEVEL
SET MULTIPLEXER FOR READING MAXIMUM SET VALUE
SENSOR INPUT READ PROGRAM
SET DATA INTO RAM ADDRESS FOR MAXIMUM SET VALUE
SET MULTIPLEXER FOR READING MINIMUM SET VALUE
SENSOR INPUT READ PROGRAM
SET REFERENCE DATA INTO ALL BUFFERS FOR ACCMULATED DATA IN THE PAST
SET MULTIPLEXER FOR READING SENSOR INPUT
RET

FIG. 7a

0148949

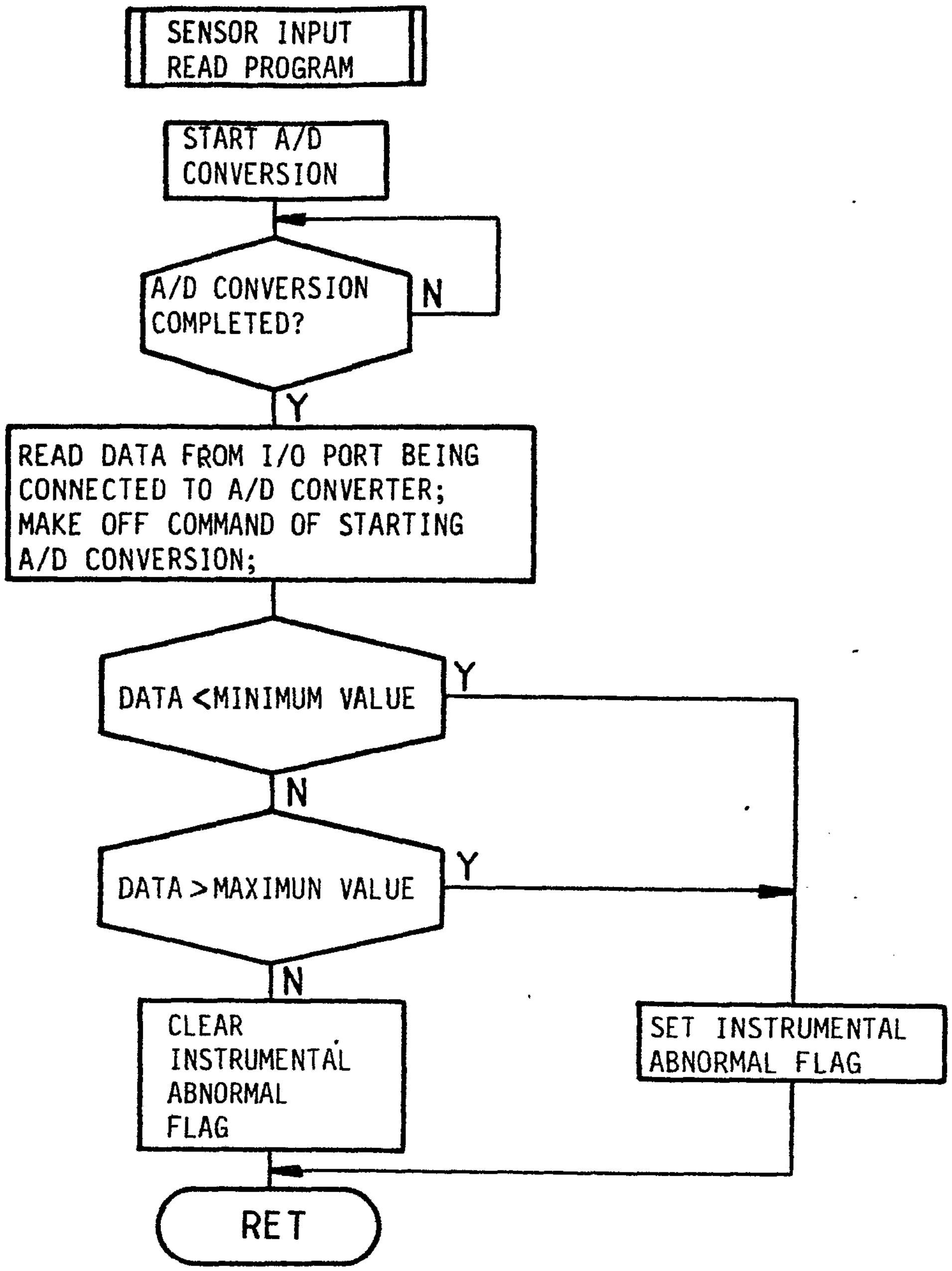


FIG. 7b

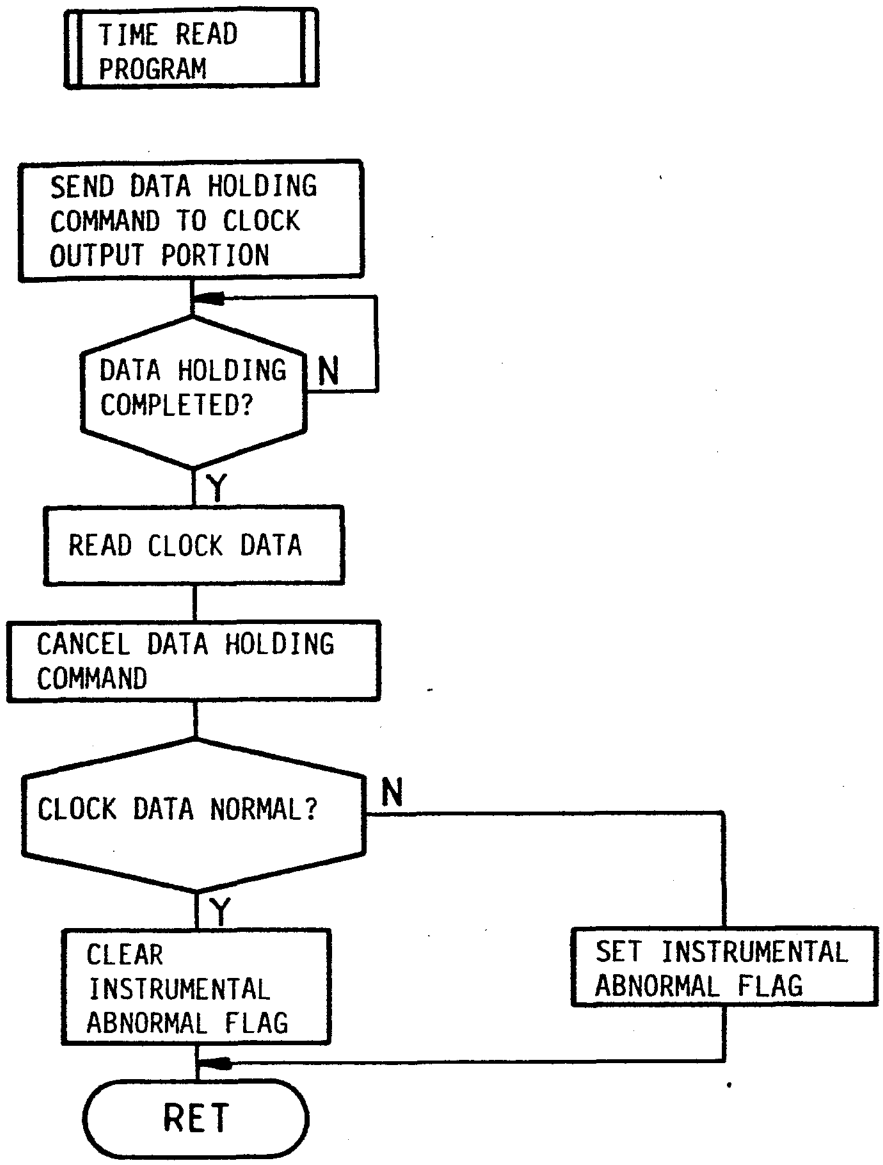
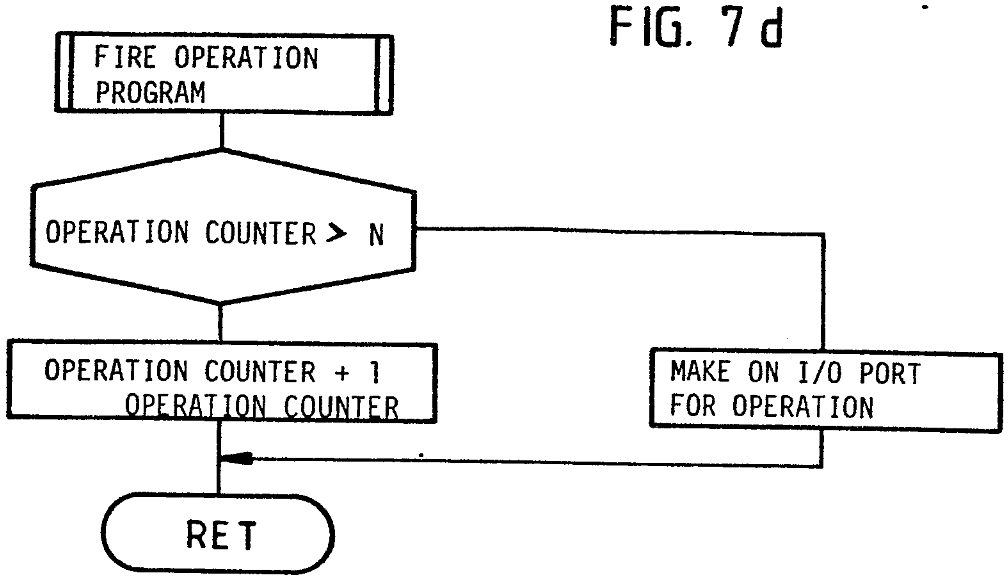

TIME READ PROGRAM
SEND DATA HOLDING COMMAND TO CLOCK OUTPUT PORTION
DATA HOLDING COMPLETED?
N
Y
READ CLOCK DATA
CANCEL DATA HOLDING COMMAND
CLOCK DATA NORMAL?
N
Y
CLEAR INSTRUMENTAL ABNORMAL FLAG
SET INSTRUMENTAL ABNORMAL FLAG
RET

FIG. 7c

FIG. 7d


FIRE OPERATION PROGRAM
OPERATION COUNTER > N
OPERATION COUNTER + 1 OPERATION COUNTER
MAKE ON I/O PORT FOR OPERATION
RET

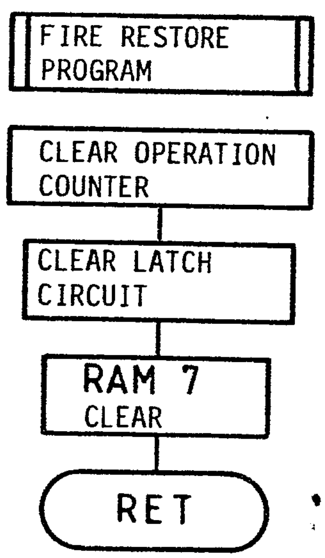
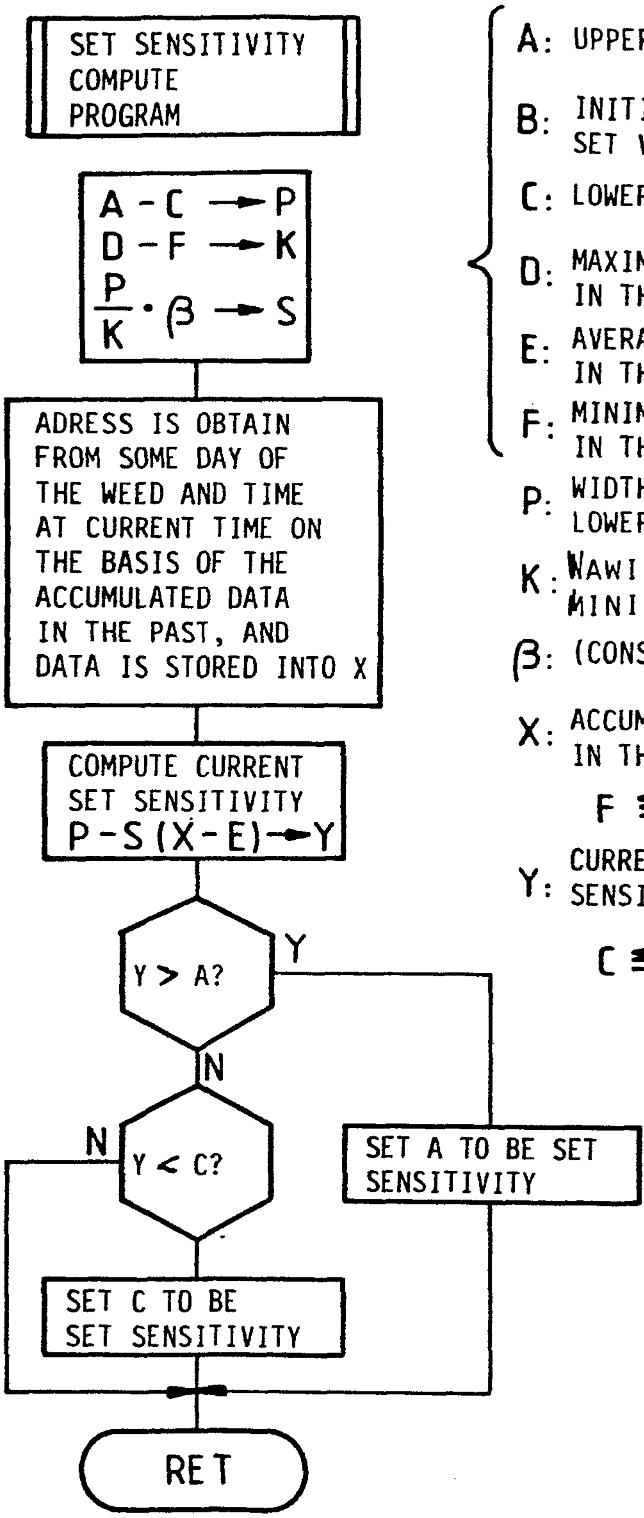

FIRE RESTORE PROGRAM
CLEAR OPERATION COUNTER
CLEAR LATCH CIRCUIT
RAM 7 CLEAR
RET

FIG. 7e

84-114
0148949



A: UPPER LIMIT SET VALUE

B: INITIAL REFERENCE SET VALUE

C: LOWER LIMIT SET VALUE

D: MAXIMUM VALUE ACCUMULATED IN THE PAST

E: AVERAGE VALUE ACCUMULATED IN THE PAST

F: MINIMUM VALUE ACCUMULATED IN THE PAST

P: WIDTH BETWEEN UPPER LIMIT AND LOWER LIMIT SET VALUE

K: WAWING WIDTH BETWEEN MAXIMUM AND MINIMUM VALUES ACCUMULATED IN THE PAST

β: (CONSTANT DIFFERENCE)

X: ACCUMULATED DATA IN THE PAST

$F \leqq X \leqq D$

Y: CURRENT SET SENSITIVITY

$C \leqq Y \leqq A$

FIG. 7f

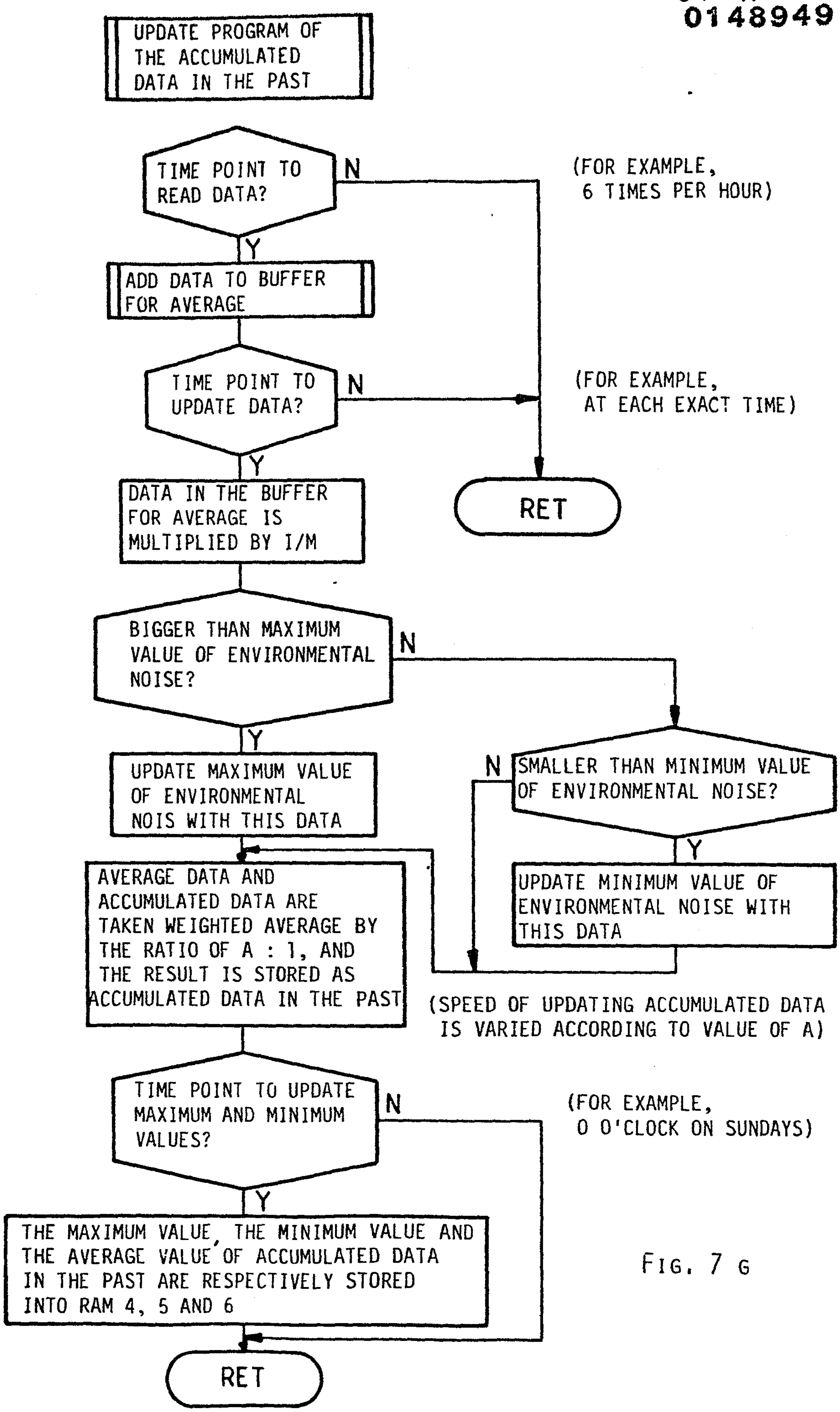
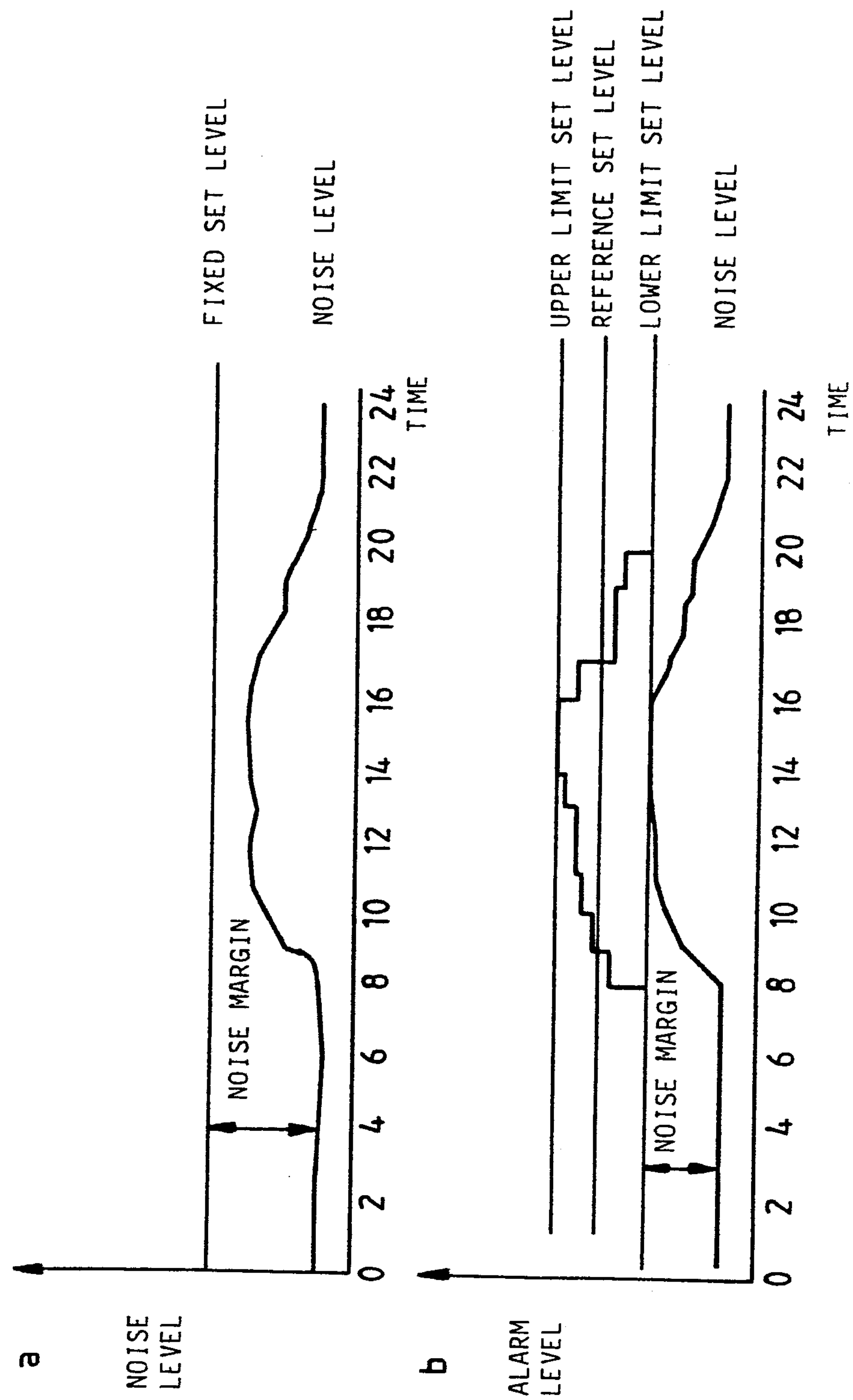

UPDATE PROGRAM OF THE ACCUMULATED DATA IN THE PAST
TIME POINT TO READ DATA?
N
(FOR EXAMPLE, 6 TIMES PER HOUR)
Y
ADD DATA TO BUFFER FOR AVERAGE
TIME POINT TO UPDATE DATA?
N
(FOR EXAMPLE, AT EACH EXACT TIME)
Y
DATA IN THE BUFFER FOR AVERAGE IS MULTIPLIED BY I/M
RET
BIGGER THAN MAXIMUM VALUE OF ENVIRONMENTAL NOISE?
N
Y
UPDATE MAXIMUM VALUE OF ENVIRONMENTAL NOIS WITH THIS DATA
SMALLER THAN MINIMUM VALUE OF ENVIRONMENTAL NOISE?
N
Y
UPDATE MINIMUM VALUE OF ENVIRONMENTAL NOISE WITH THIS DATA
AVERAGE DATA AND ACCUMULATED DATA ARE TAKEN WEIGHTED AVERAGE BY THE RATIO OF A : 1, AND THE RESULT IS STORED AS ACCUMULATED DATA IN THE PAST
(SPEED OF UPDATING ACCUMULATED DATA IS VARIED ACCORDING TO VALUE OF A)
TIME POINT TO UPDATE MAXIMUM AND MINIMUM VALUES?
N
(FOR EXAMPLE, 0 O'CLOCK ON SUNDAYS)
Y
THE MAXIMUM VALUE, THE MINIMUM VALUE AND THE AVERAGE VALUE OF ACCUMULATED DATA IN THE PAST ARE RESPECTIVELY STORED INTO RAM 4, 5 AND 6
RET

FIG. 7 G

84-114
0148949

FIG. 8



INTERNATIONAL SEARCH REPORT

0148949

International Application No.

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl^3 G08B 17/06, 17/10

II. FIELDS SEARCHED

Minimum Documentation Searched[4]

Classification System	Classification Symbols
IPC	G08B 17/06, 17/10

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[5]

Jitsuyo Shinan Koho	1964 - 1984
Kokai Jitsuyo Shinan Koho	1971 - 1984

III. DOCUMENTS CONSIDERED TO BE RELEVANT[14]

Category*	Citation of Document,[16] with indication, where appropriate of the relevant passages[17]	Relevant to Claim No.[18]
A	JP, A, 50-123299 (Matsushita Electric Works, Ltd.), 27 September 1975 (27. 09. 75)	1
A	JP, A, 56-132690 (Hohchiki Kabushiki Kaisha), 17 October 1981 (17. 10. 81)	1
P	JP, A, 59-27395 (Nittan Kabushiki Kaisha), 13 February 1984 (13. 02. 84)	1, 2, 3, 4,5

* Special categories of cited documents:[15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search[2]	Date of Mailing of this International Search Report[2]
June 5, 1984 (05. 06. 84)	June 18, 1984 (18. 06. 84)
International Searching Authority[1]	Signature of Authorized Officer[20]
Japanese Patent Office	