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 Method for setting and indicating the density of an image in image forming apparatus.

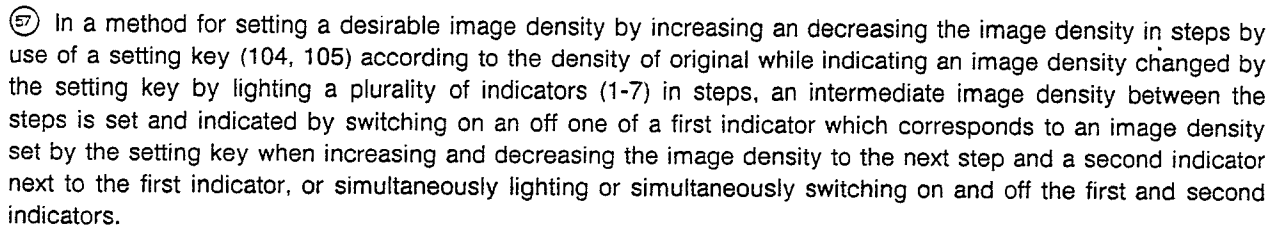
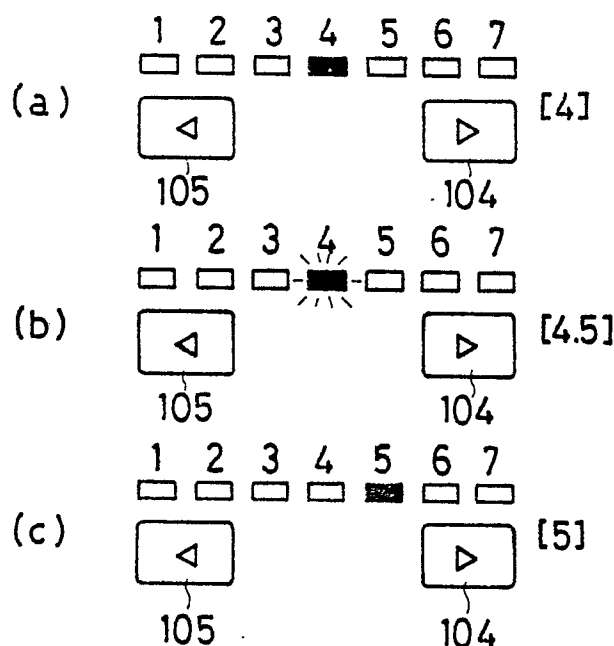

 In a method for setting a desirable image density by increasing an decreasing the image density in steps by use of a setting key (104, 105) according to the density of original while indicating an image density changed by the setting key by lighting a plurality of indicators (1-7) in steps, an intermediate image density between the steps is set and indicated by switching on an off one of a first indicator which corresponds to an image density set by the setting key when increasing and decreasing the image density to the next step and a second indicator next to the first indicator, or simultaneously lighting or simultaneously switching on and off the first and second indicators.

FIG.2



"METHOD FOR SETTING AND INDICATING THE DENSITY OF AN IMAGE IN IMAGE FORMING APPARATUS"

This invention relates to a method for setting and visually indicating the image density of image forming apparatus, such as electrophotographic copying machines and facsimile terminal equipment, according to the density of an original.

It has been known to provide an image density setting device in an electrophotographic copying machine or the like to enable an operator to set a desired image density in accordance with the density of the original. It is a current trend that the image density of such an image density setting device is changed not in an analogue fashion but in a digital fashion or steps. Such detail setting is, for example, disclosed in JP-A-11364/1982.

JP-A-11364/1982 discloses an exposure setting device, that is, an image density setting device, comprising means for changing the exposure amount to a desired amount in steps and then setting the desired amount and means for visually indicating the amount in steps in accordance with the set content of the setting means.

However, in such an image density setting device, in which the image density is set and indicated in the digital way or in steps, it is difficult to indicate a more finely adjusted image density on account of the fact that the difference between one indicating step and the next indicating step is large. The drawback may be overcome by increasing the number of image density indicating steps. However, such improvement requires an increased number of indicators, such as light emitting diodes (LED), consequently raising the cost. Therefore, it will be apparent that this improvement is not the best way.

The present invention has the object of providing a method for setting and indicating image density which makes it possible to change the image density finely and indicate a changed image density without using a large number of indicators.

The invention is set out in the claims.

Embodiments of the invention are described below by way of example with reference to the drawings.

In the drawings:-

Fig. 1 is a plan view of an operational panel in which a method of the present invention is performed; Figs. 2, 3, 4, 5 and 6 are views illustrating methods of the present invention respectively; Fig. 7 is a block diagram of a control circuit by which the method is performed; Fig. 8 is a flowchart in accordance with which the method of Figs. 2 and 3 is carried out; and Fig. 9 is a flowchart in accordance with which the method of Figs. 4 and 5 is carried out.

Fig. 1 shows an operation panel 100 of apparatus such as copying machine in which a method of the present invention is performed. Indicated at 101 is a copy number indicator, indicated at 102 is a ten-key array for setting the number of copy, indicated at 103 is a start button, indicated at 104 and 105 are setting keys for changing the exposure in steps in accordance with the density of original. The numeral 104 indicates an UP key and the numeral 105 a DOWN key. Indicated at L is an indicating device including a row of a plurality of indicators (seven indicators in the case of the present embodiment) which are lighted to visually indicate an image density changed by the setting keys 104, 105. A light emitting diode (LED) is used for the indicator. The indicating device L visually indicates the image density in the following way. The first indicator 1 positioned at the left end is lighted when the image density is reduced so as to correspond to the lightest original. The seventh indicator 7 positioned at the right end is lighted when the image density is increased so as to correspond to the darkest original. The second through sixth indicators are lighted corresponding to an image density changed in steps by the setting keys 104, 105. The fourth indicator 4 positioned at the intermediate portion indicates a standard image density.

Fig. 2 shows the first method embodying the present invention which sets and indicates the image density in the case of increasing and decreasing from an image density to the next image density. In the Fig. 2(a) in which the fourth indicator 4 is lighted, in other word, the lighted indicator 4 is colored black, an image density is set, for example, an image density of "4". Now, if pushing the UP key 104 one time, the fourth indicator 4 is switched on and off as shown in Fig. 2(b). Radial lines around the indicator 4 represents the indicator being held in the ON-and-OFF state. The ON-and-OFF state indicates that the image density is set at "4.5". Next, if pushing the UP key 104 one more time, as shown in Fig. 2 (c), the fourth indicator is changed from the ON-and-OFF state to the OFF state and the fifth indicator 5 next to the fourth indicator 4 is lighted. That is, an image density of "5" is set. In the first embodiment, as mentioned above, an intermediate image density is set and indicated by switching on and off the indicator. When decreasing the image density, steps reverse to the above-mentioned steps are executed by the use of the DOWN key 105.

Fig. 3 shows the second embodiment in which the fifth indicator 5 is switched on and off to indicate an image density of "4.5" as shown in Fig. 3(b).

It will be noted that the following method is adoptable as a variation of the first and second embodiments: the image density is indicated by the method of Fig. 2 when increasing the image density and by the method of Fig. 3 when decreasing the image density, or in reverse to the above. More specifically, an image density of "4.5" is indicated by the ON-and-OFF state of the fourth indicator 4 in the case of increasing the image density and by the ON-and-OFF state of the fifth indicator 5 in the case of decreasing the density.

It will be seen that the ON-and-OFF state of the indicator gives two interpretations in the above embodiments. More specifically, the ON-and-OFF state of the fourth indicator 4 can be interpreted in two way, that is, an image density of "3.5" and an image density of "4.5". Also, the ON-and-OFF state of the fifth indicator 5 can be interpreted as an image density of "4.5" or an image density of "5.5". Therefore, it is desirable to define which of two intermediate image densities the ON-and-OFF state of the indicator indicates according to copying machines and notify the definition. In the first embodiment of Fig. 2, the ON-and-OFF state of the indicator indicates an image density added "0.5" to an image density of the indicator coming on and off. The second embodiment of Fig. 3 indicates an image density reduced "0.5" from an image density of the indicator coming on and off. Also, in the case that the indicating method is changed in accordance with the increasing and decreasing of the image density, it will be seen that if the indicator is kept in the ON-and-OFF state even after an operator finishes copying, the next operator can not determine which image density the ON-and-OFF state indicates. To eliminate such trouble, it is desirable that after an operator finishes copying, the image density is made to automatically reset at a predetermined standard density in a given period of time by means of a timer or the like.

Fig. 4 shows the third method embodying the present invention which sets and indicates the image density. In this embodiment, in increasing and decreasing the image density, the intermediate state is provided in which the indicators next to each other are lighted at the same time. An intermediate image density is set in the state that the two indicators are lighted at the same time. More specifically, a state of Fig. 4(a) in which the fourth indicator 4 is lighted is changed to a state of Fig. 4(b) in which the fourth and fifth indicators 4 and 5 are lighted at the same time by pushing the UP key 104 one time, and then changed to a state of Fig. 4(c) in which the fifth indicator 5 is lighted by pushing the UP key 104 one more time. In the intermediate state in which the fourth and fifth indicators are lighted at the same time, an image density of "4.5" is set. It will be apparent that instead of the simultaneous lighting of two indicators, it is appropriate to switch on and off two indicators next to each other at the same time.

Also, it will be apparent that it is appropriate to render the ON-and-OFF state of the seventh indicator 7 correspond to an image density of "7.5" or an image density of "8" if necessary.

Fig. 6 shows a variation of the embodiments of Figs 4 and 5. In the variation, before the simultaneous lighting state as shown in Fig. 6(c) or the simultaneous ON-and-OFF state (not shown), the state of Fig. 6(b) is provided in which one indicator, for example the indicator 4, is lighted and the next indicator 5 is switched on and off and an image density of "4.25" is set. Also, after the simultaneous lighting state as shown in Fig. 6(c) or the simultaneous ON-and-OFF state (not shown), the state of Fig. 6(d) is provided in which the indicator 4 is switched on and off and the indicator 5 is lighted and an image density of "4.75" is set. Accordingly, it is possible to change the image density by "0.25".

The cumbersomeness of pushing the UP key or DOWN key many times to change the image density is eliminated by redering the image density change in steps by a predetermined period of time with the keys being held in the pushed state.

Also, it is appropriate that the body of a copying machine is provided with a selection switch for changing from a mode in which intermediate states are provided as mentioned above to a mode in which no intermediate states are provided as conventional method and vice versa.

Fig. 7 shows the construction of a control circuit for carrying out the method of the present invention. Signals from the UP key 104 and the DOWN key 105 are sent to a microcomputer 106 constituting a control unit for controlling the whole of a copying machine. A command of the microcomputer 106 is sent to an exposure voltage control circuit 107 in which then render an exposure lamp 108 work at a set image density. The indicating device L is operated by the microcomputer 106 as mentioned above.

Fig. 8 is a flowchart of procedure in accordance with which the microcomputer 106 executes the image density indication of Figs. 2 and 3. Fig. 9 is a flowchart of procedure in accordance with which the microcomputer 106 executes the image density indication of Figs. 4 and 5. With Fig. 8, at step S1, an image density setting routine is started. At step S2, the fourth indicator 4 is lighted which corresponds to an image density of "4". At step S3, it is checked whether there is an input signal from the UP key 104 or the DOWN key 105. If YES, the procedure proceeds to step S4 at which it is checked whether the indicating

device is in the light state. If YES, in other words, when the indicating device is in the state of Fig. 2(a) or Fig. 3(a), the procedure proceeds to step S5 at which an indicator (LED) corresponding to an input signal of the keys is switched on and off. Consequently, when the key input is done by the UP key 104, the indicating device comes to the state of Fig. 2(b) or Fig. 3(b). Next, at step S6, it is checked whether there is an input signal from the keys. If YES, the procedure returns to step S4. If NO, the procedure returns to the main routine. If the answer of step S4 is NO, in other words, when the indicating device is in such switching on and off state as shown in Fig. 2(b) or Fig. 3(b), the procedure proceeds to step S8 at which an indicator (LED) corresponding to the key input signal is lighted. Consequently, when the key input is done by the UP key 104, the indicating device comes to the state of Fig. 2(c) or Fig. 3(c). When the key is pushed without a break, the answer of step S6 is kept at YES. Accordingly, the procedure alternately proceeds to step S5 and step S8, so that indicators are put into the lighting state and ON-and-OFF state alternately and successively. When the key is pushed with a break, the answer of step S3 is kept at YES, the procedure proceeds to step S4 and then alternately to step S5 and step S8, so that the indicating device operates in the same way as mentioned above.

The flowchart of Fig. 9 is the same as that of Fig. 8 except step S4', S5', S8'. At step S4', it is checked whether only one indicator is lighted. If YES, in other words, if the indication device is in the state of Fig. 4(a) or Fig. 5(a), the procedure proceeds to step S5' at which two indicators (LED) corresponding to the key input signal is lighted or switched on and off. Consequently, when the key input is done up by the UP key 104, the indicating device comes to the state of Fig. 4(b) or Fig. 5(b). Next, if the answer of step S4' is NO, the procedure proceeds to step S8' at which one indicator (LED) corresponding to the key input signal is lighted. Consequently, the indicating device comes to the state of Fig. 4(c) or in Fig 5(c). The lighting position of the indicating device is changed according to the input signal of the image density setting keys in such a way as mentioned above.

As described above, the present invention, which sets and indicates a set image density in steps by lighting a particular indicator of a plurality of indicators and further sets and indicates an intermediate image density in steps by switching on and off an indicator, or lighting or switching on and off two indicators next to each other at the same time, makes it possible to set and indicate the image density by an increased number of stages without increasing the number of indicator, consequently assuring setting and indicating of an image density more suitable to the density of original at a reduced cost.

Claims

1. A method for setting a desired image density in an image forming apparatus wherein the image density is increased or decreased in steps under control of a density setting key and the image density selected by use of the setting key is indicated by selective lighting of a plurality of indicators characterized in that one or more intermediate density setting levels intermediate between two setting levels which are respectively indicated by lighting individually two adjacent indicators are indicated in one of the following ways:-

(a) changing a first one of said adjacent indicators from a lit state to an ON-and-OFF (flashing) state when increasing or decreasing the image density by one step to an intermediate level, and changing the first indicator from the ON-and-OFF (flashing) state to an OFF state and putting the second of said adjacent indicators in the lit state when changing the image density one further step, whereby the intermediate density level is set and indicated when the first indicator is in said ON-and-OFF (flashing) state;

(b) changing a first one of said adjacent indicators from a lit state to an OFF state and putting the second of said two adjacent indicators in an ON-and-OFF (flashing) state when increasing or decreasing the image density by one step to an intermediate level, and changing the said second indicator from the ON-and-OFF (flashing) state to the lit state when changing the image density level one further step, whereby the intermediate image density level is set and indicated when the second indicator is in the ON-and-OFF (flashing) state;

(c) when increasing and decreasing the image density by one step to an intermediate level holding a first one of said adjacent indicators in a lit state or changing said first indicator from the lit state to an ON-and-OFF (flashing) state and changing the second of said adjacent indicators from the OFF state to bring it to the same state as the first indicator, and when changing the image density one further step changing the first indicator from the lit state or ON-and-OFF (flashing) state to the OFF state holding the second indicator in the lit state or changing it from the ON-and-OFF (flashing) state to the lit state, whereby the intermediate image density level is set and indicated when the first and second indicators are in the simultaneously lit state or the simultaneously ON-and-OFF states;

(d) changing the states of the two adjacent indicators to indicate a series of three said intermediate setting levels as follows:

5	<u>Setting level</u>	<u>Indicator states</u>	
		<u>First</u>	<u>Second</u>
10	i) level corresponding to first indicator	ON	OFF
	ii) first intermediate level	ON	FLASHING ON-AND-OFF
15	iii) second intermediate level	ON	ON
20	iv) third intermediate level	FLASHING ON-AND-OFF	ON
	v) level corresponding to second indicator	OFF	ON

25 2. A method for setting a desired image density in an image forming apparatus wherein the image density is increased or decreased in steps under control of a density setting key and the image density selected by use of the setting key is indicated by selective lighting of a plurality of indicators characterized in that one or more intermediate density setting levels intermediate between two setting levels which are respectively indicated by lighting individually two adjacent indicators are indicated by putting the two
30 adjacent indicators into respectively one or more of the following states or combinations of states:

- i) one indicator ON-and-OFF (flashing), the other OFF
- ii) both indicators ON
- iii) both indicators ON-and-OFF (flashing).

35 3. Image forming apparatus having image density setting means, image density setting control means for the operator and a plurality of image density setting indicators, characterized by control means for said indicators arranged to set the indicators in accordance with the method of claim 1 or claim 2.

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FIG.1

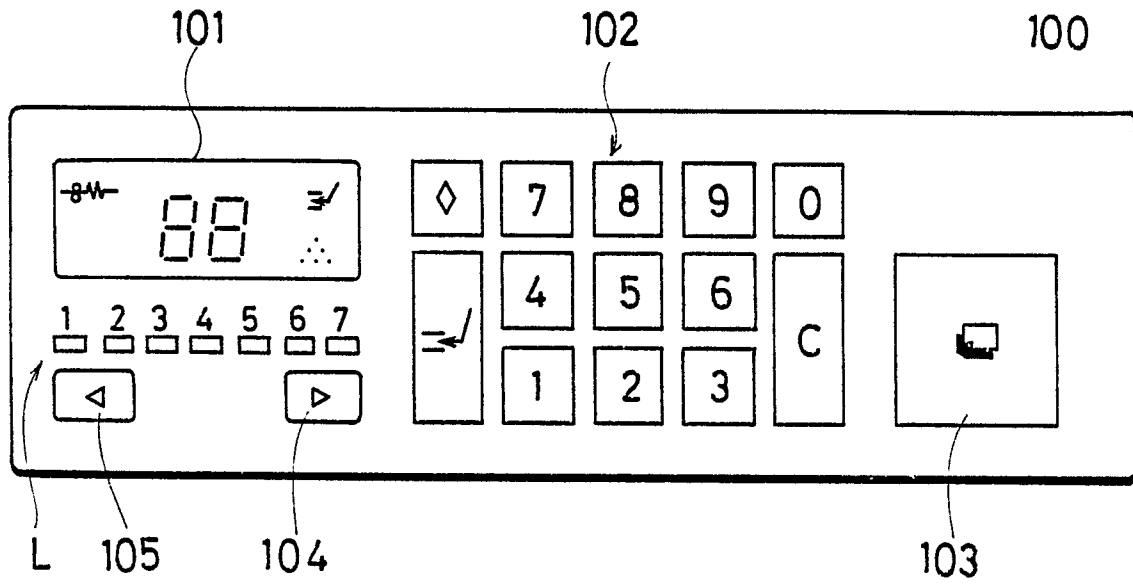


FIG.2

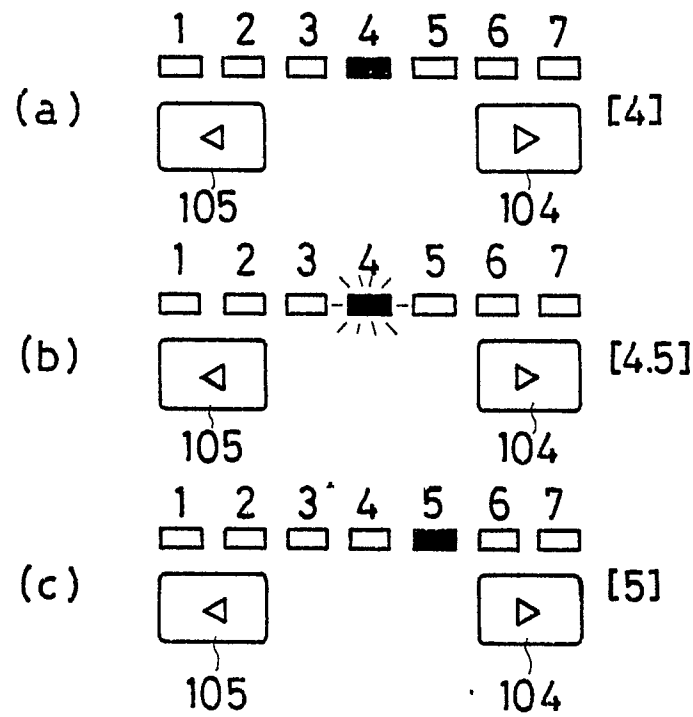


FIG.3

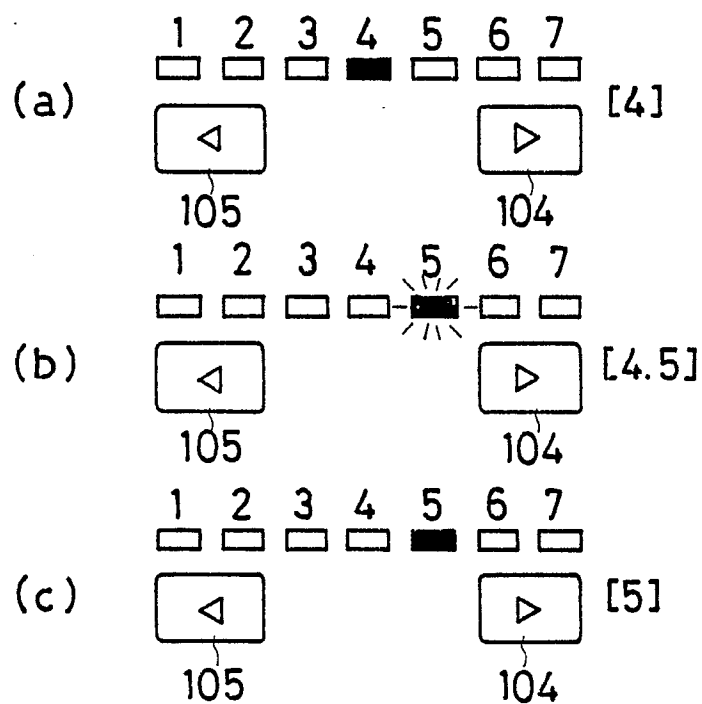


FIG.4

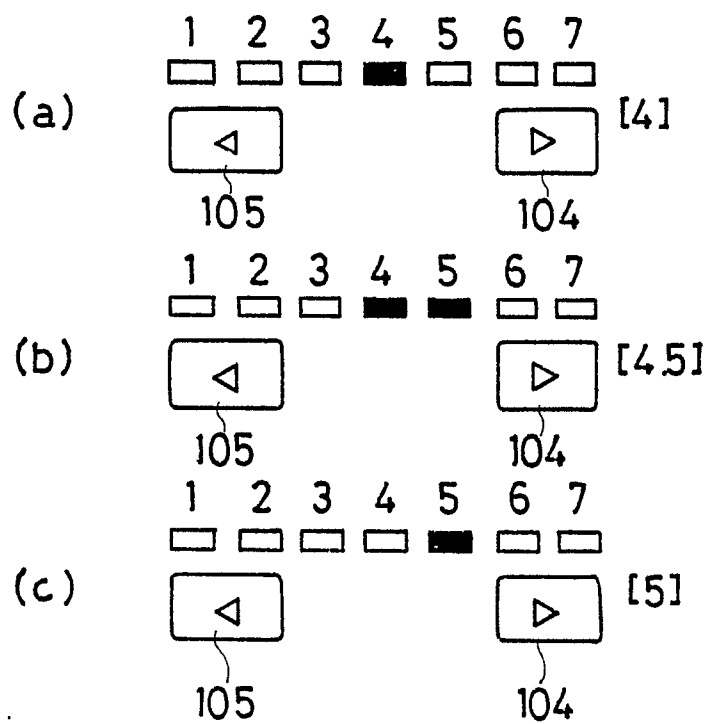


FIG.5

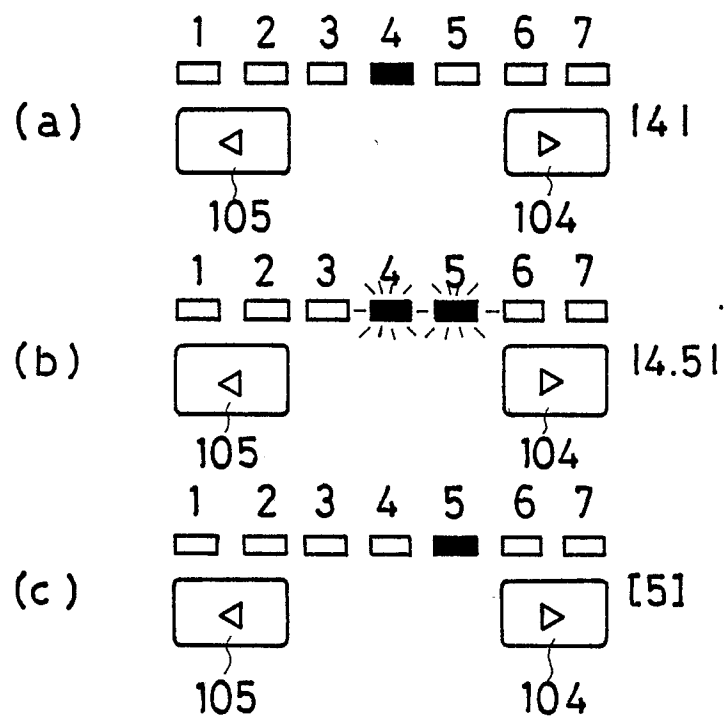


FIG.6

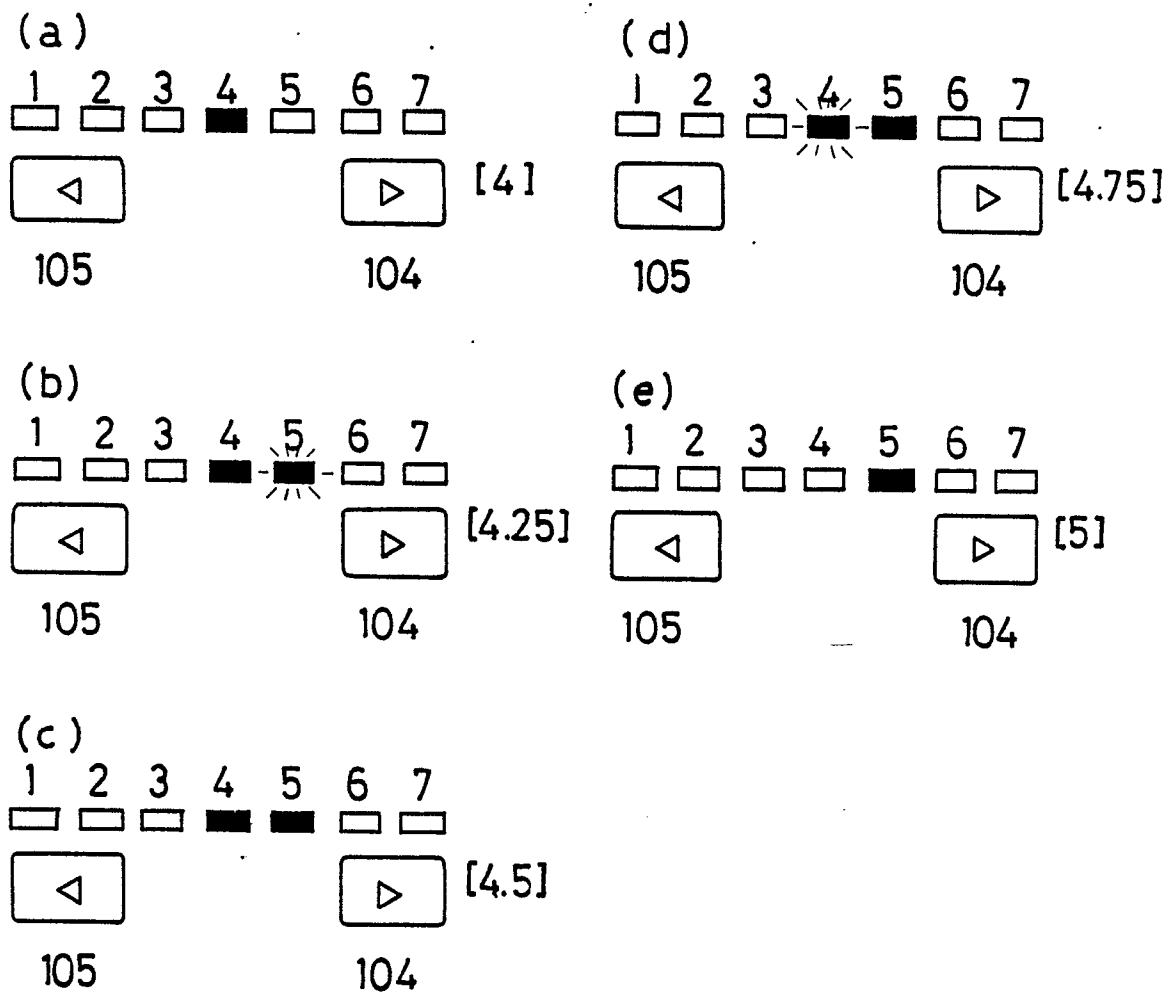


FIG.7

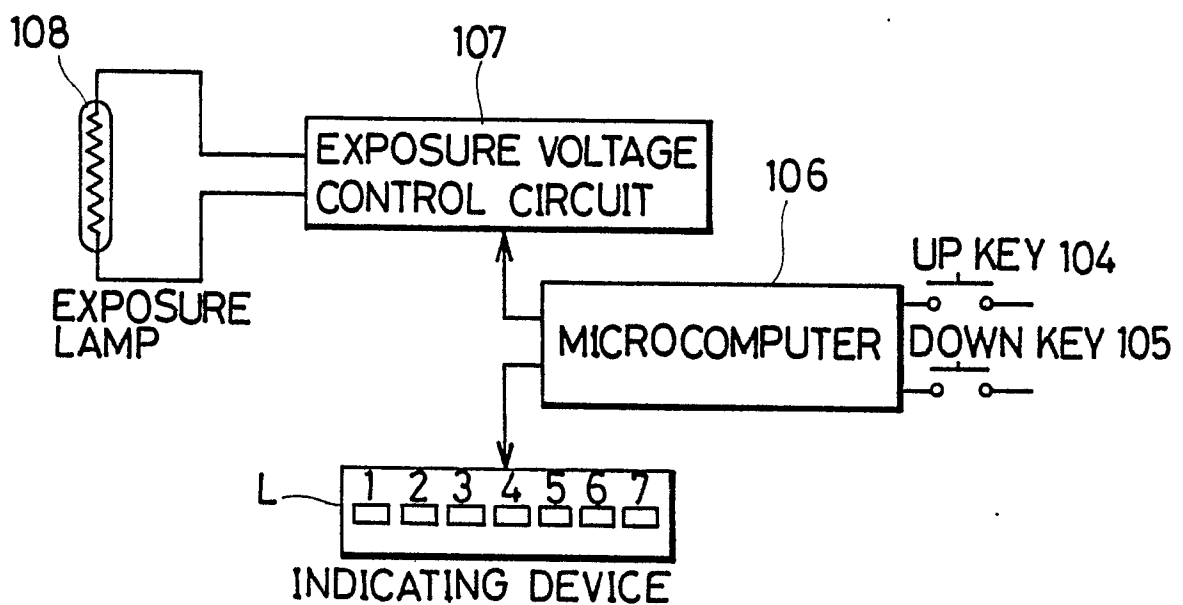


FIG. 8

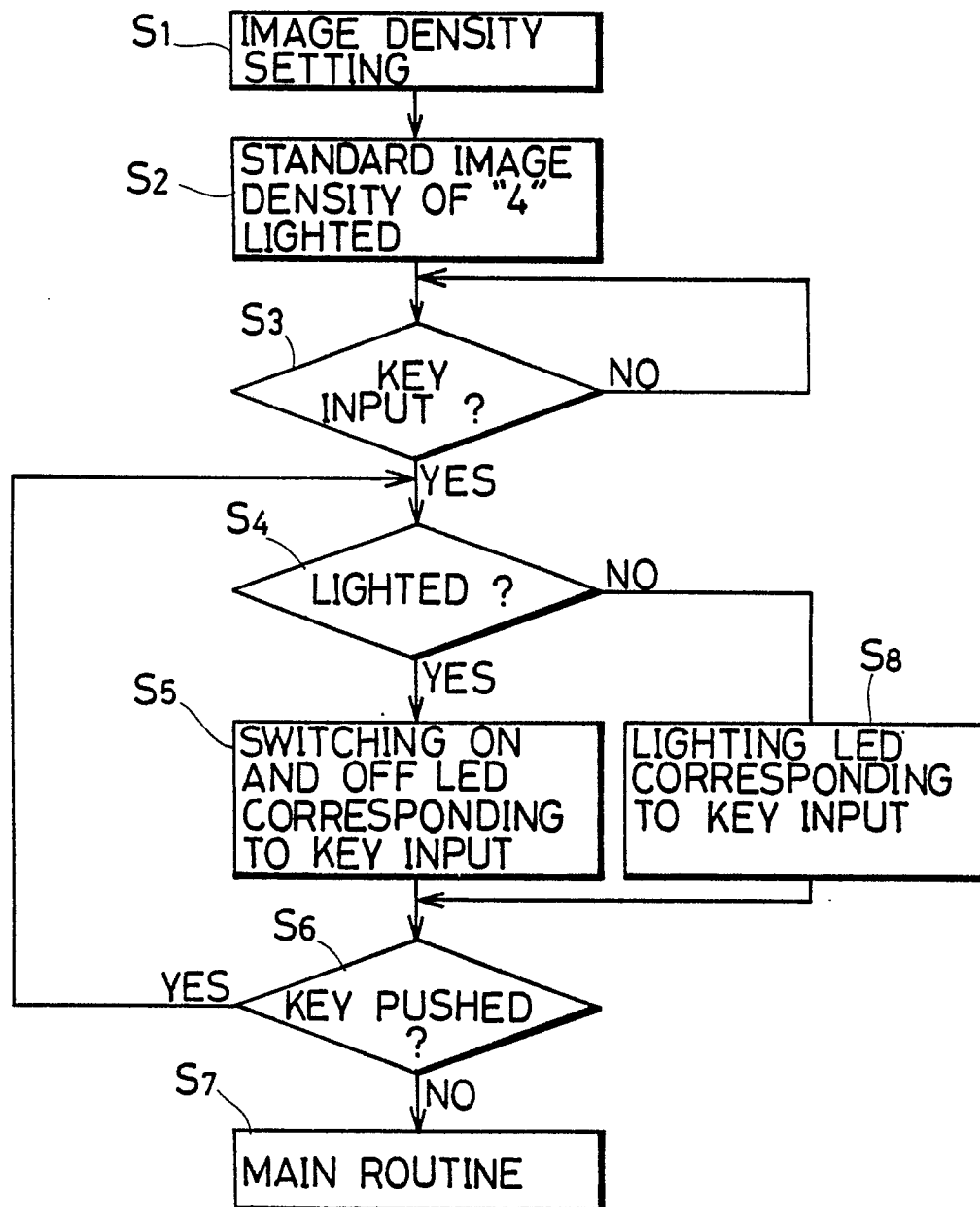
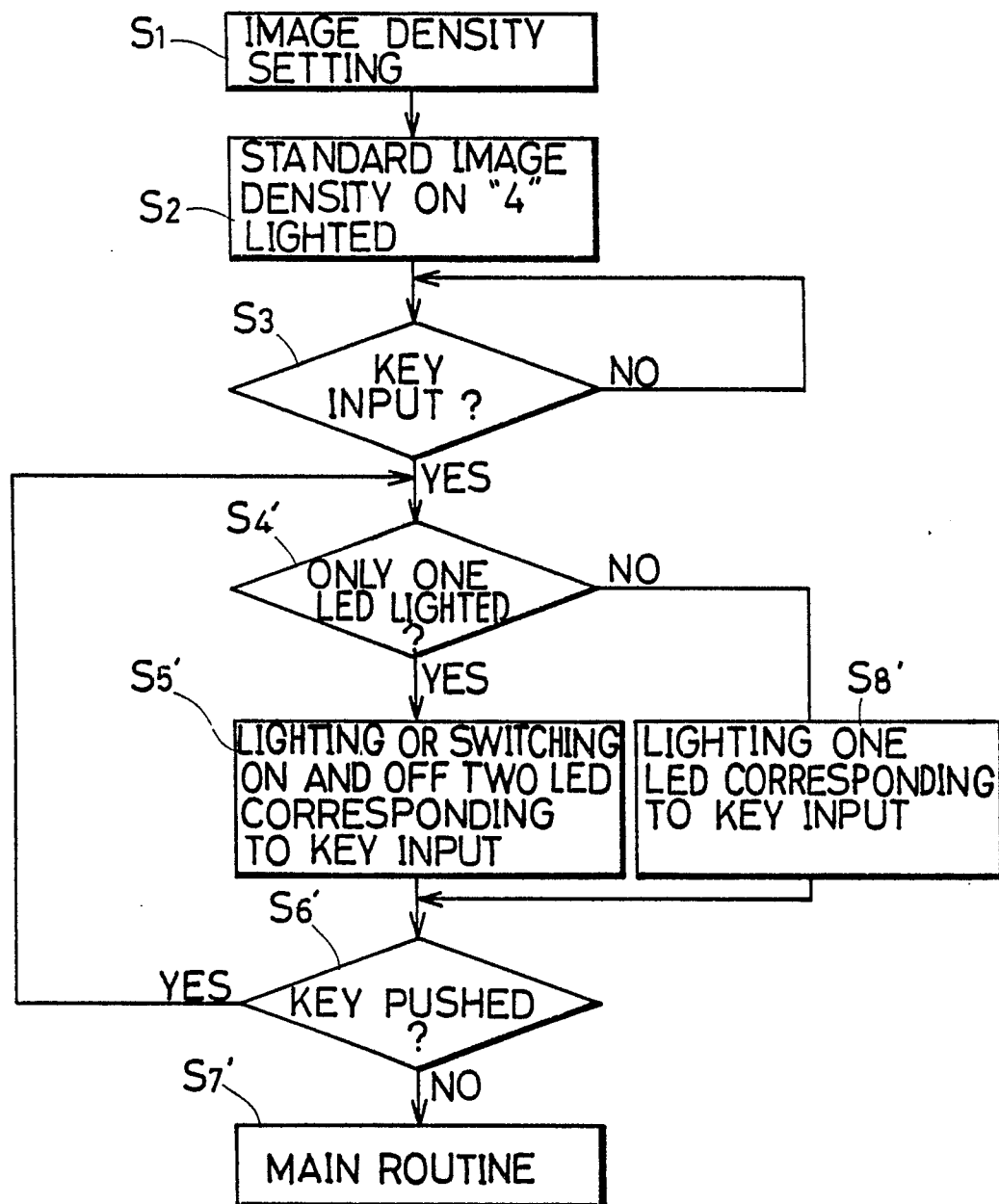


FIG. 9





EP 87 30 8061

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
D,A	PATENT ABSTRACTS OF JAPAN, vol. 6, no. 75 (P-114)[953], 12th May 1982; & JP - A - 57 11364 (TOKYO SHIBAURA DENKI) 21-01-1982 ---	1-3	G 03 G 15/00 G 03 G 15/052
A	DE-A-3 123 452 (MINOLTA CAMERA) * figure 2 * ---	1-3	
A	DE-A-3 334 361 (CANON) * claim 1; figures 1-3 * -----	1-3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			G 03 G 15/00
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 02-12-1987	Examiner HOPPE H
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document			