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

(11) Publication number: **0 444 636 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91102930.4**

(51) Int. Cl.5: **H05B 37/02**

(22) Date of filing: **27.02.91**

(30) Priority: **28.02.90 JP 47794/90**

(43) Date of publication of application:
04.09.91 Bulletin 91/36

(84) Designated Contracting States:
DE GB

(71) Applicant: **TOSHIBA LIGHTING & TECHNOLOGY CORPORATION**
4-28, Mita 1-chome
Minato-ku Tokyo(JP)

(72) Inventor: **Nagata, Yoshio**
105 Sunny-Villa, 645-21, Futoo-cho,
Kohoku-ku
Yokohama-shi(JP)
Inventor: **Watanabe, Yuichi**
3-23, Yasuura-cho
Yokosuka-shi, Kanagawa-ken(JP)
Inventor: **Yamazaki, Kyoji**
1502-2-509, Shinyoshida-cho, Kohoku-ku
Yokohama-shi(JP)

(74) Representative: **Henkel, Feiler, Hänzel & Partner**
Möhlstrasse 37
W-8000 München 80(DE)

(54) A system for remotely conrolling a plurality of lighting equipments.

(57) In a system for remotely controlling a plurality of lighting equipments wherein remote-controlled relays (6_1 to 6_4) are driven by a control terminal 3B connected to a main controller via a transmission line (2) and lighting equipments (5) connected to the remote-controlled relays (6_1 to 6_4) via a power source line are turned on/off by an opening/closing operation of a relay contact (R), a remote-controlled transformer (7), which supplies driving power source to the control terminal (3B) and the remote-controlled relays, is arranged in one row in a distribution board, and the control terminal (3B) is arranged between the remote-controlled relays (6_1 to 6_4) and the remote-controlled transformer (7). Then, a power signal output from the remote-controlled transformer (7) is supplied to the remote-controlled relays (6_1 to 6_4) via the control terminal (3B), thereby preventing a signal line, which transmits a control signal to the remote-controlled relays (6_1 to 6_4) from the control terminal (3B), from crossing a signal line, which is input from the remote-controlled transformer (7).

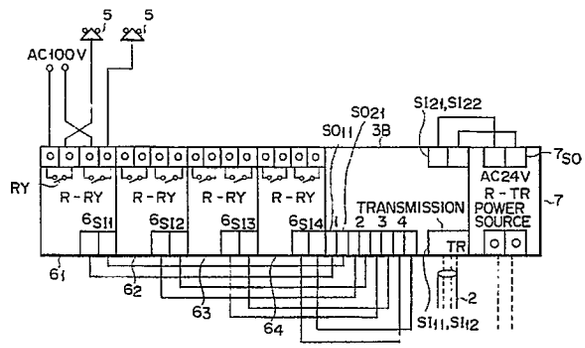

FIG. 2

EP 0 444 636 A2

This invention relates to a system for remotely controlling a plurality of lighting equipments, which drives a remote-controlled relay by a control terminal connected via a main controller and a transmission signal line, and which turns on/off lighting requirements connected to the remote-controlled relay via a power source line by the opening and closing operation of a relay contact.

In order to control a number of lighting equipments in a concentrated manner provided in large-scale facilities such as multistoried buildings, Published Unexamined Japanese Patent Application (PUJPA) No. 62-123896, for example, discloses a system for remotely controlling lighting requirements wherein a main controller, a plurality of monitoring terminals, and a plurality of control terminals are connected by a transmission line, and a monitor signal transmitted from the monitoring terminal is processed by the main controller, thereby transmitting a control signal to the control terminal from the main terminal, and a plurality of remote-controlled relays connected to the control terminal by the signal transmitted from the main controller are driven, thereby turning on/off the lighting equipments.

However, in such system for remotely controlling the lighting equipments, the remote-controlled relays are arranged in two rows in a distribution board and the control terminal is arranged between the rows. Due to this, one wire, which connects the control terminal to the remote-controlled relay, crosses the other wire, which connects to a transformer for supplying driving power to the remote-controlled relays, thereby there was a problem that an erroneous wiring is easily caused.

Moreover, in the above-mentioned system for remotely controlling the lighting equipments, since the remote-controlled relays are arranged in two rows in the distribution board, there was a problem that the wire connecting to the transformer becomes longer.

An object of the present invention is to provide a system for remotely controlling a plurality of lighting equipments, which can prevent an erroneous wiring from being caused by crossing two wires, one of which connects the control terminal to the remote-controlled relay, and the other of which connects to a transformer for supplying driving power to the remote-controlled relays, and which can shorten the length of the wire connecting the remote-controlled relay to the transformer.

Accordingly, the present invention provides a system for remotely controlling a plurality of lighting equipments which comprises a plurality of remote-controlled relays arranged in one row in a distribution board, and having a relay contact interrupting power-supply to lighting equipments; relay power generating means, arranged in said distribution board along the array direction of said remote-controlled relays, for generating power for driving said remote-controlled relays; a main controller for controlling said lighting equipments; a transmission line for transmitting a control signal output from said main controller; and a control terminal including first signal input means, arranged between said remote-controlled relays and said relay power generating means in said distribution board, for inputting said control signal from said main controller via said transmission line, second signal input means for inputting a power signal output from said relay generating means, first signal outputting means for outputting a signal opening and closing said relay contact of said remote-controlled relays in accordance with said control signal input in said first signal input means, and second signal outputting means for outputting said power signal input in said second signal input means to said remote-controlled relays.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic structural view showing one embodiment of a system for remotely controlling a plurality of lighting equipments according to the present invention;

Fig. 2 is a view showing the relationship of the connection among a control terminal in said system, a remote-controlled relay, and a remote-controlled transformer;

Fig. 3 is a structural view of a main controller in said system;

Fig. 4 is a structural view of a control terminal in said system;

Fig. 5 is a plan showing a control terminal arranged in a distribution board, a remote-controlled relay, and a remote-controlled transformer;

Fig. 6 is a front view of Fig. 5;

Fig. 7 is a side view of Fig. 5;

Fig. 8 is a plan showing a control terminal; and

Fig. 9 is a view showing a modification of the control terminal.

An embodiment of the present invention will be explained with reference to the drawings.

Fig. 1 is a schematic structural view showing a system for remotely controlling a plurality of lighting equipments according to the present invention. A plurality of monitoring terminals 3A and a plurality of control terminals 3B are connected to a main controller 1 of this system via a transmission signal line 2. A plurality of lighting switches 4, which are monitoring objects, are connected to the monitoring terminals 3A. A plurality of lighting equipment 5, which are controlling objects, are connected to the control terminals 3B via remote-controlled relays

6_1, 6_2, 6_3, and 6_4, as shown in Fig. 2. A remote-controlled transformer 7 is connected to the control terminals 3B.

The main controller 1 transmits a control signal to the control terminals 3B in accordance with a monitor signal sent from the monitoring terminals 3A. As shown Fig. 3, the main controller 1 comprises a transmitting/receiving circuit 8, a current detecting circuit 9, a comparator 10, and a signal processing circuit 11.

The transmitting/receiving circuit 8 transmits/receives a transmission signal to/from the monitoring terminals 3A and the control terminals 3B. The transmitting/receiving circuit 8 comprises transistors Tr_1, Tr_2, Tr_3, Tr_4, a driving circuit 12 for driving the transistors Tr_1, Tr_2, Tr_3, Tr_4, and signal input/output terminals 8_{ST1} and 8_{ST2} for inputting/outputting the transmission signal.

The base terminals of transistors Tr_1, Tr_2, Tr_3, Tr_4 are connected to the signal output terminals 01, 02, 03, 04 of the driving circuit 12. If a driving signal is applied to the base terminals of the transistors Tr_1, Tr_2, Tr_3, Tr_4 from the signal output terminals 01, 02, 03, 04 of the driving circuit 12, the transistors $Tr^{1'}$ Tr_2, Tr_3, Tr_4 are turned on. Moreover, the signal input terminals 11, 12, 13 and 14 of the driving circuit 12 are connected to the signal processing circuit 11. Then, if a pulse signal is output to the signal input terminals 11, 12, 13, and 14 of the driving circuit 12 from the signal processing circuit 11, a driving pulse is output from the signal output terminals 01, 02, 03, and 04 of the driving circuit 12.

The collector terminals of the transistors Tr_1 and Tr_2 are connected to the output terminal of a power source circuit (not shown) and a bias voltage of + 24 V is applied thereto. The emitter terminals of the transistors Tr_1 and Tr_2 are connected to the collector terminals of the the transistors Tr_3 and Tr_4. Moreover, the emitter terminals of the transistors Tr_3 and Tr_4 are connected to the current detection circuit 9. Then, the signal input/output terminal 8_{ST1} is connected between the emitter of the transistor Tr_1 and the collector of the transistor Tr_3, and the signal input/output terminal 8_{ST2} is connected between the emitter of the transistor Tr_2 and the collector of the transistor Tr_4.

Therefore, if the transistors Tr_1 and Tr_4 are turned on by the driving circuit 12, a voltage signal of + 24 V is applied to the signal input/output terminals 8_{ST1} and 8_{ST2}. If the transistors Tr_2 and Tr_3 are turned on by the driving circuit 12, a voltage signal of - 24 V is applied to the signal input/output terminals 8_{ST1} and 8_{ST2}.

The current detection circuit 9 converts the transmission signal received by the transmitting/receiving circuit 8 to a voltage mode from a current mode. In other words, the current detection circuit 9 is constituted so that the current signal sent from the transistor Tr_4 is converted into the voltage signal at a condenser C.

The comparator 10 converts the output of the current detection circuit 9 into a binary signal, and a reference voltage of + 5 is input to an input terminal of a plus side of the comparator 10.

The signal processing circuit 11 processes the output signal sent from the comparator 10 and generates a control signal. The signal processing circuit 11 comprises a central processing unit 13, a pulse signal generator 14 supplying a pulse signal for generating the control signal to the central processing unit 13, and a reset circuit 15 resetting the central processing unit 13 when power source is input.

The monitoring terminals 3A monitor the state of the switches 4 and transmits a monitor signal to the main controller 1. A contact signal, which is generated by the respective switches 4, is processed by a signal processing circuit (not shown) of the monitor terminals 3A, thereafter outputting the signal as a monitor signal to the main controller 1 via the transmission signal line 2.

The control terminals 3B control the remote-controlled relays 6_1, 6_2, 6_3, 6_4 in accordance with the control signal sent from the main controller 1. As shown in Fig. 4, the monitoring terminals 3B comprises a transmitting/receiving circuit 16, a signal processing circuit 17, a relay driving circuit 18, and a photocoupler circuit 19.

The transmitting/receiving circuit 16 transmits/receives the transmission signal to/from the main controller 1. The transmitting/receiving circuit 16 comprises signal input/output terminals SI_{11} and SI_{12} for inputting the control signal from the main controller 1 via the transmission signal line 2.

The signal processing circuit 17 processes the control signal sent from the main controller 1 and generates a control signal for driving the relays. The signal processing circuit 17 comprises a central processing unit 20, and a pulse signal generator 22, which supplies a pulse signal for generating a control signal to the central processing unit 21.

The relay driving circuit 18 drives the remote-controlled relays 6_1 6_2, 6_3, 6_4 in accordance with the pulse signal output from the central processing unit 20. The relay driving circuit 18 comprises signal input terminals SI_{11}, SI_{12}, SI_{13}, SI_{14} for inputting the pulse signal from the central processing unit 20, and signal output terminals SO_{11}, SO_{12}, SO_{13}, SO_{14} for outputting a driving signal to the remote-controlled relays 6_1, 6_2, 6_3, 6_4.

The photocoupler circuit 19 electrically separates the input side of the control terminals 3B and the output side. The photocoupler circuit 19 com-

prises a plurality of light-emitting diodes 24 connected to the central processing unit 20 and a plurality of phototransistor 25 connected to the relay driving circuit 18.

The control terminals 3B comprises a control power source circuit 26 for generating a controlling power source from the transmition signal input into the transmitting/receiving circuit 16, a transmission abnormality detection circuit 27 for detecting abnormality of the transmission signal, a fail-safe circuit 28 for lighting the lighting equipments 5 when the transmission abnormality is detected by the transmission abnormality detection circuit 27, an address setting circuit 29 for setting addresses of the control terminals 3B, signal input terminals SI_{21}, SI_{22} for inputting an output signal sent from the remote-controlled transformer 7, a relay driving power circuit 32 for using a power signal input into the signal input terminals SI_{21}, SI_{22} as a remote-controlled power source, and signal output terminals SO_{21}, SO_{22}, SO_{23}, SO_{24} for outputting a voltage generated by the relay driving power circuit 32 to the remote-controlled relays 6_1, 6_2, 6_3, and 6_4 via the relay driving circuit 18.

The remote-controlled relays 6_1, 6_2, 6_3, 6_4 turn on/off the lighting equipment 5 in accordance with the control signal sent from the control terminals 3B. The remote-controlled relays 6_1, 6_2, 6_3, 6_4 comprise a relay contact RY, which interrupts the power supply to the lighting equipment 5, and a relay coil (not shown), which opens and closes the relay contact RY.

The remote-controlled transformer 7 generates power source of to drive the remote-controlled relays 6_1, 6_2, 6_3, 6_4. The voltage signal, which is output from the remote-controlled transformer 7, is supplied to the remote-controlled relays 6_1, 6_2, 6_3, 6_4 via the control terminals 3B.

The control terminals 3B, the remote-controlled relays 6_1, 6_2, 6_3, 6_4, and the remote-controlled transformer 7 are arranged in one row in a distribution board (not shown). Also, the control terminals 3B, the remote-controlled relays 6_1, 6_2, 6_3, 6_4, and the remote-controlled transformer 7 are fixed to the distribution board via a fixing plate 31 as shown in Figs. 5 to 7. Moreover, the control terminals 3B are provided between the remote-controlled relay 6_4 and the remote-controlled transformer 7.

As shown in Figs. 2 and 8, the signal output terminals SO_{21}, SO_{22}, SO_{23}, and SO_{24}, the signal output terminals SO_{11}, and SO_{12}, SO_{13}, SO_{14}, and the signal input terminals SI_{11} and SI_{12} are provided in one side of the control terminals 3B. The signal input terminals SI_{21} and SI_{22} are provided in the other side of the control terminals 3B. Also, the first signal output terminals SO_{11}, SO_{12}, SO_{13}, SO_{14}, the second signal output terminals SO_{21}, SO_{22}, SO_{23}, SO_{24}, and the first input terminals SI_{11} and SI_{12} are provided on the same on side where the signal input terminals 6_{S11} to 6_{S14} of the remote-controlled relays 6_1, 6_2, 6_3,and 6_4 are provided. The second signal input terminals SI_{21} and SI_{22} are provided on the same one side where the signal output terminal 7_{SO} of the remote-controlled transformer 7 is provided.

Moreover, the signal output terminals SO_{11}, SO_{12}, SO_{13}, SO_{14} of the control terminals 3B, and the signal output terminals SO_{21}, SO_{22}, SO_{23}, SO_{24} are provided on the one end side of the control terminals 3B to be adjacent to the remote-controlled relays 6_1, 6_2, 6_3 and 6_4. The signal input terminals SI_{21} and SI_{22} are provided on the other end side of the control terminals 3B to be adjacent to the remote-controlled ttansformer 7.

Moreover, the signal input terminals SO_{21}, SO_{22}, SO_{23}, and SO_{24} are provided on the same one side where the signal output terminals SO_{11}, SO_{12}, SO_{13}, and SO_{14} are provided to be close to the side of the remote-controlled transformer 7.

In the above-structured embodiment, if the monitor signal, which is sent from the monitor terminals 3A, is input to the main controller 1, the control signal is output from the main controller 1 and input to the control terminals 3B via the transmission signal line 2. At this time, in the control terminals 3B, the central processing unit 20 discriminates whether or not address data, which is included in the control signal input from the transmitting/receiving circuit 16, coincides with self-address data. If the address data coincides with self-address data, the control signal, which turns on/off the remote-controlled relays 6_1, 6_2, 6_3, and 6_4, is output from the signal output terminal SO_{11}, SO_{12}, SO_{13}, and SO_{14}. Thereby, the remote-controlled relays 6_1, 6_2, 6_3 and 6_4 open and close the relay contact RY by the control signal, which is output from the signal output terminal SO_{11}, SO_{12}, SO_{13}, and SO_{14} of the control terminals 3B, and turn on/off the lighting equipments 5.

In the above-structured embodiment, the voltage signal, which is output from the remote-controlled transformer 7, is input to the remote-controlled relays 6_1, 6_2, 6_3, and 6_4 via the control terminals 3B. Due to this, the signal line, which transmits the control signal to the remote-controlled relays 6_1, 6_2, 6_3, and 6_4 from the control terminals 3B, does not cross the signal line, which supplies power to the remote-controlled relays 6_1, 6_2, 6_3, and 6_4 from the remote-controlled transformer 7.

Thereby, the erroneous wiring can be prevented and the wiring can be efficiently provided. Also, electrical interference can be prevented, thereby obtaining the technical advantage in terms of the noise surface.

Moreover, the control terminals 3B are arranged between the remote-controlled relays 6_1,

6_2, 6_3,and 6_4, which are arranged in one row in the distribution board, and the remote-controlled transformer 7. Due to this, the wiring between the control terminals 3B and the remote-controlled relays 6_1, 6_2, 6_3, and 6_4, and the wiring between the control terminals 3B and the remote-controlled transformer 7 can be shortened.

Furthermore, in the above embodiment, the signal input terminals SI_{21}, and SI_{22}, which input the voltage signal from the remote-controlled transformer 7, and the signal output terminal SO_{11}, SO_{12}, SO_{13}, SO_{14}, which output the control signal to the remote-controlled relays 6_1, 6_2, 6_3, and 6_4, and the signal output terminals SO_{21}, SO_{22}, SO_{23}, and SO_{24}, which output the driving voltage signal to the remote-controlled relays 6_1, 6_2, 6_3, 6_4, are provided on one side where the control terminals 3B are opposed to each other. Moreover, the signal input terminals SI_{21}, and SI_{22} are arranged on the side of the remote-controlled transformer 7. The signal output terminals SO_{11}, SO_{12}, SO_{13}, and SO_{14}, and the signal output terminals SO_{21}, SO_{22}, SO_{23}, and SO_{24} are provided on the side of the remote-controlled relays 6_1, 6_2, 6_3, and 6_4. Due to this, the length of the transmission line, which transmits the voltage signal output from the remote-controlled transformer 7 to the control terminals 3B, can be shortened.

Fig. 9 is a view showing a modification of the control terminal 3B. As shown in Fig. 9, on one side of the control terminals 3B and the same one side where the signal input terminals 6A11 to 6S14 of the remote-controlled relays 6_1, 6_2, 6_3 and 6_4, there are provided the first signal input terminals SI_{11} and SI_{12}, the second signal input terminals SI_{21} and SI_{22}, the first signal output terminals SO_{11}, SO_{12}, SO_{13}, SO_{14} for outputting a control signal to the remote-controlled relays 6_1, 6_2, 6_3 and 6_4, and the second signal output terminals SO_{21}, SO_{22}, SO_{23}, SO_{24} for outputting a control signal to the remote-controlled relays 6_1, 6_2, 6_3 and 6_4. Then, the second signal input terminals S_{I21} and S_{I22} are provided on one end side of the control terminals 3B to be adjacent to the remote-controlled transformer 7. The first and second signal output terminals So_{11}, SO_{12}, SO_{13}, SO_{14}, SO_{21}, SO_{22}, SO_{23}, SO_{24} are provided on the other end dise of the control terminals 3B to be adjacent to the remote-controlled relays 6_1, 6_2, 6_3 and 6_4.

According to the above structure, similar to the above-mentnioned embodiment, the erroneous wiring can be prevented. Moreover, the wiring between the control terminals 3B and the remote-controlled relays 6_1, 6_2, 6_3 and 6_4, and the wiring between the control terminals 3B and the remote-controlled transformer 7 can be shortened.

Additionally, the present invention is not limited to the above-mentioned embodiment. Various modifications can be applied to the present invention without departing from the gist of the present invention.

Claims

1. A system for remotely controlling a plurality of lighting equipments, comprising:

   a plurality of remote-controlled relays (6_1 to 6_4) arranged in one row in a distribution board, and having a relay contact (RY) interrupting power-supply to lighting equipments (5);

   relay power generating means (7), arranged in said distribution board along the area direction of said remote-controlled relays (6_1 to 6_4), for generating power for driving said remote-controlled relays (6_1 to 6_4);

   a main controller (1) for controlling said lighting equipments (5);

   transmission line (2) for transmitting a control signal output from said main controller (1); and

   a control terminal (3B) arranged between said remote-controlled relays (6_1 to 6_4) and said relay power generating means (7) in said distribution board and including first signal input means (SI_{21}, SI_{22}), for inputting said control signal from said main controller (1) via said transmission line (2), second signal input means (SI_{21}, SI_{22}) for inputting a power signal output from said relay generating means (7), first signal outputting means (SO_{11}, SO_{12}, SO_{13}, SO_{14}) for outputting a signal opening and closing said relay contact (RY) of said remote-controlled relays (6_1 to 6_4) in accordance with said control signal input in said first signal input means (SI_{11}, SI_{12}), and second signal outputting means (SO_{21}, SO_{22}, SO_{23}, SO_{24}) for outputting said power signal input in said second signal input means (SI_{21}, SI_{22}) to said remote-controlled relays (6_1 to 6_4).

2. The system according to claim 1, characterized in that said first signal input means (SI_{11}, SI_{12}), second signal input means (SI_{21}, SI_{22}), first signal output means (SO_{21}, SO_{22}, SO_{23}, SO_{24}) are provided on one side of said control terminal (3B).

3. The system according to claim 1, characterized in that said second signal input means (SI_{21}, SI_{22}) are provided on one end side of said control terminal (3B) to be adjacent to said relay power generating means (7).

4. The system according to claim 1, characterized in that said first signal output means

(SO_{11}, SO_{12}, SO_{13}, SO_{14}) and second signal output means (SO_{21}, SO_{22}, SO_{23}, SO_{24}) are provided on the other end side of said control terminal (3B) to be adjacent to said remote-controlled relays (6_1 to 6_4).

5. The system according to claim 1, characterized in that said first signal input means (SI_{11}, SI_{12}) are provided between said second signal input means (SI_{21}, SI_{22}) and said first signal output means (SO_{11}, SO_{12}, SO_{13}, SO_{14}).

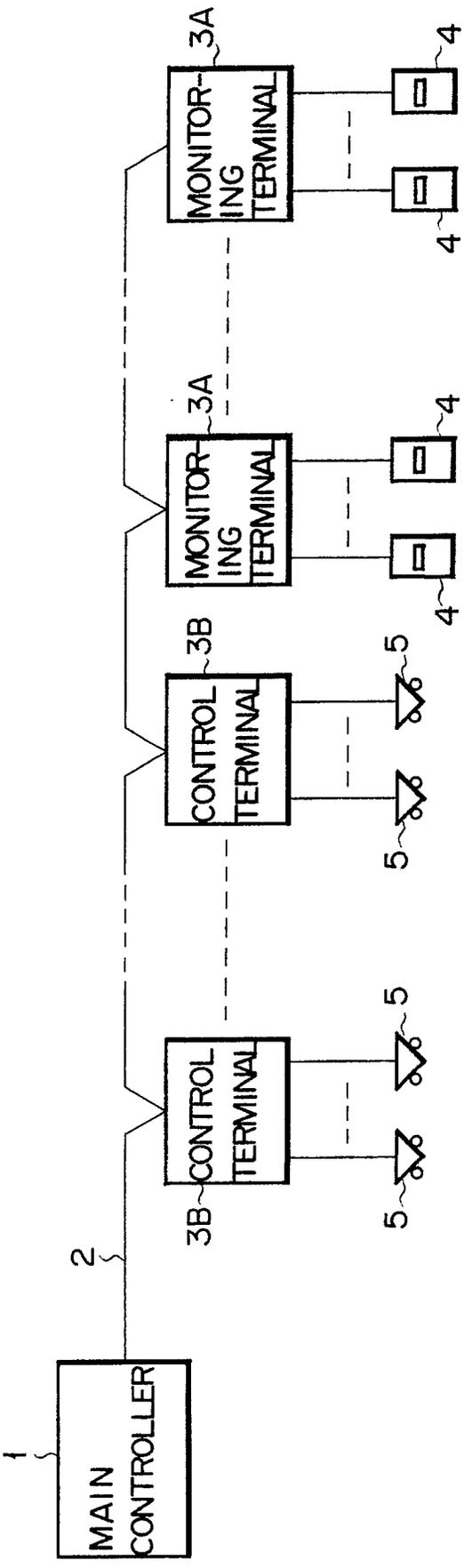
MAIN CONTROLLER
1
2
CONTROL TERMINAL
3B
MONITOR-ING TERMINAL
3A
4
5

FIG. 1

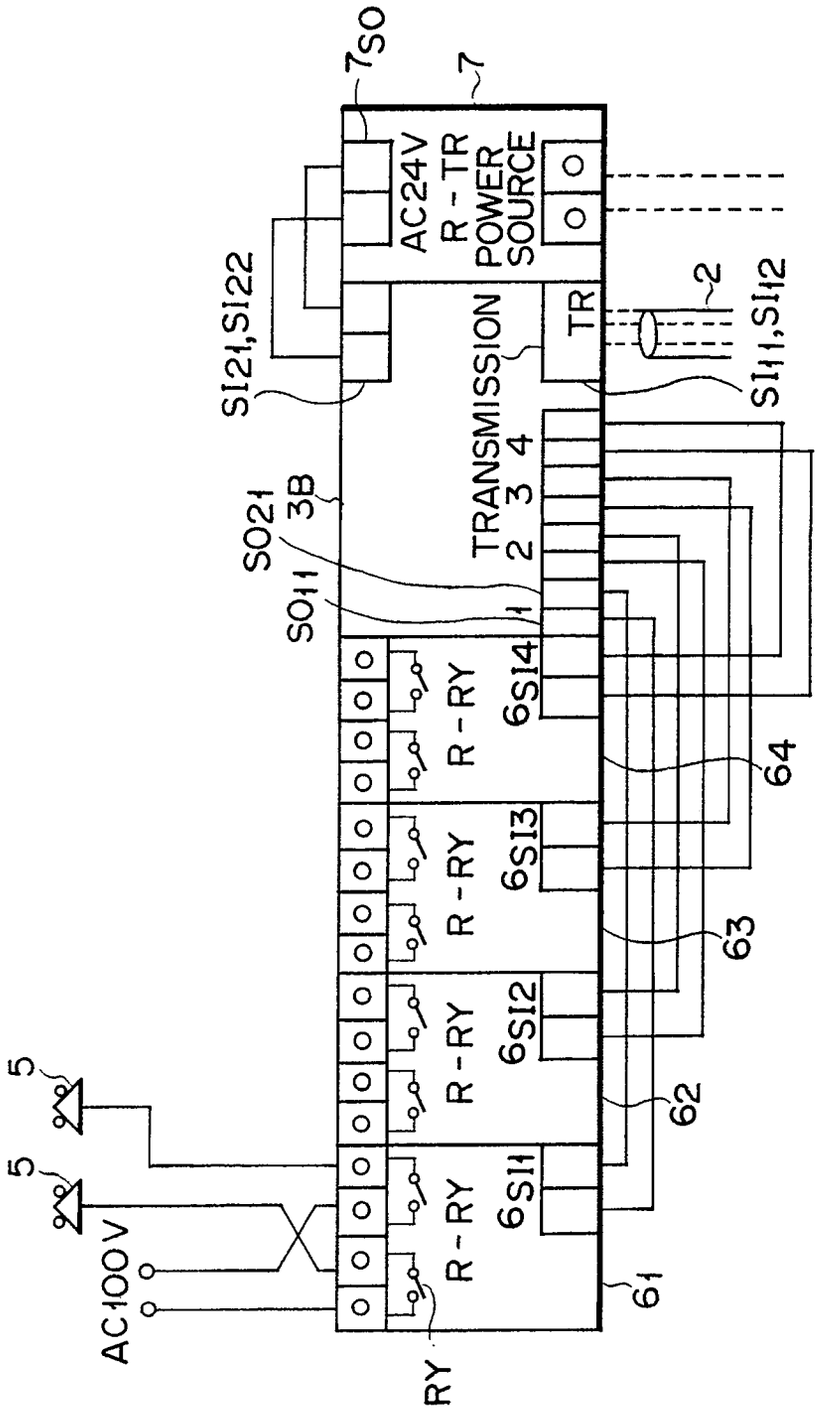
7SO
7
AC24V
R-TR
POWER
SOURCE
SI21,SI22
TR
2
SI11,SI12
TRANSMISSION
1 2 3 4
SO21
3B
SO11
6SI4
R-RY
6SI3
R-RY
6SI2
R-RY
6SI1
R-RY
64
63
62
61
5
5
AC100V
RY

FIG. 2

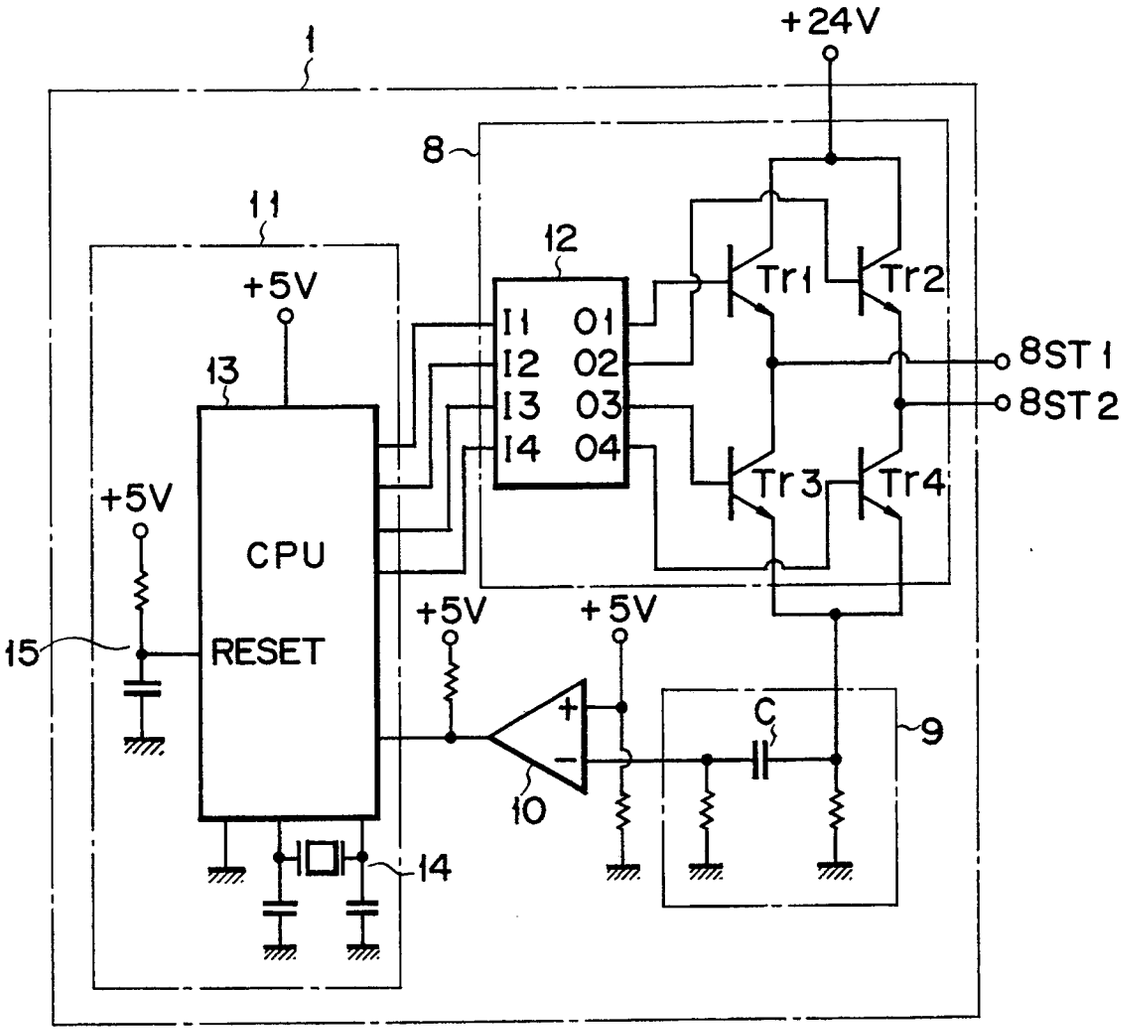
+24V
1
8
11
12
+5V
I1 01
I2 02
I3 03
I4 04
Tr1
Tr2
8ST1
8ST2
13
+5V
CPU
Tr3
Tr4
+5V
+5V
15
RESET
C
9
10
14

FIG. 3

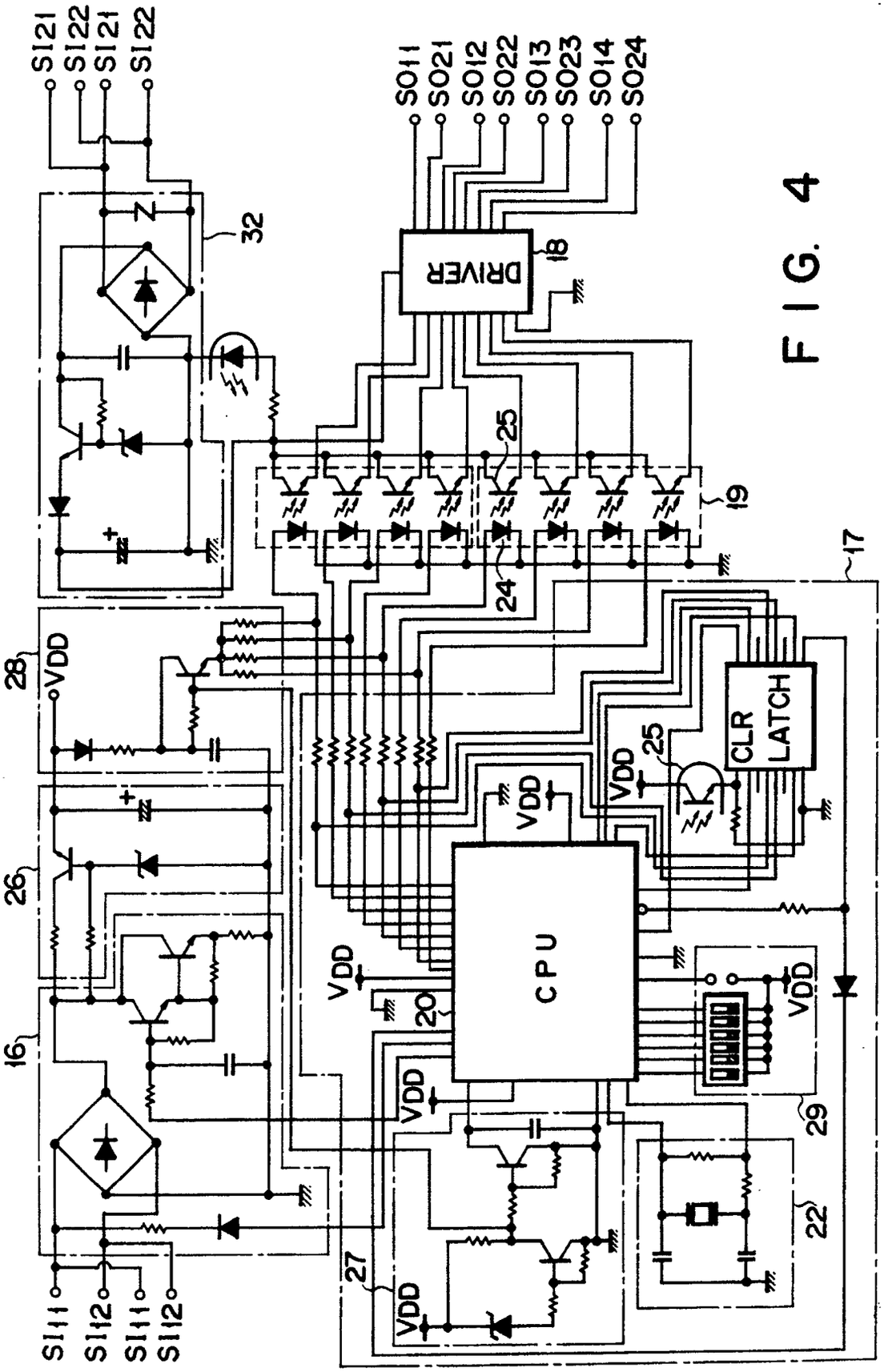
S121
S122
S121
S122
SO11
SO21
SO12
SO22
SO13
SO23
SO14
SO24
DRIVER
18
32
25
19
17
24
28
VDD
CLR
LATCH
26
CPU
20
16
29
22
27
S111
S112
S111
S112

FIG. 4

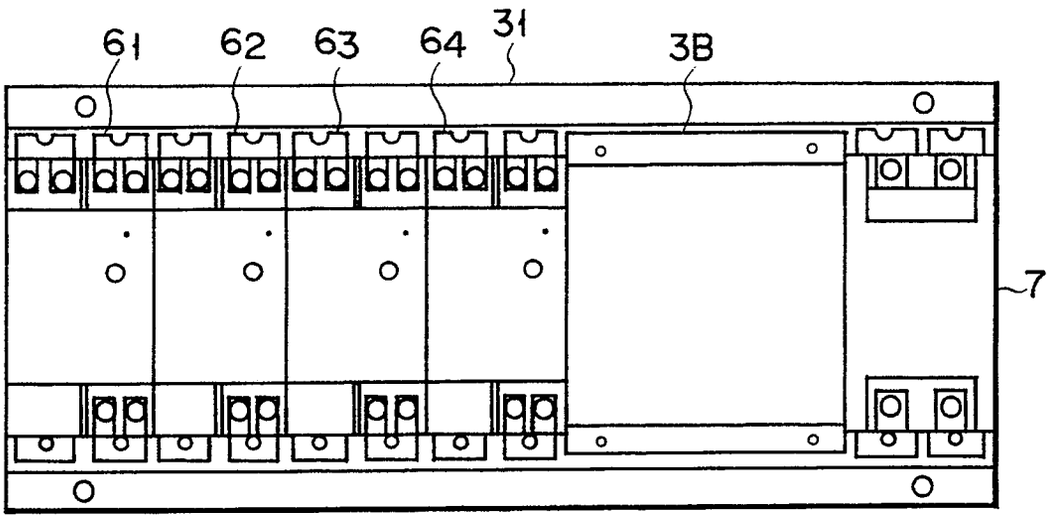

FIG. 5

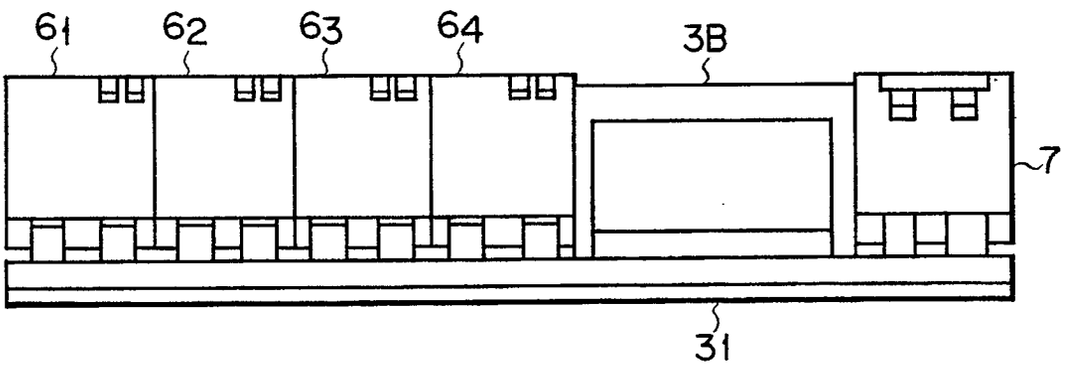

FIG. 6

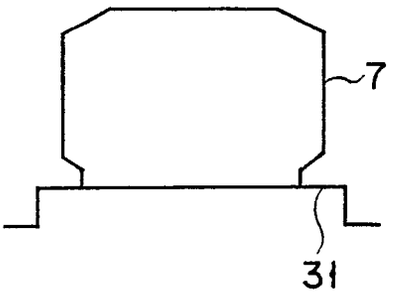
7
31

FIG. 7

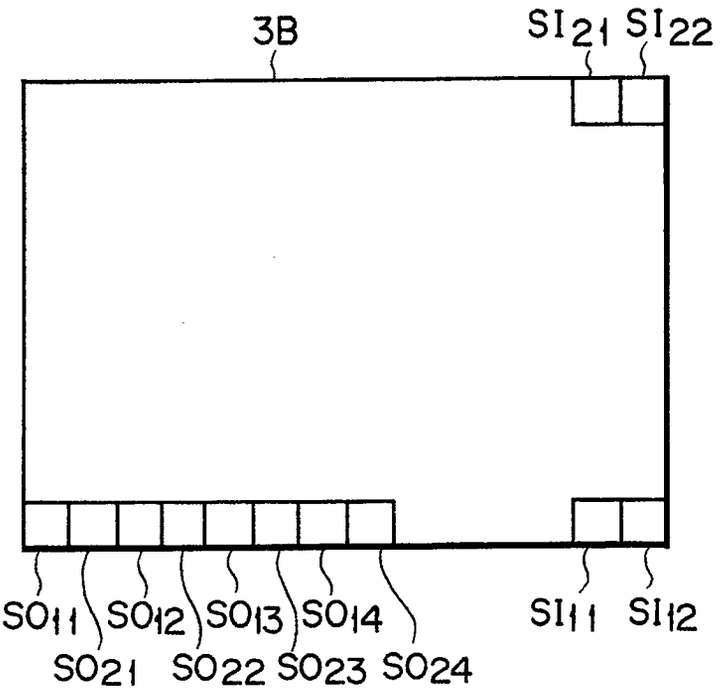
3B
SI21
SI22
SO11
SO12
SO13
SO14
SO21
SO22
SO23
SO24
SI11
SI12

FIG. 8

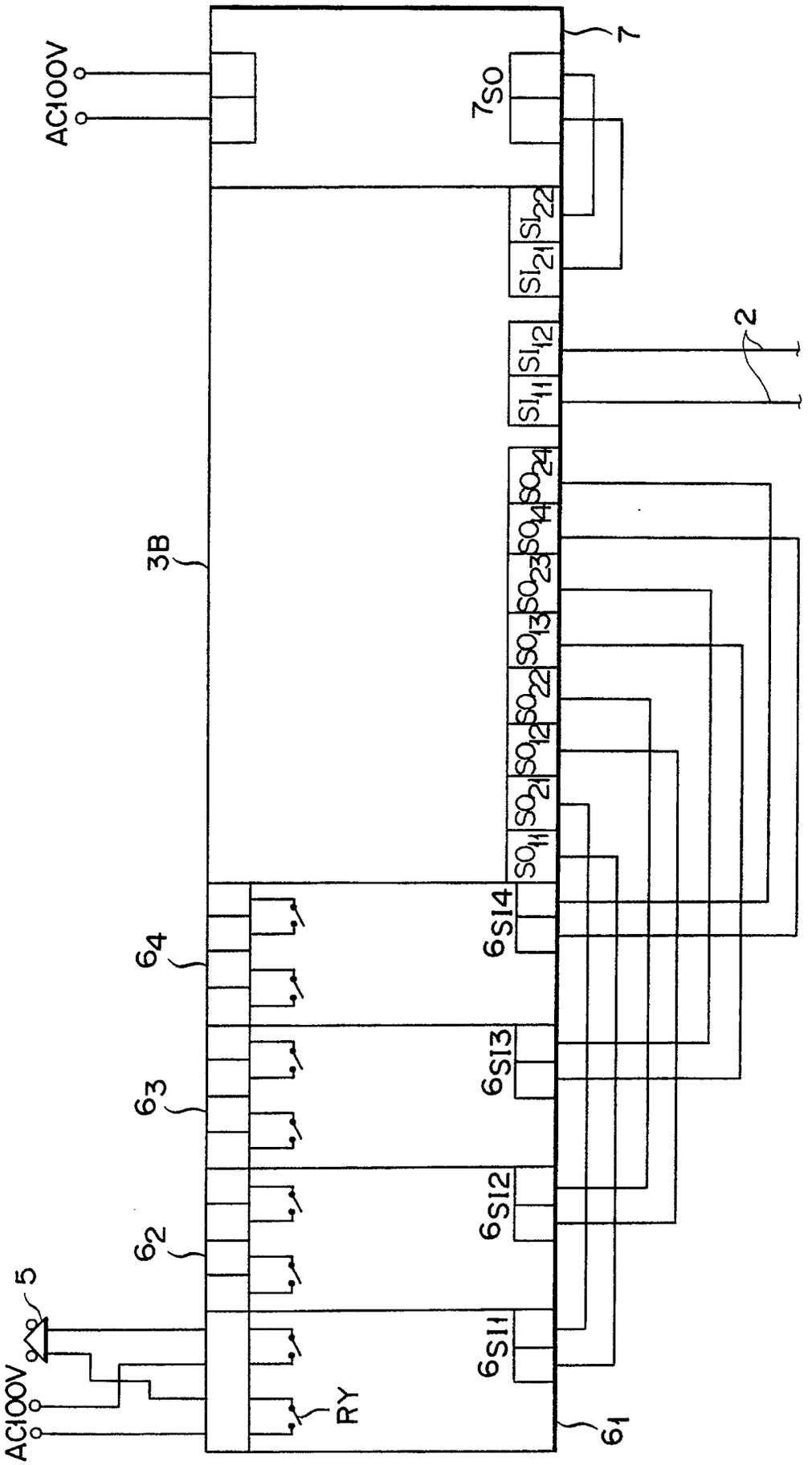
AC100V
AC100V
5
RY
6_1
6_2
6_3
6_4
6_{S11}
6_{S12}
6_{S13}
6_{S14}
3B
7_{SO}
7
SO_{11} SO_{21} SO_{12} SO_{22} SO_{13} SO_{23} SO_{14} SO_{24}
SI_{11} SI_{12} SI_{21} SI_{22}
2

FIG. 9