

(45) Issue date: April 15, 1998 (1998)

(24) Date of registration: January 23, 1998 (1998)

(51) Int.Cl. ⁶	Identification Symbol	FI
G04G 1/00	310	G04G 1/00 310D

Number of claims 5 (8 pages in total)

(21) Application number	Application H5-302057	(73) Patentee	000115854 Rinnai Corporation 2-26 Fukuzumi-cho, Nakagawa-ku, Nagoya-shi, Aichi-ken
(22) Application date	December 1, 1993	(72) Inventor	Yasui SHIGEAKI Within Rinnai Corporation, 2-26 Fukuzumicho, Nakagawa-ku, Nagoya-shi
(65) Publication number	Japanese Unexamined Patent Application Publication No.	(72) Inventor	Yukihiro SUZUKI Within Rinnai Corporation, 2-26 Fukuzumicho, Nakagawa-ku, Nagoya-shi
(43) Date of publication	H7-151873	(74) Agent	Kenji Ishiguro, patent attorney
Date of request for review	June 16, 1995 June 19, 1995	Examiner	Hitoshi Sakurai

Continue to last page

(54)[Title of the Invention] Clock device

1

2

(57)[Scope of Patent Claims]

[Claim 1] A clock device characterized in that, in a clock device comprising a timekeeping means, for which power for operation is provided via a commercial power source, for measuring the current time, and

a display means, for which power for operation is provided via a commercial power source, for displaying, on a display device, the current time measured by the timekeeping means, the device is provided with

a semiconductor non-volatile memory capable of storing data and electrically rewriting the stored data;

a power outage detection means for detecting a power outage of a commercial power source; and

a data storage means for allowing the timekeeping means to store the following data in the semiconductor nonvolatile memory as time data and power outage data, when the power outage detection means¹⁰ detects a power outage of the commercial power supply; the data of the current time being measured by the remaining power and the fact that the power outage has occurred;

wherein the device is provided with a data reading means for reading the time data and the power outage data from the semiconductor non-volatile memory, when the commercial power source is restored and

the power outage detection means detects the power restored; wherein the timekeeping means resumes the time measurement from a time corresponding to the time data read when the power outage detection means detects the power outage, and the display means displays the measured time delayed due to the power outage and power outage occurrence indication in the display device.

[Claim 2] A clock device characterized in that, in a clock device comprising a timekeeping means, for which power for operation is provided via a commercial power source, for measuring the current time, and

a display means, for which power for operation is provided via a commercial power source, for displaying, on a display device, the current time measured by the timekeeping means, the device is provided with

a semiconductor non-volatile memory capable of storing data and electrically rewriting the stored data;

a power outage detection means for detecting a power outage of a commercial power source; and

a data storage means for allowing the timekeeping means to store the following data in the semiconductor nonvolatile memory as time data and power outage data, when the power outage detection means detects a power outage of the commercial power supply; the

data of the current time being measured by the remaining power and the fact that the power outage has occurred; and a data reading means for reading the time data and the power outage data from the semiconductor non-volatile memory, when the commercial power source is restored and the power outage detection means detects the power restored; wherein when the power outage detection means detects power recovery, the timekeeping means resumes timekeeping from the time corresponding to the read time data, and the display means displays a power outage indication on the display; and manually operating a predetermined switch can switch the display on the indicator to the measured time that has been delayed due to the occurrence of the power outage.

[Claim 3] The clock device according to claim 1, wherein when the power outage detection means detects power recovery, the indication means alternately displays the measured time delayed due to the power outage occurrence and the power outage occurrence indication on the display device.

[Claim 4] The clock device according to claim 1, wherein when a separate indicator is newly installed, and when the power outage detection means detects power recovery, the display means displays a power outage occurrence indication on a different display.

[Claim 5] The clock device according to claim 1, wherein when the power outage detection means detects power recovery, the display means displays the measured time that is delayed due to the occurrence of a power outage, and also flashes the measured time to indicate the occurrence of a power outage.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Application] The present invention relates to a clock device in which power for operation is supplied via a commercial power source.

[0002]

[Prior Art] Gas hot-air heaters that are used by being connected to a commercial power supply are known, where the heater is provided with a clock device having a timekeeping means for clocking the current time and a display means for displaying, on a display, the current time clocked by the clock means, so that it can replace the clock during driving halt. If an on-timer is added to the above gas hot-air heater, the operation can be started when the current time reaches the timer setting time.

[0003] However, when commercial power fails, stopping the power for operation to the timekeeping means reset the clock, and when the power is restored, the timekeeping means starts clocking from "0:00". Except when power is restored at a time close to "0:00", the actual current time and the displayed current time are significantly different, so it takes time and effort for the user to reset the clock.

[0004] In order to prevent this, there is known a technique for keeping a clock running with a backup power source even during a power outage, so that the clock will not go wrong even if the power outage occurs for a short period of time (several minutes).

[0005]

[Problem to Be Solved by the Invention] Adopting the above technology for backing up the clock in the event of a power outage for the above gas hot-air heater eliminates the need to reset the clock after a short power outage. But it requires, for example, a large-capacity capacitor, as a backup power supply, which increases the parts cost.

[0006] The object of the present invention is to provide a clock

device that is connected to a commercial power supply, where it is easy to know whether or not a power outage has occurred, and less trouble is required for adjusting the clock when the power is restored. [0007]

[Means for Solving the Problem] In order to solve the above issues, the present invention adopted the following configuration.

(1) In a clock device comprising a timekeeping means, for which power for operation is provided via a commercial power source, for measuring the current time, and a display means, for which power for operation is provided via a commercial power source, for displaying, on a display device, the current time measured by the timekeeping means, the device is provided with a semiconductor non-volatile memory capable of storing data and electrically rewriting the stored data; a power outage detection means for detecting a power outage of a commercial power source; and a data storage means for allowing the timekeeping means to store the following data in the semiconductor nonvolatile memory as time data and power outage data, when the power outage detection means detects a power outage of the commercial power supply; the data of the current time being measured by the remaining power and the fact that the power outage has occurred; wherein the device is provided with a data reading means for reading the time data and the power outage data from the semiconductor non-volatile memory, when the commercial power source is restored and the power outage detection means detects the power restored; wherein the timekeeping means resumes the clock from a time corresponding to the time data read when the power outage detection means detects the power outage, and the display means displays, on the display device, the measured time delayed due to the power outage and power outage occurrence indication.

[0008] (2) In a clock device comprising a timekeeping means, for which power for operation is provided via a commercial power source, for measuring the current time, and a display means, for which power for operation is provided via a commercial power source, for displaying, on a display device, the current time measured by the timekeeping means, the device is provided with a semiconductor non-volatile memory capable of storing data and electrically rewriting the stored data; a power outage detection means for detecting a power outage of a commercial power source; a data storage means for allowing the timekeeping means to store the following data in the semiconductor nonvolatile memory as time data and power outage data, when the power outage detection means detects a power outage of the commercial power supply; the data of the current time being measured by the remaining power and the fact that the power outage has occurred; and a data reading means for reading the time data and the power outage data from the semiconductor non-volatile memory, when the commercial power source is restored and the power outage detection means detects the power restored; wherein when the power outage detection means detects power recovery, the timekeeping means resumes the clock from the time corresponding to the read time data, and the display means displays a power outage indication on the display; and manually operating a predetermined switch can switch the display on the indicator to the measured time that has been delayed due to the occurrence of a power outage.

[0009] (3) Having the configuration described in (1) above, when the power outage detection means detects power recovery, the indication means alternately displays the measured time delayed due to the power outage occurrence and the power outage

occurrence indication on the display device.

[0010] (4) Having the configuration described in (1) above, when a separate indicator is newly installed, and the power outage detection means detects power recovery, the display means displays a power outage occurrence indication on a different display.

[0011] (5) Having the configuration described in (1) above, when the power outage detection means detects power recovery, the display means displays the measured time that is delayed due to the occurrence of a power outage, and also flashes the measured time to indicate the occurrence of a power outage.

[0012]

[Operation of the Invention]

[Regarding Claim 1] In the event that no power outage has occurred in the commercial power supply, the timekeeping means receives the power supply for operation from the commercial power supply and measures the current time, and the display means displays the current time in the display device.

[0013] In the event of a power outage on a commercial power supply, the power outage detection means detects the power outage, and the data storage means stores the current time and the fact of the occurrence of the power outage in the semiconductor non-volatile memory as the current time data and power outage data.

[0014] When a power outage of the commercial power supply is restored, the power outage detection means detects the power recovery, and the data reading means reads time data and power outage data from the semiconductor non-volatile memory.

[0015] The timekeeping means resumes timekeeping from the time corresponding to the read time data, and the display means displays the measured time delayed due to the occurrence of the power outage and the occurrence of the power outage on the display.

[0016] [Regarding Claim 2]

When a power outage of the commercial power supply is restored, the power outage detection means detects the power recovery, and the data reading means reads time data and power outage data from the semiconductor non-volatile memory.

[0017] In addition, the display means displays the power outage occurrence indication on the display device, and the timekeeping means resumes the time measurement from the time corresponding to the time data read.

[0018] When the user manually operates the specified switch, the display means switches the display to the measured time that is delayed due to a power outage.

[0019] [Regarding Claim 3]

When a power outage of the commercial power supply is restored, the power outage detection means detects the power recovery, and the data reading means reads time data and power outage data from the semiconductor non-volatile memory.

[0020] In addition to allowing the timekeeping means to restart the clock from the time corresponding to the time data read, the display means alternately display the measured time delayed due to a power outage and the power outage occurrence indication on the display device.

[0021] [Regarding Claim 4]

When a power outage of the commercial power supply is restored, the power outage detection means detects the power recovery, and the data reading means reads time data and power outage data from the semiconductor non-volatile memory.

[0022] The timekeeping means resumes timekeeping from the time corresponding to the read time data, and the display means displays

the measured time delayed due to the occurrence of the power outage, and displays the occurrence of the power outage on another display.

[0023] [Regarding Claim 5]

When a power outage of the commercial power supply is restored, the power outage detection means detects the power recovery, and the data reading means reads time data and power outage data from the semiconductor non-volatile memory.

[0024] The timekeeping means resumes timekeeping from the time corresponding to the read time data, and the display means displays the measured time delayed due to the occurrence of the power outage on the display, and blinks the measured time as an indication of occurrence of power outage.

[0025]

[Effects of the Invention] [Common Effects of Claims 1 to 5]

When the power outage of the commercial power source is restored, the clock is delayed only by the time of the power outage. Therefore, short power outage time means that the clock device requires less time and effort to adjust the clock when the power is restored.

[0026] The clock device does not require a power supply for backup, saving the cost of parts.

[0027] [Effects specific to Claim 1] By checking whether a power outage indication is displayed on the display, a user can easily determine whether a power outage has occurred, and whether or not it is necessary to adjust the clock.

[0028] [Effects specific to Claim 2] By checking whether a power outage indication is displayed on the display, a user can easily determine whether a power outage has occurred. When a power outage occurs and the power is restored, the power outage can be recognized at a glance because the power outage indication is displayed instead of the current time on the display. Also, when power is restored after a power outage, the display state of the display is different from that in normal times without power outage, so the user does not forget to adjust the delayed clock.

[0029] [Effects specific to Claim 3] By looking at the display, a user can easily determine whether a power outage has occurred. When a power outage occurs and the power is restored, the power outage can be recognized at a glance because the current time and the power outage indication are alternately displayed on the display. Also, when power is restored after a power outage, the display state of the display is different from that in normal times without power outage, so the user does not forget to adjust the delayed clock.

[0030] [Effects specific to Claim 4] By checking whether a power outage indication is displayed on another display, a user can easily determine whether a power outage has occurred, and whether or not it is necessary to adjust the clock.

[0031] Because it is configured to display a power outage indication on a separate display device, the display content of the power outage indication can be freely selected.

[0032] [Effects specific to Claim 5] By checking whether a power outage indication is displayed on the display, the user can easily know whether a power outage has occurred and whether it is necessary to adjust the clock.

[0033]

[Examples] The first embodiment of the invention (corresponding to Claim 2) is described based on FIGS. 1 and 2. The clock device A employed in the gas hot air heater comprises a control circuit 1 having a microcomputer 11, an E²PROM 2, a semiconductor non-volatile memory, a display 3, a clock-matching switch 4, a means for confirming the occurrence of a power outage, and a rectification

voltage detection circuit 5, as shown in FIG. 1.

[0034] The control circuit 1 includes a timekeeping means, a display means, a power outage detection means, a data storage means, and data reading means, and operates based on the flowchart shown in FIG. 2 in the event of a power outage and power recovery.

[0035] In this control circuit 1, voltage is always supplied, by connecting the primary side of a power transformer to a commercial power supply, and the secondary side of the power transformer to a rectifying circuit and a stabilizing circuit (neither of which is shown in the drawings). When a power outage occurs, the power supply for operating the microcomputer 11 is maintained for about 0.5 seconds by the capacitor of the power supply circuit.

[0036] The timekeeping means measures the current time when there is no power outage, and when a power outage occurs and power is restored, the timekeeping is resumed based on the current time data read from E²PROM 2.

[0037] The display means displays the current time measured by the timekeeping means on the display when there is no power outage, and displays the occurrence of power outage on the display 3 when the power is restored after a power outage. Furthermore, pressing the clock matching switch 4 turns off the power outage indication and displays the current time (lagging) in the display 3.

[0038] The power outage detection means determines whether or not the commercial power supply has failed based on the drop in the divided voltage output 51 of the rectified voltage detection circuit 5.

[0039] The data storage means stores the current time measured the timekeeping means when a power outage occurs, and the fact of the occurrence of a power outage in the specified operating state of the heating machine in E²PROM 2 as the current time data and power outage data.

[0040] The data reading means reads the current time data and the power outage data from E²PROM 2 when power is restored after a power outage has occurred.

[0041] E²PROM 2, for example, has a structure in which floating gates are formed in the insulation of SiO₂, and charge is accumulated in the gate using the tunnel effect, and the accumulation of charge allows a non-volatile storage of time data and power outage data.

[0042] Indicator 3 is an LED capable of displaying numbers, "-", "•", ":", etc., and is energized by control circuit 1. In the case of non-interruptions, the current time is displayed when the timer is waiting or stopped, and the set temperature is displayed during operation.

[0043] The clock setting switch 4 is a normally open tact switch, and sends out an ON signal 41 when pressed. In addition to being used when matching the clock, this clock matching switch is also used to communicate to the control circuit 1 that a power outage occurrence indication has been confirmed.

[0044] In this embodiment, the rectified voltage detection circuit 5 is a circuit that rectifies and divides the AC voltage on the secondary side of the power transformer described above, and the divided voltage output 51 is input to the control circuit 1.

[0045] Next, the operation of the control circuit 1 in the event of a power outage and restoration is described based on the flowchart shown in FIG. 2.

[0046] In step s1, the power outage detection means it proceeds to step s2 once it detects the power outage (YES), and if not, (NO), the current operating state is maintained. In addition, when a power

outage occurs, the data of the set time disappears, and the timer is turned off.

[0047] In step s2, if the gas hot air heater is in operation or waiting for a timer when the power outage occurs (YES), it proceeds to step s3; if stopped (NO), it proceeds to step s4.

[0048] In step s3, the data storage means it stores the current time and the fact that a power outage has occurred in E²PROM 2 as time data and data of the occurrence of a power outage (heater is not stopped).

[0049] In step s4, the data storage means it stores the current time and the fact that a power outage has occurred in E²PROM 2 as time data and data of the occurrence of a power outage (heater is stopped).

[0050] When a power outage occurs, steps s2, s3, and s4 are performed while the output voltage from the stabilizing circuit supplying power to the control circuit 1 does not fall below the operable range of the control circuit 1 (within 0.5 seconds).

[0051] When the power outage of the commercial power supply is restored, in step S1, the data reading means reads time data and power outage occurrence data from E²PROM 2, and the timekeeping means resumes the timekeeping based on the time data read, and it proceeds to step S2.

[0052] In step S2, based on the power outage occurrence data read out, a determination is made whether the gas hot air heater was in non-stop (running, waiting for timer) or stopped immediately before the power outage, and if it is determined to be in non-stop (YES), it proceeds to step S3, and if it is determined to be in stop (NO), it proceeds to step S4.

[0053] In step S3, the control circuit 1 displays "00" (power outage occurrence indication) in display 3 and it proceeds to step S5.

[0054] In step S4, the control circuit 1 displays "—" (power outage occurrence indication) in display 3 and it proceeds to step S5.

[0055] In step S5, a determination is made whether or not the clock matching switch 4 is pressed, and if it is pressed (YES), it proceeds to step S6.

[0056] In step S6, the display of the power outage occurrence indication is turned off from the display 3, and the current time (delayed by the power interruption time) is displayed in the display 3. The time data and power outage data in E²PROM 2 are erased.

[0057] In addition, in the above example, the power outage occurrence display at the time of power outage was changed according to the operation status of the heater at the time of power outage. If the heater was in operation, first an error is displayed, and after that, by operating the operation switch, the same display as the power outage occurrence display when the heater is stopped may be performed.

[0058] The following describes the advantages of clock device A in this example.

[a] By checking the presence or absence of a power outage indication by looking at indicator 3, whether or not a power outage occurred during the user's absence or sleep can be easily determined.

[0059] When a power outage indication is displayed, a user can know that the clock is delayed due to the power outage and the hot air heater is in a state of shutdown.

[0060] [b] Because the indication of the occurrence of a power outage was set to two types: operating, waiting for a timer, and stopping, it is easy to know whether the gas-heated air heater was operating (including waiting for a timer) or stopping when there is a power outage.

[0061] [c] Currently, power outage is from a few minutes to at most 30 minutes. When a power outage occurs, the time data pertaining to the current time is stored in E²PROM 2, and when power is restored, the time data is read from E²PROM 2, and the time is resumed from the current time corresponding to the retrieved time data.

[0062] Therefore, when the user presses the time adjustment switch 4 and confirms the occurrence of a power outage, the current time displayed on the display 3 is only delayed by the power outage time. This can reduce the number of pressing the "UP" switch (not shown) for setting the time.

[0063] [d] Because a backup power source, such as a capacitor, is unnecessary** to keep the control circuit 1 in operation during a power outage, part costs can be saved, and there is no need to replace the battery.

[0064] FIGS. 3, 4, 5, and 6 are flowcharts illustrating each operation of the clock device according to the second embodiment of the present invention (corresponding to Claim 1), the third embodiment (corresponding to Claim 3), the fourth embodiment (corresponding to Claim 4), and the fifth embodiment (corresponding to Claim 5).

[0065] The clock device of each of these examples also has the same effect as [a] and [d] above.

[Brief Description of the Drawings]

[FIG. 1] A block diagram of a clock device according to the first embodiment of the present invention.

[FIG. 2] A flowchart showing the operation of the clock device.

[FIG. 3] A flowchart showing the operation of a clock device according to the second embodiment of the present invention.

[FIG. 4] A flowchart showing the operation of a clock device according to the third embodiment of the present invention.

[FIG. 5] A flowchart showing the operation of a clock device according to the fourth embodiment of the present invention.

[FIG. 6] A flowchart showing the operation of a clock device according to the fifth embodiment of the present invention.

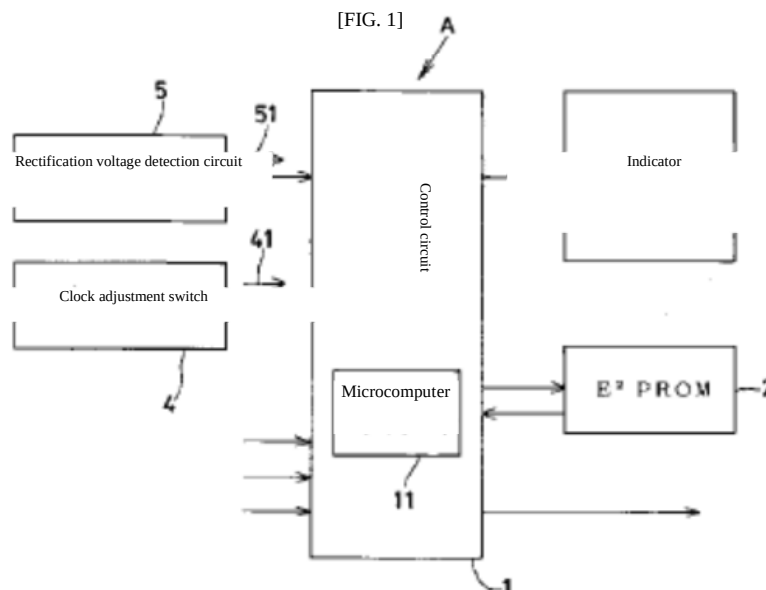
[Explanation of References]

- A Clock device
- 1 Control circuit (power outage detection means, data storage means, data reading means, display means)
- 2 E²PROM (semiconductor non-volatile memory)
- 3 Indicators
- 4 Clock adjustment switch (power outage confirmation means)

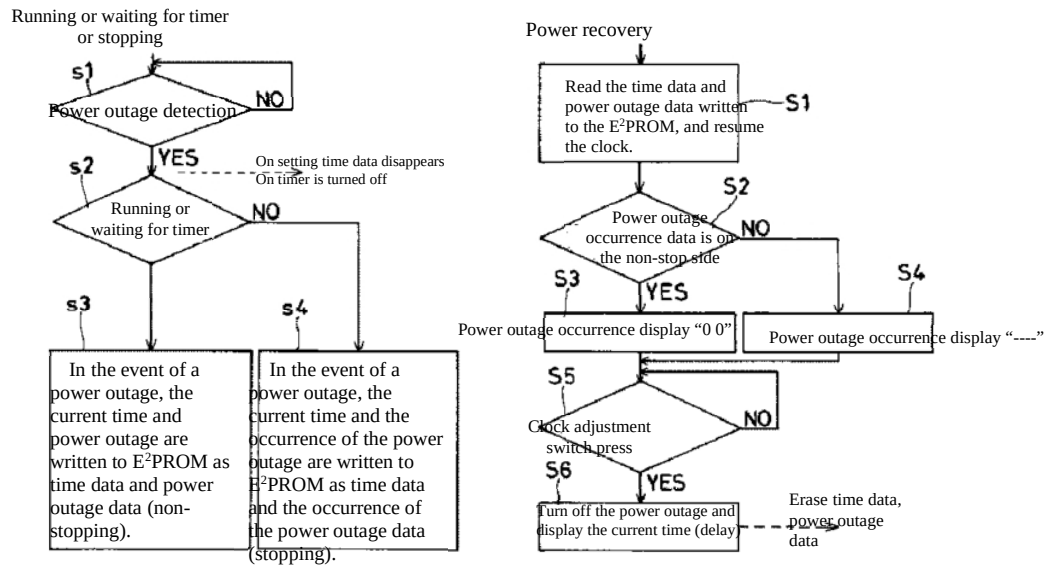
10

20

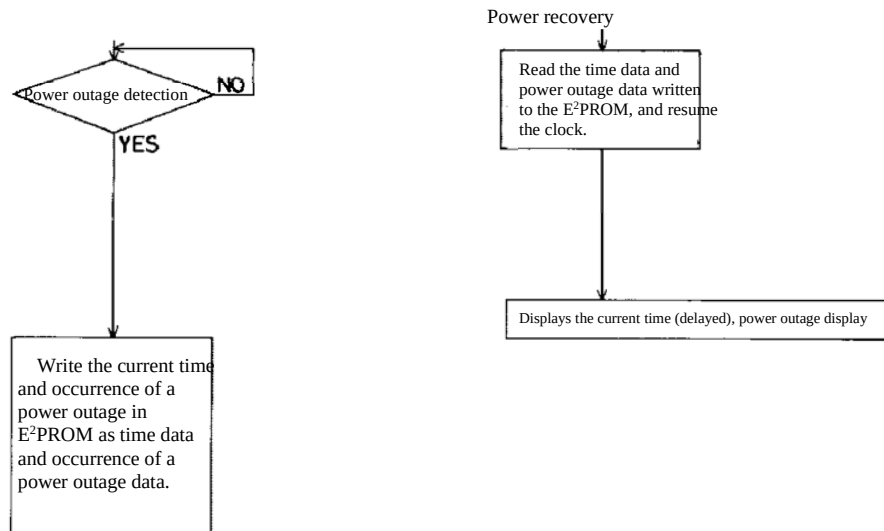
30

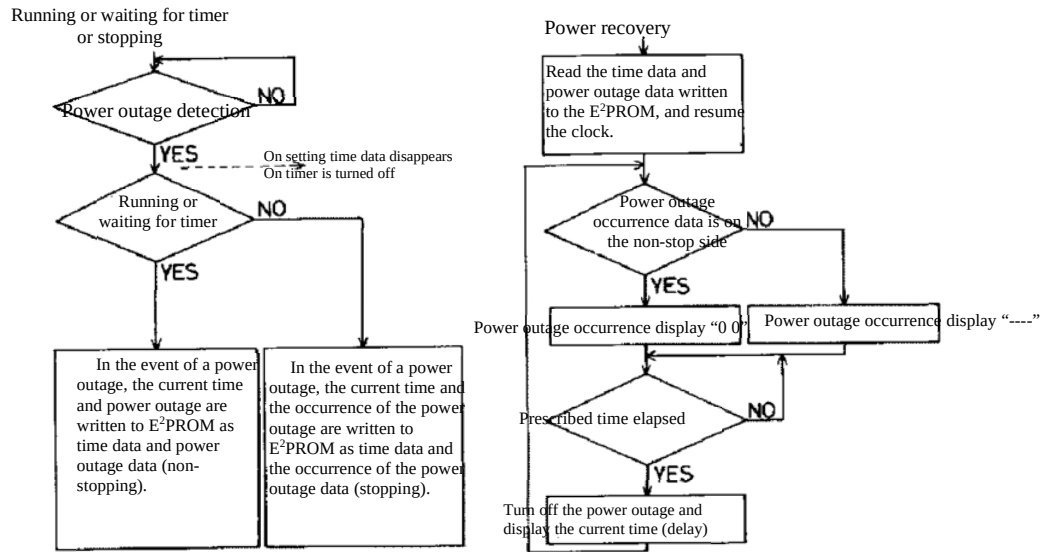


[FIG. 2]

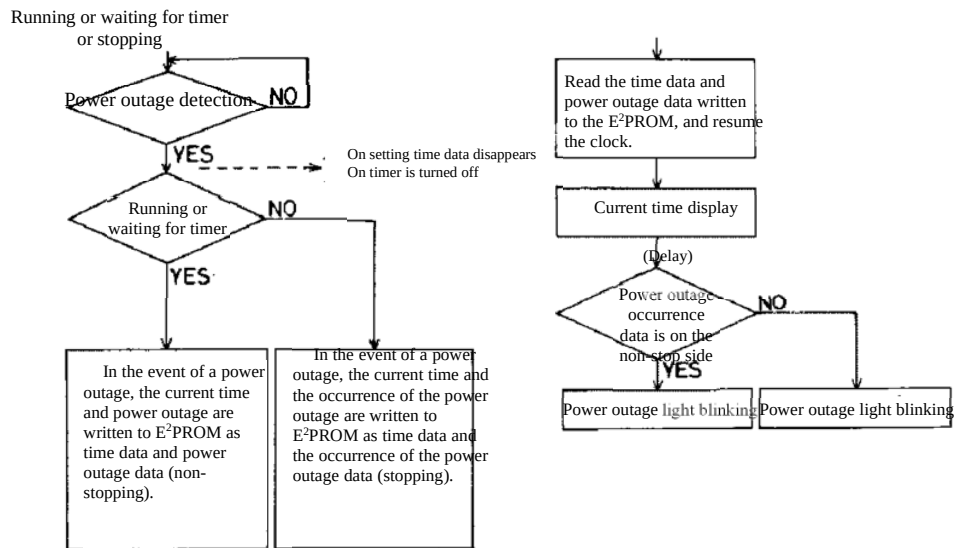


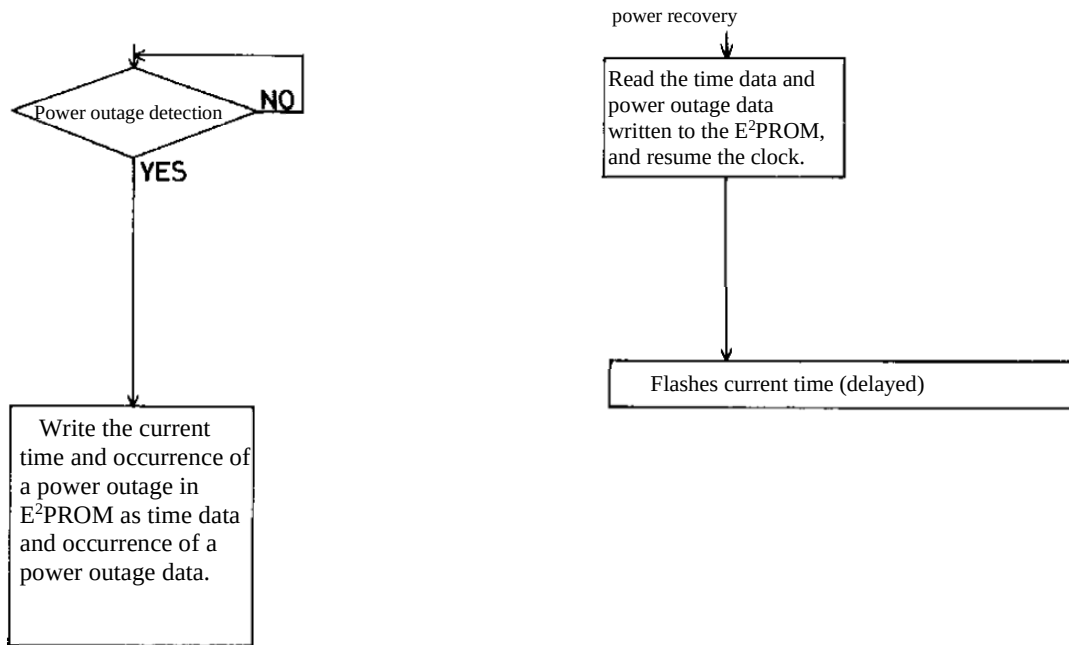
[FIG. 3]





[FIG. 5]





Continued from the front page

- (56) Reference literatures Japanese Unexamined Patent Application Publication No. H1-143995 (JP, A)
 Japanese Unexamined Patent Application
 Publication No. S48-11074 (JP, A)
 H5-62895 (JP, U)
 S52-144777 (JP, U)
 S56-86740 (JP, U)
 S55-97491 (JP, U)