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(54) **FACILITY FOR PREVENTING DISASTERS.**

(57) A facility for preventing disasters which controls terminal equipment or devices to be controlled connected to said terminal equipment according to a predetermined control instruction via a control circuit provided in said terminal equipment. The terminal equipment is provided with a clocking means which performs a predetermined clocking operation upon receipt of said control instruction. The terminal equipment or the devices to be controlled are controlled for a period of time specified by the clocking operation.

EP 0 279 864 A1

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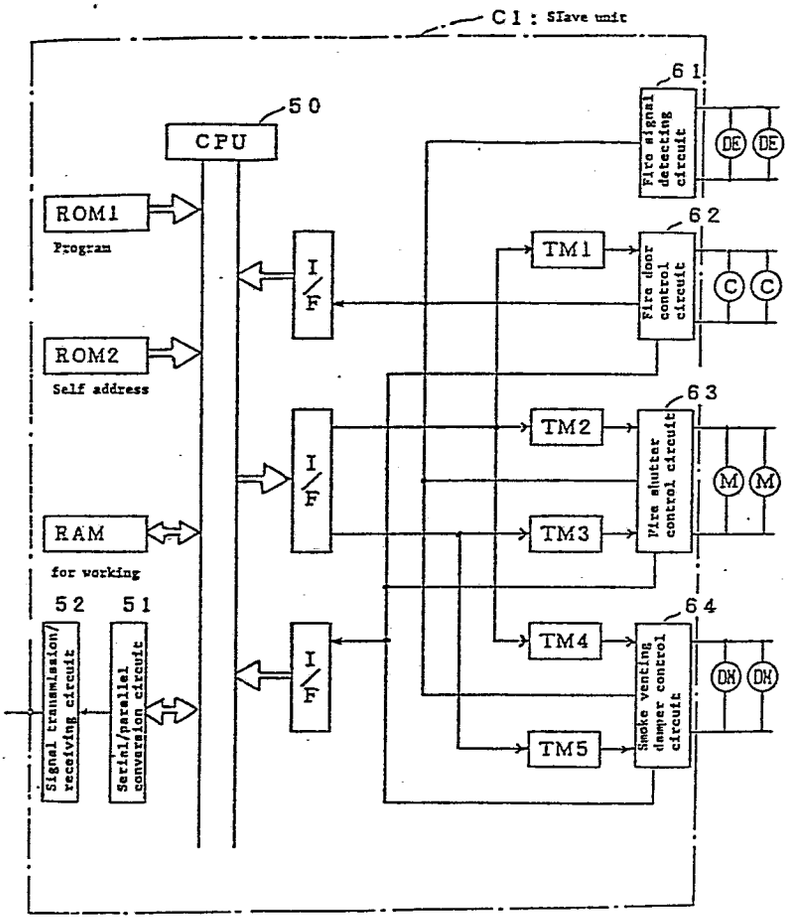
C1 : SIave unit
61
50
CPU
Fire signal detecting circuit
DE
DE
ROM1
Program
62
TM1
Fire door control circuit
C
C
I/F
ROM2
Self address
63
TM2
Fire slutter control circuit
M
M
I/F
RAM
for working
TM3
52
51
64
TM4
Signal transmission/ receiving circuit
Serial/parallel conversion circuit
Smoke venting damper control circuit
DM
DM
I/F
TM5

FIG.2

TITLE MODIFIED
see front page

SPECIFICATION

DISASTER PROTECTION SYSTEM

TECHNICAL FIELD

The invention relates to a disaster protection system and more particularly, it relates to a protection system employing the polling method, wherein the workload of a fire control panel is reduced when controlling the terminal units, and which can easily be adapted to changes of the devices to be controlled.

TECHNOLOGICAL BACKGROUND

Some conventional fire protection systems employ the polling method which causes the fire control panel to circularly call the terminal units in order and to read from each of the called terminal units the state information (presence or absence of an abnormality signal from an abnormality sensor, or ON/OFF of the control circuits for devices to be controlled) or to control the called terminal units.

The above terminal units may be slave units to which are connected abnormality sensors (fire detectors, gas sensors etc,) and/or devices to be controlled (fire doors, smoke control devices, smoke venting devices, fire extinguishing systems etc.), or those abnormality sensors or controlled devices themselves.

In the above-mentioned fire protection system the terminal units to be controlled and the time needed for the control are stored in advance in memory means such as ROM's in the fire control panel so that the fire control panel may

control the appropriate terminal units on the basis of the data stored in the memory means in case of an abnormality, such as a fire or a gas leak.

Now, there are various terminal units to be controlled, and yet, the time required for their control varies with each terminal unit. For example, fire doors, emergency doors, smoke venting dampers, or smoke control dampers which are kept locked in a position by electric locks are released from locking by actuating the electric lock control circuits in the slave units for about 10 seconds, and then move to the predetermined positions with the aid of door closers or their own weight.

For opening, closing, and resetting a motor driven fire shutter, smoke venting damper, or a smoke control/fire damper provided in the duct of an air conditioning system, it is necessary to operate the control circuits in the slave units for the control of the motors, i.e. the forward or reverse rotation for a certain length of time ranging from about 10 seconds to a few minutes.

In case of fire, the fire control panel sends a control start command to the terminal unit to be controlled and causes the control circuit in said terminal unit to operate. After the lapse of time required for control, the fire control panel sends a control termination command to the terminal unit to stop the operation of the control circuit. As to those terminal units requiring their reset after the extinguishment of the fire, the fire control panel sends a control start command and a control termination command at the time of the reset start and the reset termination, respectively.

As can be seen from the above description, the time required for control varies, and this imposes a heavy workload on the fire control panel in conventional systems.

Moreover, there are problems in that the contents stored in the memory means of the fire control panel need to be newly prepared for each installation of a fire alarm system, and that whenever changes are made with respect to devices to be controlled, those stored contents have to be changed accordingly, and such preparation and changes are troublesome.

DISCLOSURE OF THE INVENTION

The present invention was made in view of these problems involved in conventional fire protection systems, and with the objective of creating a fire protection system such as a fire alarm system using the polling method which reduces the workload of the fire control panel when controlling the terminal units, and which may easily be adapted to changes of the devices to be controlled.

The present invention was made in order to achieve said object. Namely, the present invention provides a disaster protection system for controlling terminal units themselves or devices to be controlled which are connected to said terminal units, according to a predetermined control command, through control circuits provided at the terminal units, wherein said terminal units have timer means which carry out a predetermined timing operation in response to the reception of said control command, whereby said terminal units themselves or said devices to be controlled are controlled during the time interval determined by the timimg operation.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram showing the control panel of an embodiment of the present invention,

Figure 2 is a block diagram showing a slave unit in this embodiment,

Figure 3 is a flowchart showing the operation of the fire control panel in this embodiment,

Figure 4 is a flowchart showing the operation of the slave unit in this embodiment,

Figure 5 is a circuit diagram showing an embodiment of the timer of the above embodiment, and

Figure 6 is a time chart showing the operation of the timer shown in Figure 5.

BEST MODE FOR CARRYING OUT THE INVENTION

Figure 1 is a block diagram showing an embodiment of the present invention. In Figure 1 a fire control panel 10 is connected with slave units C 1, C 2, C n. While devices other than the slave units C 1 - C n may also be connected as terminal units, the slave units alone are shown in Figure 1 as example.

The fire control panel 10 is equipped with a CPU 11 for overall control, an operating part 12, an interface 13, a serial/parallel conversion circuit 14 converting serial data into parallel data (or vice versa), a signal transmission/receiving circuit 15 for signal transmission or receiving, an indication part 16 for indicating predetermined data, and an interface 17.

The fire control panel 10 is also equipped with a ROM 1, a ROM 2, a ROM 3, a ROM 4, a ROM 5, a RAM 1, a RAM 2, a RAM 3, a RAM 4, and a RAM 5 which store the system program, the address classification map, the program for analyzing state information, the control program, the program for analyzing the control results, the polling address, the command codes, the terminal numbers and classifications of the terminal units to which the control state commands need to be sent, the terminal numbers and

classifications of the terminal units ti which the reset commands need to be sent, the terminal numbers and classifications of the terminal units which need to be checked for proper control, respectively, and with a ROM 6 for working.

Figure 2 is a block diagram showing a practical example of the slave unit C 1. The slave units C 2 - C n, too, have the same composition as that of slave unit C 1. The slave unit C 1 is equipped with a circuit 61 which detects the fire signal from a fire detector DE, with a control circuit 62 which controls an electric clock C of a fire door, a control timer TM 1 for the fire door control circuit 62, a control circuit 63 which controls the forward/reverse rotation of a motor M for a fire shutter, a timer TM 2 which controls the forward rotation time of the motor M, a timer TM 3 which controls the reverse rotation time of the motor M, a control circuit 64 which controls the forward/reverse rotation of a motor DM for a smoke venting damper, a timer TM 4 which controls the forward rotation of the motor DM, and a timer TM 5 which controls the reverse rotation of the motor DM.

The timers TM 1 - TM 5 have their operating times set for the intended controls, for example, TM 1 has an operating time of 5 seconds, TM 2 of 60 seconds, TM 3 of 90 seconds, and both TM 4 and TM 5 have 20 seconds.

The fire door control circuit 62, the fire shutter control circuit 63, and the smoke venting damper control circuit 64 are shown as examples of control circuits which control the terminal units themselves or devices connected with and controlled by the terminal units. The fire door, the fire shutter, and the smoke venting damper are shown as examples of controlled devices.

The timers TM 1 - TM 5 are shown as examples of the timer means which are triggered by the control command signal from the fire control panel and generate an output for a predetermined length of time. The output time of the timer means is adjustable.

The operation of the above embodiment is described hereinafter.

Figure 3 is a flowchart showing the operation of the fire control panel 10.

On the part of the fire control panel 10, firstly an initial value is set (S 1), a terminal number n (a terminal unit number, i.e. a polling address) is incremented by 1 (S 2) and referred to the terminal numbers and classifications stored in the RAM 3 - RAM 5, with respect to the terminal units to which the control start command, the reset command, and the command for checking the controls need to be sent. If there is the terminal number n in one of the RAM 3 - RAM 5, a corresponding command code is prepared. In the absence of the terminal number n in any of them, a command code requesting a state information is prepared (S 3). Then, the address code and the command code prepared in step S 3 are sent to the terminal unit (S 4).

After this, if there is a return signal from the polled terminal unit (S 5) indicating a result of the control (S 6), this information on the control result is analyzed by the analyzing program stored in the ROM 5, the result of which is indicated by the means of the indicating part 16 (S 7).

If the return signal from the terminal unit does not represent a control result but rather a state of the terminal unit, the state information is analyzed by the analyzing program stored in ROM 3 and indicated by indicator 16 (S 8).

If it is necessary to start controlling a device such as a fire door (S 11) as a result of the analyzation of the state information from the fire detector DE, the classification (classification of the control device) and the number n of the terminal unit are stored in the RAM 3 (S 12). If it is necessary to reset the controlled device (S 13), the classification and the terminal number n of the controlled device are stored in the RAM 4 (S 14). If it is required to know a result of the control (S 15), the classification and the terminal number n of the device to which the command for checking the control applies is stored in the RAM 5 (S 16).

These operations of S 6 - S 16 are repeated until all the received information is processed (S 21). After processing all the received information, the above operations are repeated until the terminal number n reaches the set value N which represents the last terminal number. When the terminal number n matches the set value N, the terminal number n is set to 0 (S 23), and the operation returns to step S 2.

Now, the operation of the slave unit C 1 is described hereunder.

Figure 4 is a flowchart showing the operation of the slave unit C 1.

Firstly, the initial value is set (S 31). If there is a return signal through the signal line (S 32), and yet the polling terminal number (address) in the return signal matches the terminal number stored in ROM 2 (S 33), the state information is stored (S 34).

The state information includes data indicating whether or not there is a fire signal from the fire signal detecting circuit 61 and the ON/OFF state of each of the control

circuit 62, 63, 64 for the fire door, the fire shutter, and for thesmoke venting damper, respectively.

Secondly , the command code in the return signal received from the fire control panel 10 is decoded. If this command code is a control command (S 35) and yet a control start command (S 41), the timers TM 1, TM 2, TM 4 are triggered (S 42) to send the state information of the detecting circuit 61 and the control circuits 62 - 64 which had previously been read and stored at step S 34 to the fire control panel 10 (S 43). With the outputs of the timers TM 1, TM 2, TM 4 the control circuits 62 - 64 are operated for a predetermined time to close the fire door and the fire shutter, and to open the smoke venting damper, resp.

On the other hand, if the control command is a reset command (S 51), the timers TM 3, TM 5 are triggered (S 52) to send the state information which has already been read and stored at step S 34 to the fire control panel 10 (S 43). With the outputs of the timers TM 3, TM 5 the control circuits 63, 64 are operated for the predetermined time to open the fire shutter and to close the smoke venting damper, respectively.

If the received command code is not a control command (S 35) but a request from the fire control panel 10 for information on results of the controls (S 61), the control results of the controlled devices (Information as to open/close of the fire door, the fire shutter, and the smoke venting damper) are read from the respective control circuits (S 62), and the information on the control results and the state information stored at step S 34 are sent to the fire control panel 10 (S 63). In brief, information on results of the controls is given with respect to those controlled devices which need to be checked for their proper controls, while state information of the control circuits is given with respect to those controlled devices which need not to be checked for their controls.

Then, the operation of the slave unit terurns to step S 32.

In the above embodiment each of the control circuits in the terminal units is provided with a control timer which is triggered by the command from the fire control panel and generates an output signal to the control circuit in the terminal unit for a predetermined length of time (Time needed for control). With this arrangement the control of the above control circuits is completed by merely sending the control signal from the fire control panel to the corresponding terminal unit when such control is required due to fire or other accidents, and there is no need for the fire control panel to manage the control time for each control circuit. This reduces the workload on the part of the fire control panel for the control of the terminal units to a large extent.

Furthermore, by providing control timers which control the operating time of the control circuits, it is possible to perform precise control of the control devices and to control each terminal unit within the optimum length of time, and consequently the power consumption for control can be reduced.

Figure 5 shows an example of the timers TM 1 - TM 5, the output time of which can optionally be changed by means of the dip switches, thus they can be adapted to devices of the same kind which have different control times (timer output times).

Figure 6 is a time chart showing the operation of the timers shown in Figure 5. This time chart shows a case where an 8-bit binary counter with preset priority function is used.

The time T of the timer output (output of the OR circuit) is given by the following formula:

$$T = 1 \text{ sec} \times \{2^8 - (2^7 \cdot S7 + 2^6 \cdot S6 + 2^5 \cdot S5 + 2^4 \cdot S4 + 2^3 \cdot S3 + 2^2 \cdot S2 + 2^1 \cdot S1 + 2^0 \cdot S0)\}$$

Therefore, the length of the output time of the timer is variable within a range of 1 second - 255 seconds.

Although the numerical value indicated on the counter at the time of turning on the power supply, it is set to zero by the power-on reset signal immediately after the power-on, and the output of the OR circuit reaches the L level, causing the counter to clear itself through the AND circuit and to lock in the cleared state.

Because of the preset priority function the counter is released from the cleared state when the start pulse is applied, and the ON/OFF state of the dip switches S 0 - S 7 is preset in the counter. After this, the counter keeps counting and again returns to and locks in the cleared state when overflowed (the output of all of Q 0 - Q 7 reached the H level). Thus, the output of the OR circuit remains at the H level for the above T seconds, and consequently the counter circuit fulfills the function of the timer.

The start pulse is generated by the terminal unit CPU 50 upon receipt of the reset command from the fire control panel and sent to the timer through I/F.

By providing each of the control circuits in the terminal unit with a control timer which is triggered by the command from the fire control panel and generated an output to the control circuit for a predetermined length of time, the present invention has such effects that the workload of the fire control panel when controlling the terminal units in a fire protection system using the polling method is reduced, and the work required for changes of devices to be controlled is readily performed.

CLAIMS

1. A disaster protection system in which terminal units are equipped with control circuits for controlling the terminal units themselves or devices connectes with said terminal units, which controls said terminal units themselves or said devices through said control circuits according to control command signals from a fire control panel, characterized in that timer means triggered by said control command signals and generating an output for a predetermined time are provided in said terminal units for controlling said terminal units themselves or connected devices through said control circuits according to the output of the timer means.

2. A disaster protection system as defined in claim 1 wherein the length of the output time of the timer means is adjustable.

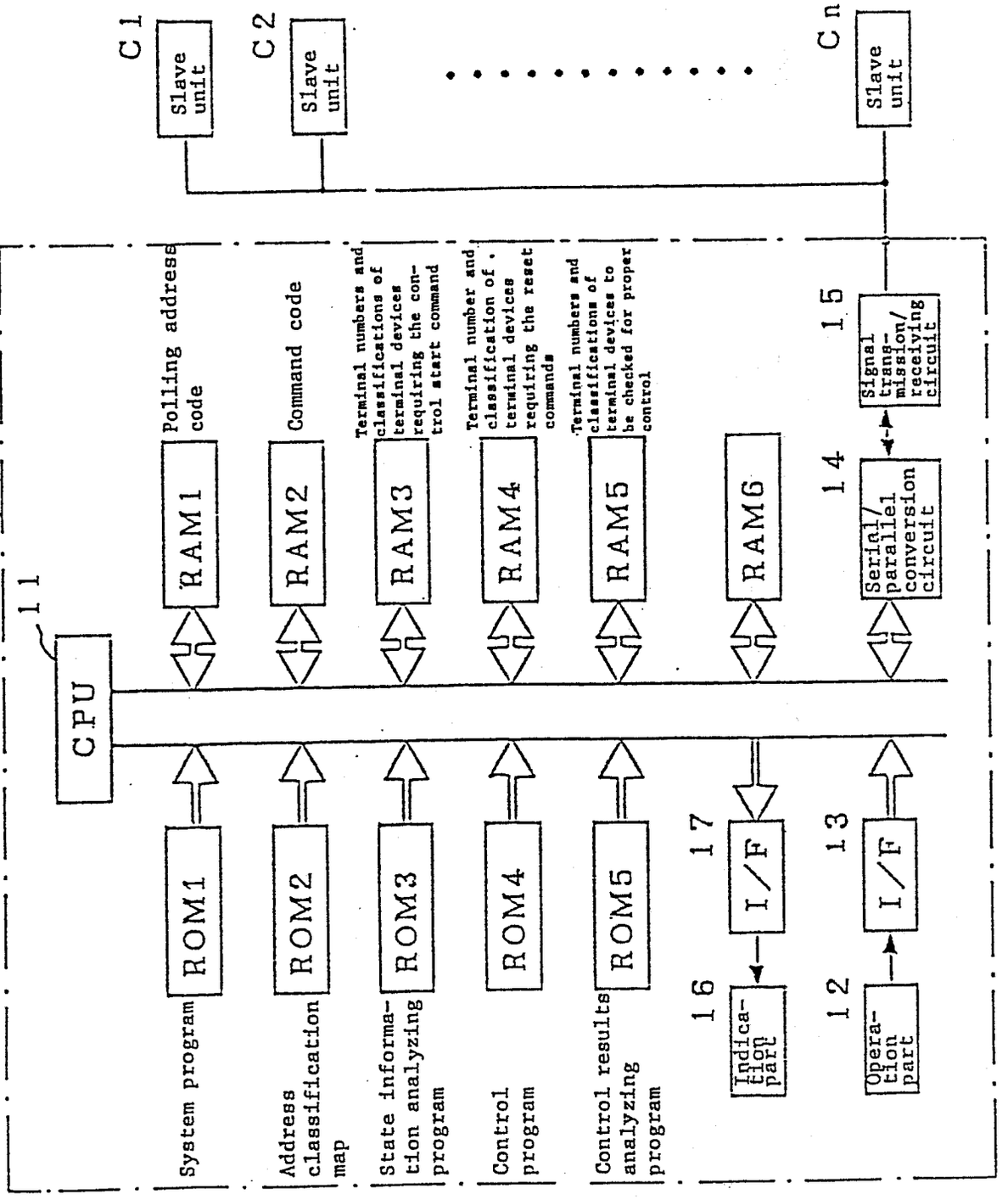
10 : Fire control panel
11
CPU
ROM1
System program
ROM2
Address classification map
ROM3
State information analyzing program
ROM4
Control program
ROM5
Control results analyzing program
RAM1
Polling address code
RAM2
Command code
RAM3
Terminal numbers and classifications of terminal devices requiring the control start command
RAM4
Terminal number and classification of terminal devices requiring the reset commands
RAM5
Terminal numbers and classifications of terminal devices to be checked for proper control
RAM6
14
Serial/parallel conversion circuit
15
Signal transmission/receiving circuit
C1
Slave unit
C2
Slave unit
Cn
Slave unit
16
Indication part
17
I/F
12
Operation part
13
I/F

FIG.1

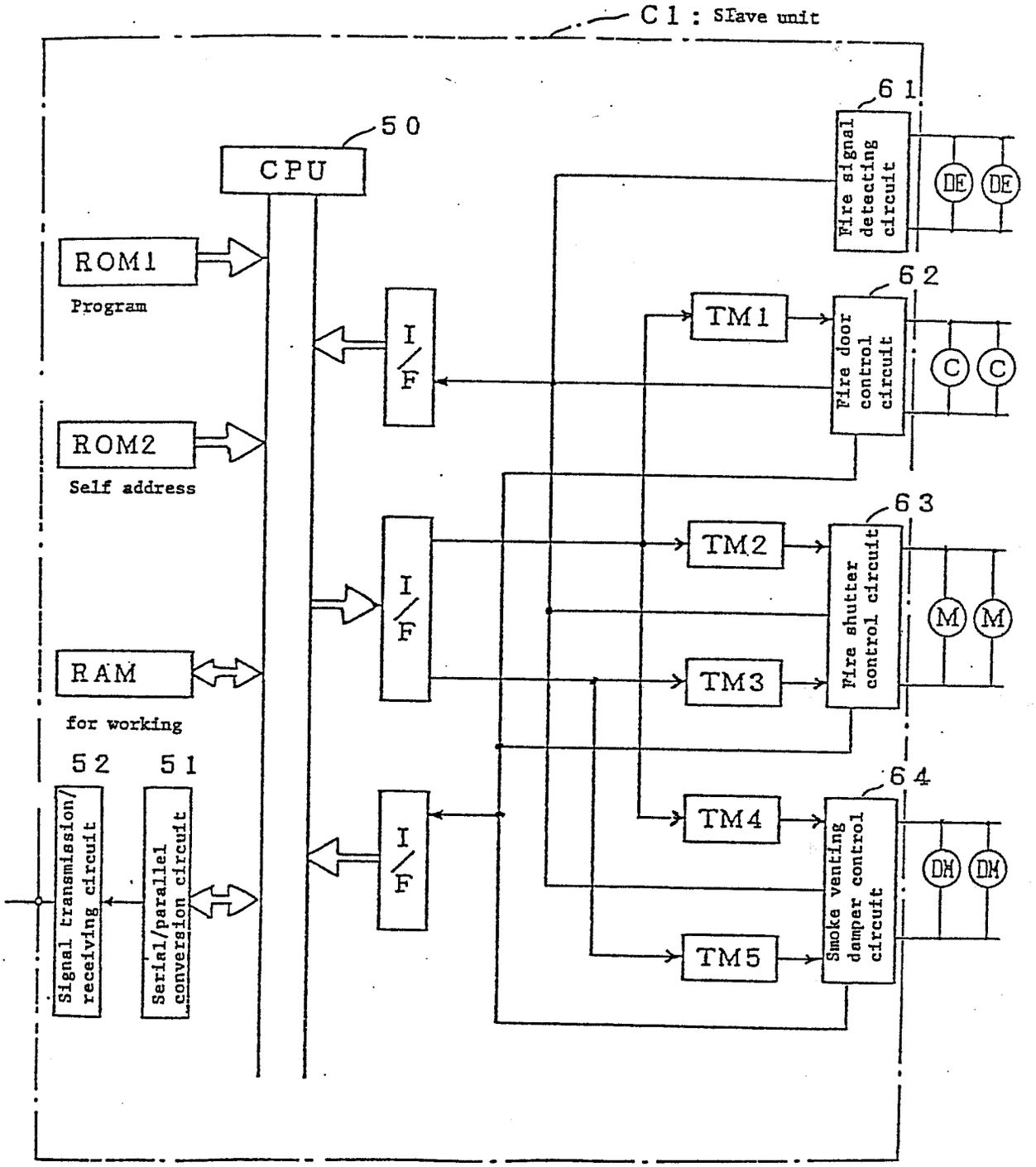
C1 : SIave unit
50
CPU
ROM1
Program
ROM2
Self address
RAM
for working
52
51
Signal transmission/ receiving circuit
Serial/parallel conversion circuit
I/F
I/F
I/F
61
Fire signal detecting circuit
DE
DE
62
TM1
Fire door control circuit
C
C
63
TM2
TM3
Fire shutter control circuit
M
M
64
TM4
TM5
Smoke venting damper control circuit
DM
DM

FIG.2

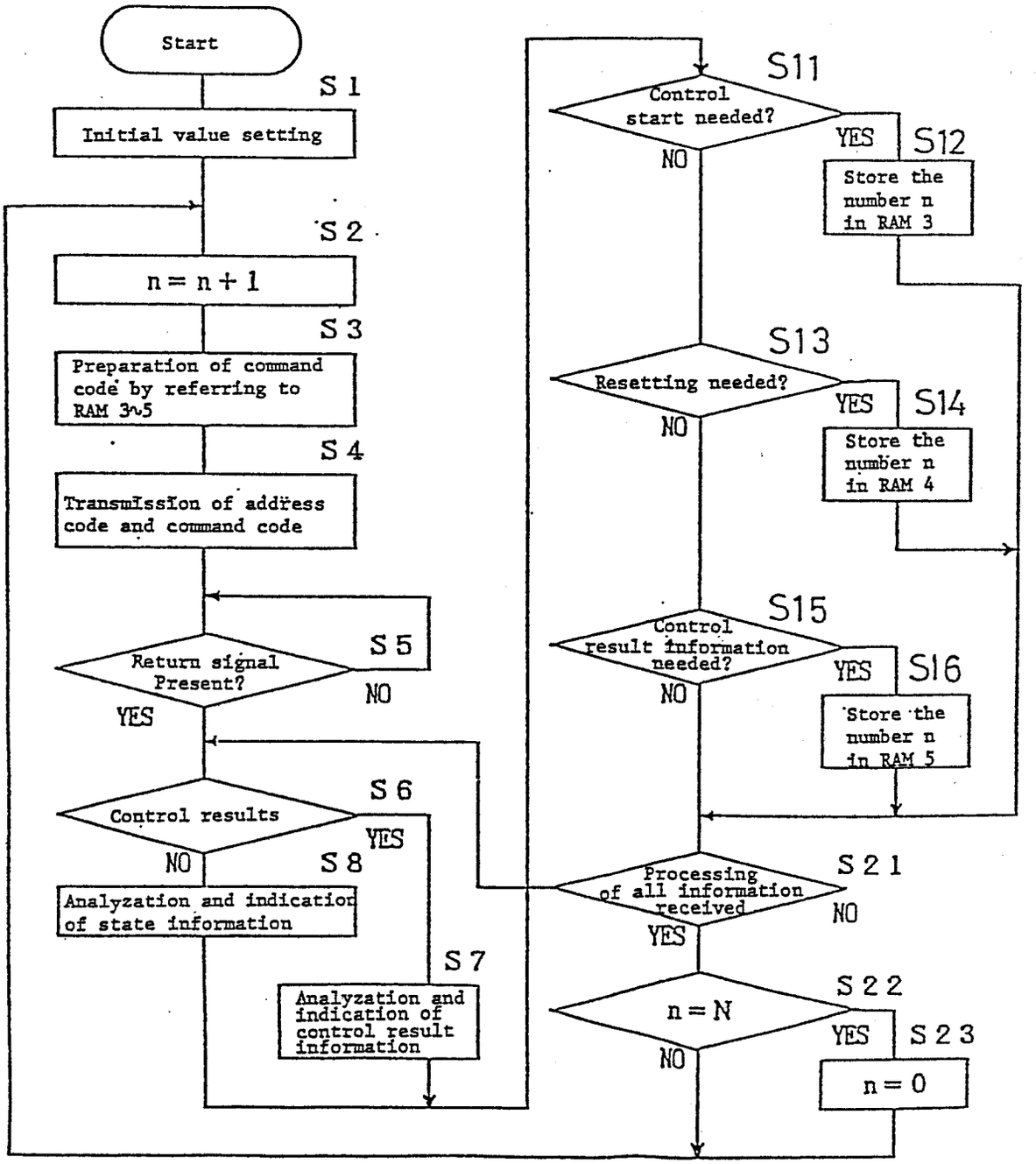
Start
S 1
Initial value setting
S 2
n = n + 1
S 3
Preparation of command code by referring to RAM 3∿5
S 4
Transmission of address code and command code
S 5
Return signal Present?
NO
YES
S 6
Control results
YES
NO
S 8
Analyzation and indication of state information
S 7
Analyzation and indication of control result information
S11
Control start needed?
YES
NO
S12
Store the number n in RAM 3
S13
Resetting needed?
YES
NO
S14
Store the number n in RAM 4
S15
Control result information needed?
YES
NO
S16
Store the number n in RAM 5
S 2 1
Processing of all information received
NO
YES
S 2 2
n = N
YES
NO
S 2 3
n = 0

FIG.3

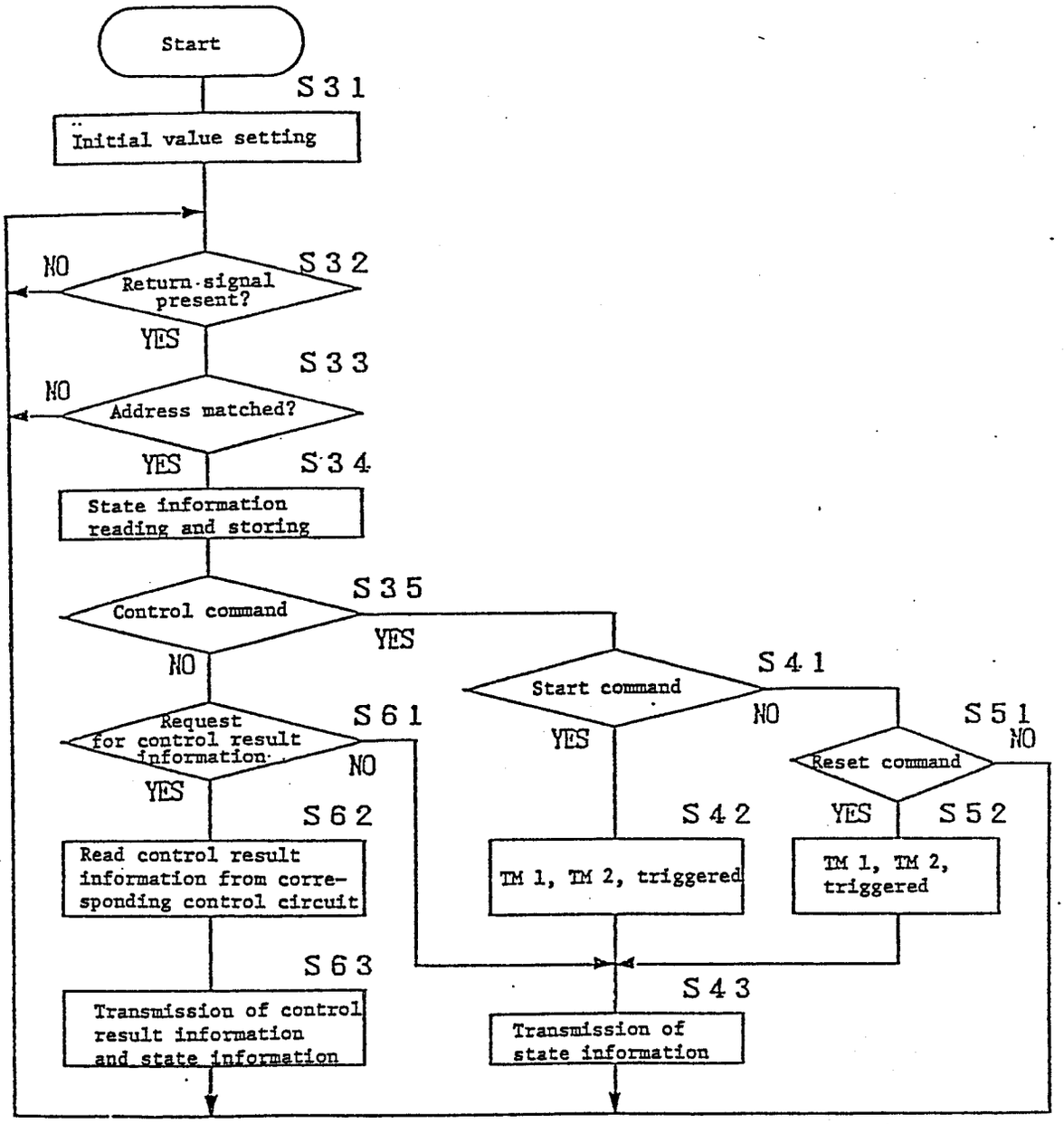
Start
S31
Initial value setting
NO
S32
Return signal present?
YES
S33
NO
Address matched?
YES
S34
State information reading and storing
S35
Control command
YES
NO
S41
Start command
NO
YES
S51
NO
Reset command
S61
Request for control result information
NO
YES
YES
S52
S62
S42
Read control result information from corresponding control circuit
TM 1, TM 2, triggered
TM 1, TM 2, triggered
S63
S43
Transmission of control result information and state information
Transmission of state information

FIG.4

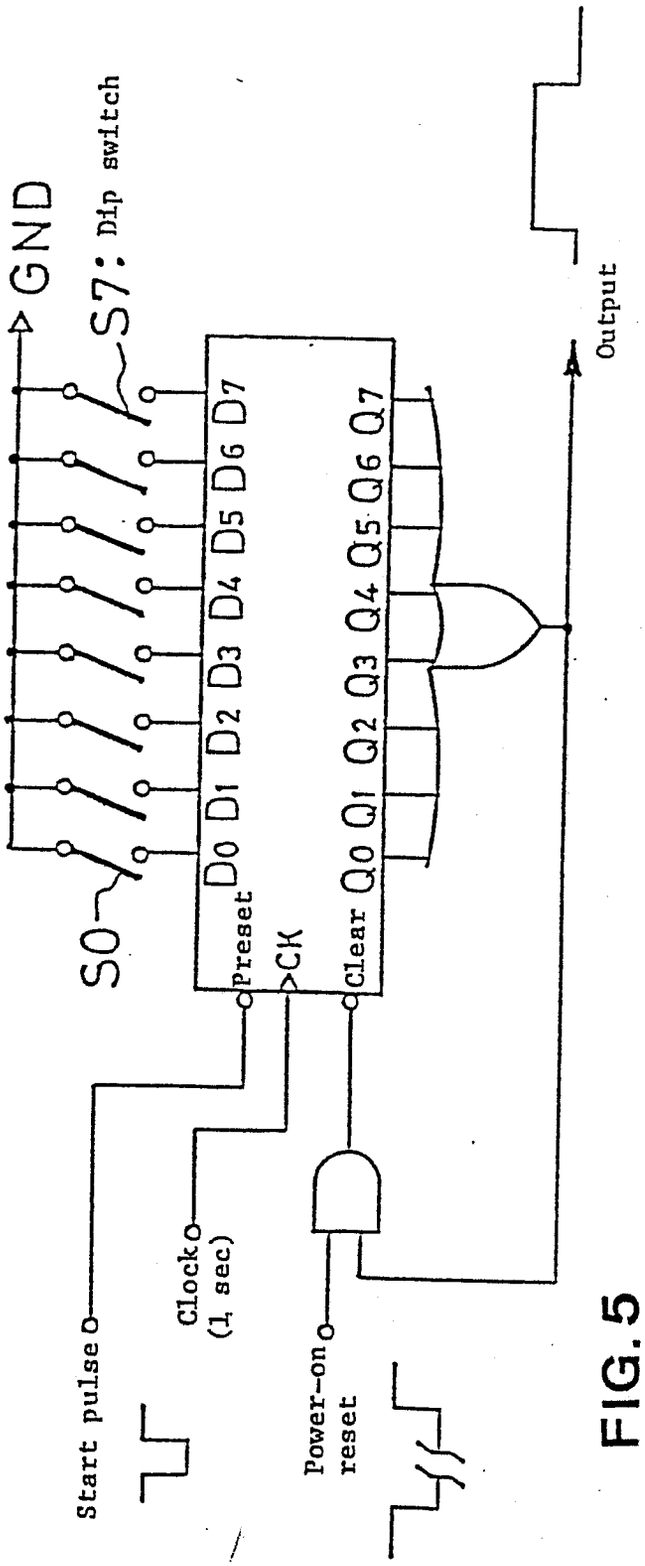
GND
S7: Dip switch
S0
D0 D1 D2 D3 D4 D5 D6 D7
Preset
CK
Clear
Q0 Q1 Q2 Q3 Q4 Q5 Q6 Q7
Output
Start pulse
Clock
(1 sec)
Power-on
reset

FIG. 5

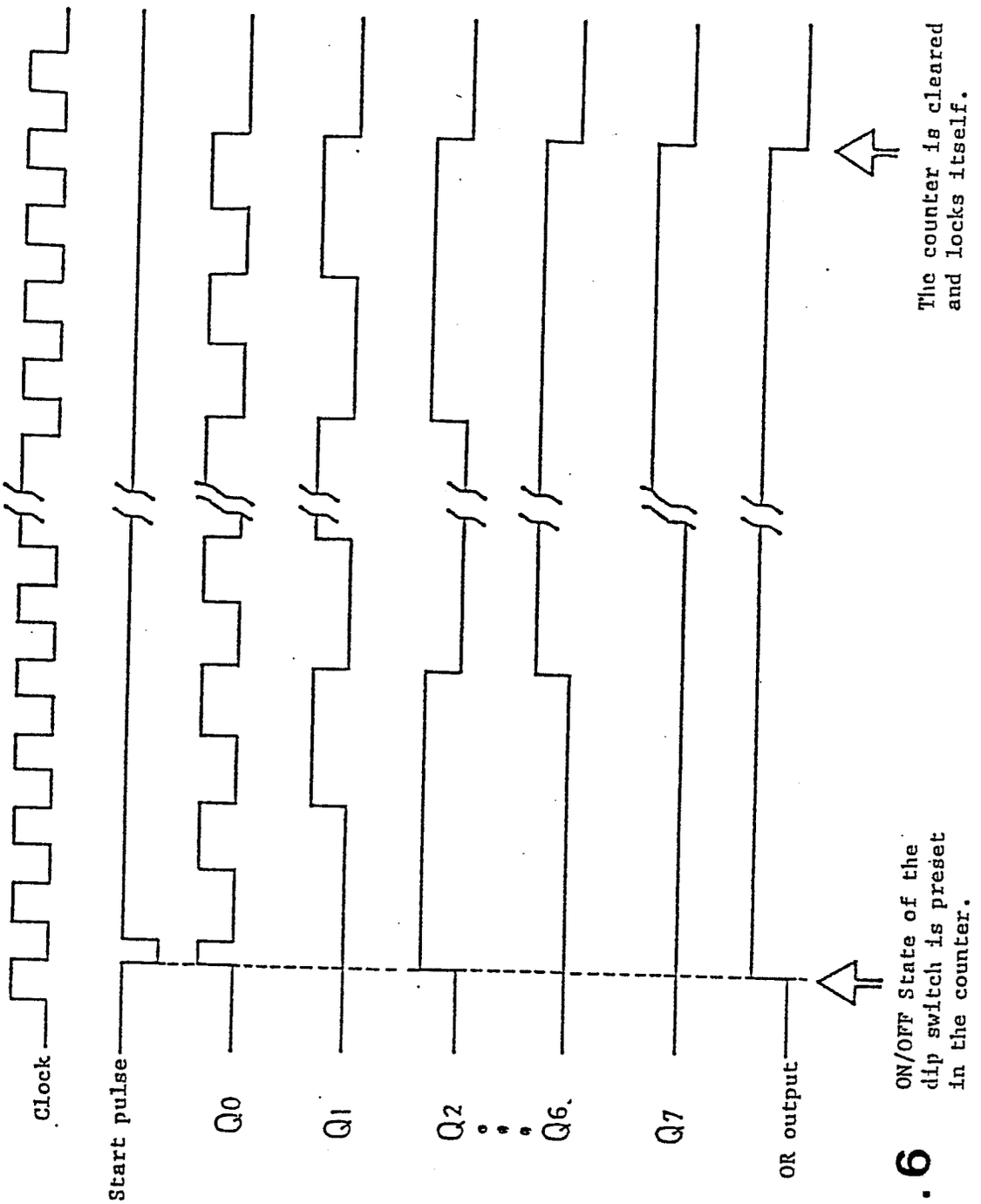
Clock
Start pulse
Q0
Q1
Q2
Q6
Q7
OR output
ON/OFF State of the dip switch is preset in the counter.
The counter is cleared and locks itself.

FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP87/00654

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[4] A62C3/14, 37/00

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System [5]	Classification Symbols
IPC	A62C3/14, 37/00-37/04

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [6]

Jitsuyo Shinan Koho	1926 - 1986
Kokai Jitsuyo Shinan Koho	1971 - 1986

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, 61-16396 (Nittan Co., Ltd.) 24 January 1986 (24. 01. 86) Page 3, lower left column, 8th line from the bottom to lower right column, 7th line from the bottom (Family: none)	1, 2
A	JP, U, 55-109550 (Hochiki Corporation) 31 July 1980 (31. 07. 80) Page 4, lines 5 to 9, page 9, lines 1 to 15 (Family: none)	1, 2
A	JP, B, 55-20276 (Nishiki Kogyo Kabushiki Kaisha) 31 May 1980 (31. 05. 80) Column 3, lines 17 to 31 (Family: none)	1, 2

* 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]
October 27, 1987 (27.10.87)	November 9, 1987 (09.11.87)
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Japanese Patent Office	