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(54) Image forming apparatus having dew preventing mechanism.

(57) The present invention provides an image forming apparatus having a dew preventing mechanism for an electrophotographic photosensitive member. Wherein the hour when a heat generating means for applying heat to the photosensitive member is started is set by an operation panel, and the electric power is not supplied to the heat generating means after a power source of the image forming apparatus is turned OFF. Whereby, it is possible to avoid the useless electric power in the midnight, sunday and holiday when the image forming apparatus is not used.

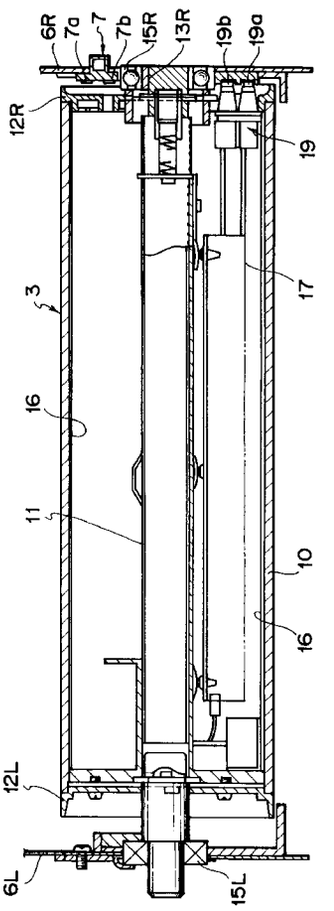

FIG. 5

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BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an image forming apparatus utilizing the electrostatic transfer process, such as an electrostatic copying machine, an electrophotographic printer and the like.

Related Background Art

Normally, under the low temperature (for example, winter), when a heating apparatus is operated in the morning in a room where an image forming apparatus is installed, since the interior of the image forming apparatus left as it is overnight in a condition that the power source is turned OFF is well cooled, dew is adhered to a photosensitive drum and an optical system including mirrors and a lens. Thus, in order to prevent the abnormity of the output image, in high-class image forming apparatuses, heat devices such as heaters were normally arranged within or in the proximity of the photosensitive drum and in the proximity of optical members such as mirrors and lens.

On the other hand, in image forming apparatuses using a noncrystal silicone photo-conductive layer, by repeating the copying processes such as the charge, image exposure, development, transferring and the like, a surface of the photosensitive member becomes sensitive to the influence of humidity, with the result that the dew is apt to be adhered to the surface of the photosensitive member. Consequently, the electric resistance of the surface of the photosensitive member is decreased, so that the surface charges are shifted toward the surface, thereby causing the flow of an image. This tendency occurs particularly under the high humidity condition. This is the reason why negative ions and positive ions generated by the corona discharge are adhered to the surface of the photosensitive member to create HNO_3, thereby facilitating the absorption of moisture. To avoid the above inconvenience, by heating the photosensitive member by a heater arranged in the photosensitive member, moisture absorbing factors such as the negative ions and positive ions generated by the corona discharge or HNO_3 were removed.

However, in the conventional image forming apparatuses, in order to avoid the above-mentioned inconvenience, it was necessary to control the operation of the heat devices by constantly connecting the image forming apparatus to the power source. Thus, even in the midnight during which the image forming apparatus is not used, the heat devices were operated, thus consuming the electric power. The useless electric power consumption such as power consumption in an inoperative condition should be avoided in consideration of the recent protection of resources and the saving of energy.

In consideration of the above, in order to solve the above problem, in the Japanese Patent Publication No. 63-59144, by providing a dew sensor, even when the dew is adhered to the elements of the image forming apparatus in a condition that the power source is turned OFF in the night, after the power source is turned ON, if the dew is detected by the dew sensor, heat devices are operated, and a copying operation is inhibited until the dew is eliminated. However, in this apparatus, a waiting time period from a time when the power source is turned ON to a time when the dew is disappeared cannot be exactly grasped, unlike to the warming-up time for heating a fixing roller in the typical image forming apparatus.

SUMMARY OF THE INVENTION

An object of the present invention is to reduce the electric power consumption by disconnecting or interrupting a power source from a dew preventing heater means when an image forming apparatus is not being used.

The other object of the present invention is to facilitate the operation for saving the electric power.

In order to achieve the above objects, the present invention provides an image forming apparatus having a dew preventing mechanism, comprising an electorphotographic photosensitive member, heat generating means for applying heat to the photosensitive member, control means for controlling the operation of the heating means, and an operation panel for setting the operations of the control means and the image forming apparatus. The present invention is characterized by that the initiation of the operation of the heating means is determined by the operation panel and, after a power source of the image forming apparatus is turned OFF, the electric power to the heating means is stopped.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a control means of a copying apparatus to which the present invention is applied;

Fig. 2 is a control flow chart for general copying machines;

Fig. 3 is a timing chart showing the drive timing of a heat device of the copying apparatus according to the present invention;

Fig. 4 is a plan view of an operation panel of the copying apparatus according to the present invention;

Fig. 5 is a sectional view of a photosensitive drum of the copying apparatus according to the present invention; and

Fig. 6A is a plan view of a sliding electrode for the photosensitive drum of Fig. 5, and Fig. 6B is a sectional view taken along the line A - A in Fig. 6A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 shows an internal construction of a microprocessor unit for controlling a copying apparatus according to the present invention. The microprocessor unit (MPU) 50 includes an operating portion (CPU) 51 having calculation and judgement functions, a treatment program storing read only memory (ROM) 52, a data storing random access memory (RAM) 53, and input and output ports for sending and receiving signals with respect to external devices. Further, a timer IC 54 is incorporated in the MPU 50 so that the timer can be set by command. Since the fundamental operation of the MPU 50 is already known, the explanation thereof will be omitted.

Fig. 2 shows a flow chart for general copying machines.

When a main switch of the copying machine is turned ON, the initialization such as main switch ON reset and the setting of an operation mode of the MPU 50, and then the initial check routine is carried out. In this initial check routine, first of all, the presence/absence of toner, a transfer sheet and the like is checked, and then, if a mirror support and a sheet supply deck are not positioned in a predetermined condition, the mirror support and the sheet supply deck are set to the initial condition by driving motors, clutches and the like. In a copying machine having a heater in a fixing means, a waiting condition is continued until the fixing means reaches a predetermined temperature, and, by detecting the temperature and humidity, a voltage applied to a charge means and bias potential for a photosensitive member are set.

Then, the number of copy sheets and a copy mode are set, and, when a start switch is turned ON, a copy process including the known charging, exposure, transferring, electricity removal and fixing is performed, during which the abnormity in the copy sequence control, sheet jam, opening/closing of a safety switch and the like are always checked. When the copy process is completed, the counter date is checked. When the predetermined number of copy sheets are obtained, the copying operation is finished, and the program is returend to the initial check routine for preparing for the next copy start.

In the copying apparatus according to the illustrated embodiment, the operation of heat devices for the photosensitive drum and mirrors, lens and the like are controlled by the CPU 51 and the program timer 54. That is to say, as the heat devices, a cylindrical face-shaped heater mounted in the photosensitive drum and a cement resistor arranged in the proximity of the mirrors and lens are used and are appropriately arranged.

Now, as an example of the above-mentioned heat devices, a heater in the photosensitive drum will be explained with reference to Figs. 5, 6A and 6B.

As shown in Fig. 5, the photosensitive drum 3 comprises a cylinder 10, left and right flanges 12L, 12R secured to both ends of the cylinder 10 and interconnected by an inner stay 11, and left and right bearings 15L, 15R attached to left and right shafts 13L, 13R protruded from the flanges 12L, 12R, and is rotatably supported by a process unit by fitting the bearings 15L, 15R into left and right support plates 6L, 6R of a case 2 of the process unit. Further, a face-shaped heater 16 is arranged along an inner peripheral surface of the cylinder 10 of the photosensitive drum 3, and a temperature control substrate 17 which receives the electric power via an electrode 19 is connected to the face-shaped heater 16. Sliding end portions 19a, 19b protruded from the electrode 19 are slidingly contacted with two rings 7a, 7b of a slip ring 7 (Figs. 6A and 6B) secured to the process unit so that the electric power can be applied to the heater 16 even when the photosensitive drum 3 is being rotated.

The heat device having the above-mentioned construction is controlled by the MPU so that, at the same time when the main switch of the copying apparatus is turned OFF (to = 0 in Fig. 3) or a predetermined time period (to) from OFF of the main switch is elapsed if necessary, the heat device is turned OFF. Further, as shown in Fig. 4, an operation panel portion of the copying apparatus is provided with various set keys (as in the conventional copying machine), a timer set key 95 for setting a time period so that the heat device is turned ON again after a predetermined time period (t1) from OFF of the main switch is elapsed, a seven segment display device 72 capable of displaying a numeral value and English characters and adapted to display a timer set time, as well as the number of copy sheets (as in the conventional copying machine), and up and down keys 96, 97 for altering and/or designating the timer set value and the like. By an input signal from the timer set key 95, the MPU 50 sends the command to the program timer IC 54, thereby setting the timer function.

Incidentally, Fig. 3 is a timing chart showing the operation timing of the copying apparatus as mentioned above.

In the above sequence, before the copying apparatus is stopped for a long time from the closing hour, the operator sets a time period to be elapsed from the present hour by using the operation panel so that the heat device is turned ON before a predetermined time period (t2 in Fig. 3) from the next starting hour (for example, tomorrow), i.e., an appropriate time period more than a time period during which the dew (if generated) in the copying apparatus is disappeared by the heat device. Thus, by setting the time period t1 by the timer, when the timer control is timed up, the MPU receives the signal from the timer and emits

the control signal to supply the electric power to the heat device again. As a result, an operator can obtain the correctly imaged copies with the time period shorter than the waiting time for eliminating the dew. Further, when the copying apparatus is not used for a long time (for example, midnight, sunday or holiday), the heat device for the photosensitive drum can be turned OFF, unlike to the conventional copying machines. Thus, the saving of energy is greatly improved, and the high safety is ensured since the heat device is not being operated under no monitor.

Next, other embodiments will be explained.

In the above-mentioned embodiment, while the time period from after the closing hour to immediately before the next starting hour was inputted, such inputting operation may be effected as follows.

That is to say, the timer can be set by previously inputting the next starting hour to the operation portion by the operator before the main switch is turned OFF in the closing hour. There have recently been proposed copying machines using an IC 55 having a calender function so that the present hour can be displayed on a liquid crystal display portion of the operation portion. In this case, a time difference between the starting hour inputted by the operator and the instant hour when the starting hour is inputted is calculated. By controlling so that the time period obtained by subtracting an appropriate time period more than a minimum time period from when the heat device is turned ON to when the dew is disappeared from the above time difference is set to the timer and is inputted to the memory of the MPU, the same technical effect as that of the first embodiment can be achieved. Further, in this embodiment, since the initiation of the operation of the heat device can be inputted as the hour, unlike to the first embodiment, the operator does not set the timer in consideration of the time period from when the heat device is turned ON to when the dew is disappeared and the time difference between the closing hour and the starting hour, thus improving the operability.

Further, in the above embodiment, by designing so that the contents once set in the timer is inputted to the RAM of the MPU, since only the timer set key 95 may be depressed, the hour when the heat device is to be turned ON is not necessarily inputted every time.

As mentioned above, according to the present invention, since the heater for removing the humidity and preventing the dew is turned OFF substantially at the same time when the main switch of the image forming apparatus is turned OFF and the operation key for setting the hour for starting the operation of the heater is provided and further the heater is controlled to be turned ON again after the predetermined time period by the operation key, it is possible to provide the image forming apparatus in which the useless electric power for driving the heater in the midnight can be avoided and which has the high safety.

Claims

1. An image forming apparatus having a dew preventing mechanism, comprising:
   an electrophotographic photosensitive member;
   heat generating means for applying heat to said photosensitive member;
   control means for controlling an operation of said heat generating means; and
   an operation panel for setting an operation of said control means to thereby set an operation of the image forming apparatus;
   characterized by that:
   the hour when the operation of said heat generating means is started is set by said operation panel, and the electric power is not supplied to said heat generating means after a power source of said image forming apparatus is turned OFF.

2. An image forming apparatus according to claim 1, wherein the hour when the operation of said heat generating means is started is set by setting the timing when said heat generating means actually generates the heat by said operation panel before the power source of the image forming apparatus is turned OFF, and said control means is operated at the set timing.

3. An image forming apparatus according to claim 1, wherein the hour when the operation of said heat generating means is started is set by setting the hour when the image forming apparatus is used by said operation panel before the power source of the image forming apparatus is turned OFF, and said control means is operated at said set hour.

4. An image forming apparatus according to claim 1, further comprising a clock function, and wherein the hour when the operation of said heat generating means is started is set by setting the hour when the image forming apparatus is used by said operation panel before the power source of the image forming apparatus is turned OFF, and said control means is operated at said set hour every day.

5. An image forming apparatus according to claim 1, wherein said operation panel has a display portion for displaying the hour when the operation of said heat generating means is started.

6. An image forming apparatus according to claim

2, wherein said operation panel has a display portion for displaying the hour when the operation of said heat generating means is started.

7. An image forming apparatus according to claim 3, wherein said operation panel has a display portion for displaying the hour when the operation of said heat generating means is started.

8. An image forming apparatus according to claim 4, wherein said operation panel has a display portion for displaying the hour when the operation of said heat generating means is started.

FIG. 1

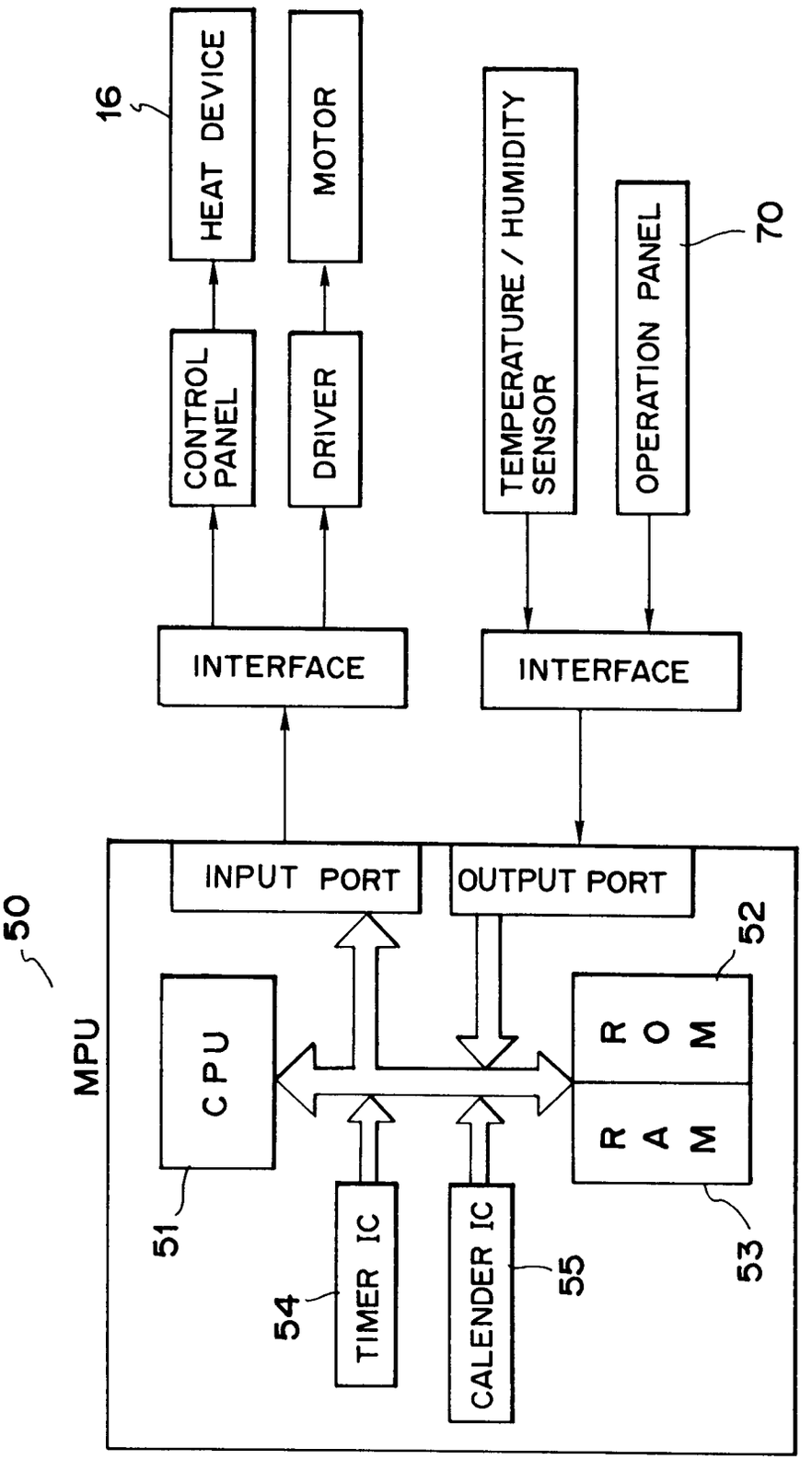
16
HEAT DEVICE
MOTOR
TEMPERATURE / HUMIDITY SENSOR
OPERATION PANEL
70
CONTROL PANEL
DRIVER
INTERFACE
INTERFACE
50
MPU
INPUT PORT
OUTPUT PORT
52
CPU
R O M
R A M
51
53
54
TIMER IC
CALENDER IC
55

FIG. 2

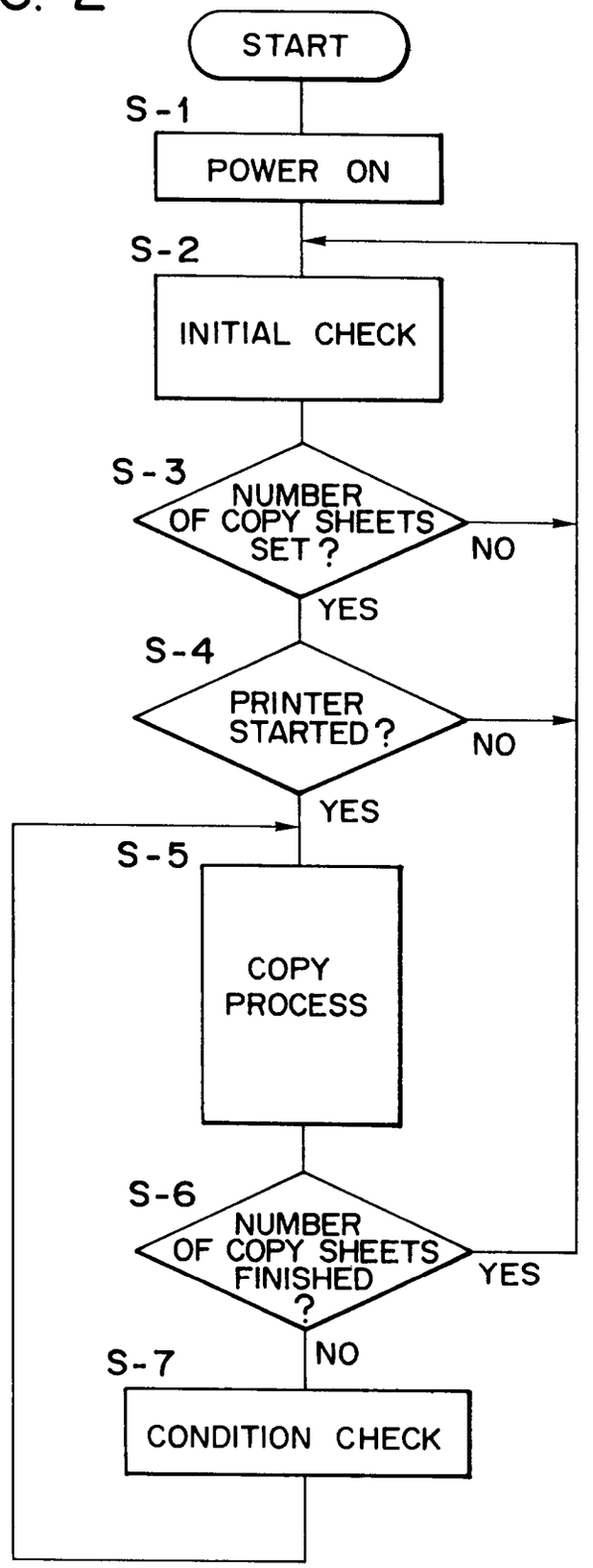
START
S-1
POWER ON
S-2
INITIAL CHECK
S-3
NUMBER OF COPY SHEETS SET ?
NO
YES
S-4
PRINTER STARTED ?
NO
YES
S-5
COPY PROCESS
S-6
NUMBER OF COPY SHEETS FINISHED ?
YES
NO
S-7
CONDITION CHECK

FIG. 3

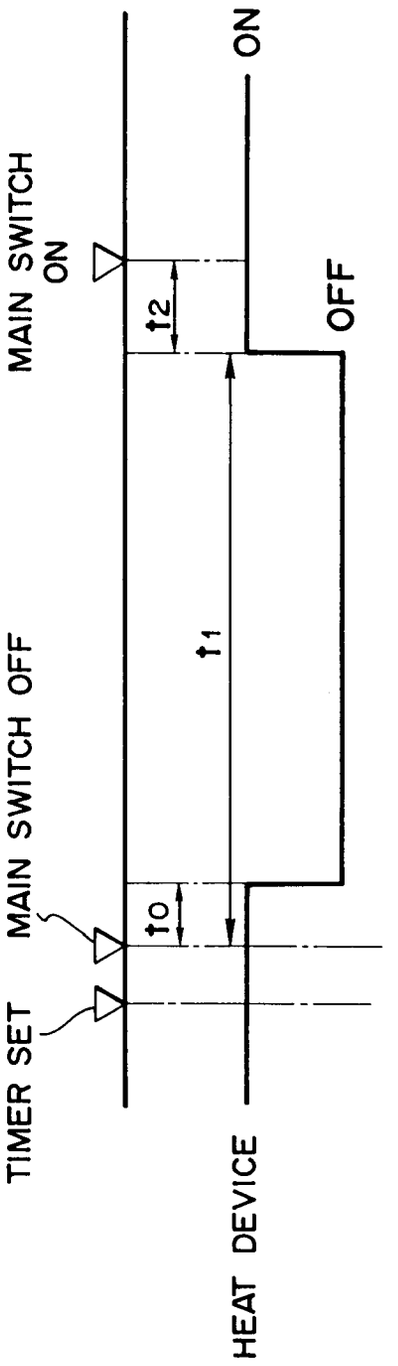
MAIN SWITCH ON
ON
OFF
t2
t1
t0
MAIN SWITCH OFF
TIMER SET
HEAT DEVICE

FIG. 4

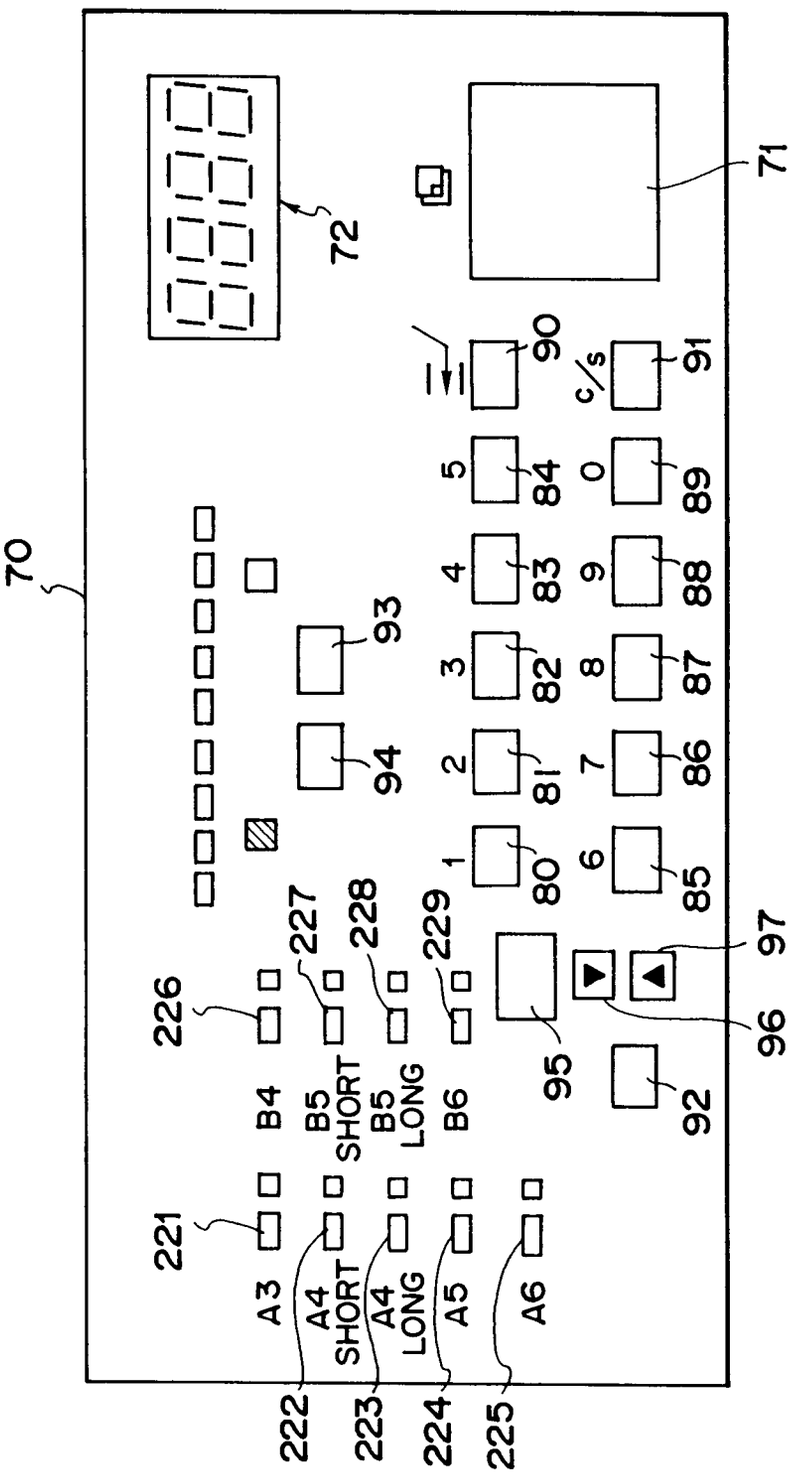
70
71
72
90
91
c/s
84
89
83
88
82
87
81
86
80
85
92
93
94
95
96
97
221
222
223
224
225
226
227
228
229
A3
A4 SHORT
A4 LONG
A5
A6
B4
B5 SHORT
B5 LONG
B6
1
2
3
4
5
6
7
8
9
0

FIG. 5

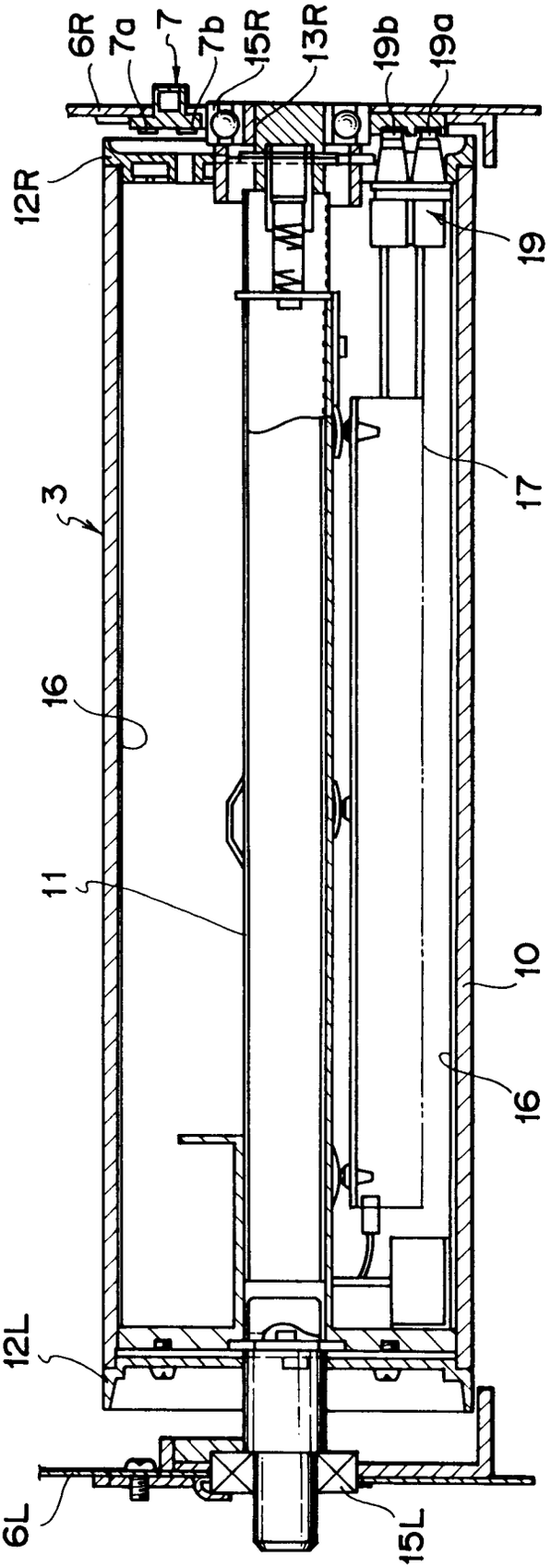

FIG. 6B

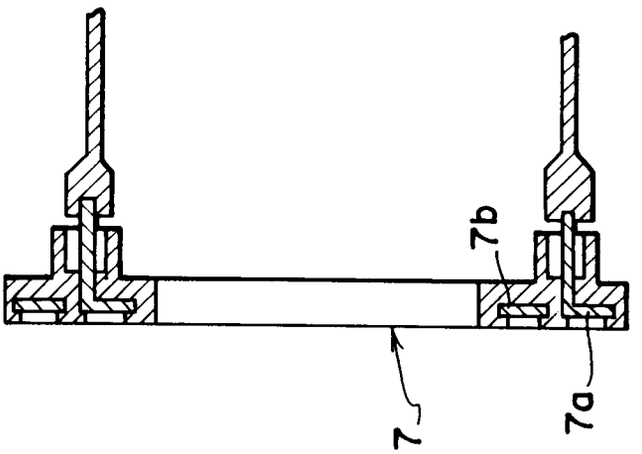

FIG. 6A