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(54) Motion detecting apparatus

(57) To provide a motion detecting apparatus which can be fitted easily to an optional part of a display screen and detect a motion in the display screen, a motion detecting apparatus having light-receiving means (1) for detecting a change of an image display and fitted to an optional part of the display screen of an image display means, and detecting means (4, 5, 6) for outputting a detection signal in accordance with the change detected by the light-receiving means (1), is CHARACTERIZED in that motion is detected by the change of the display screen at an optional part in the display screen.

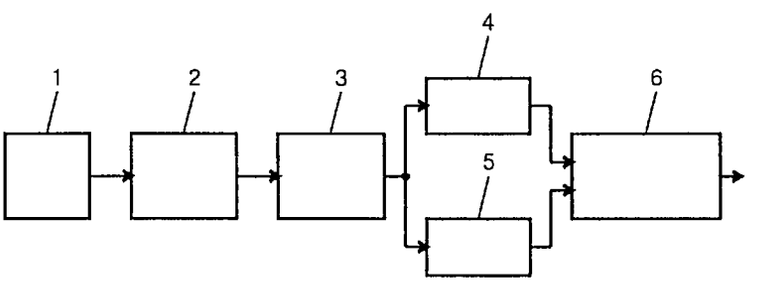


FIG. 1

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Description

The invention relates to a motion detecting apparatus for detecting a motion of an optional part of a display screen of an image displaying means. Particularly, it relates to the motion detecting apparatus which can be used by attaching to a monitoring screen of a prior display of a monitoring apparatus.

In a normal image monitoring system, an image signal which is sent from a monitoring camera is displayed on an image displaying means (for example, CRT display, as refer to a display), so that the image is monitored by a watchman. In this image monitoring system, there is a case that image of various places are displayed on a lot of displays, so that a load of the watchman is to large. Furthermore, the watchman must keep watching an image of the screen for a long time. There is a situation in which the watchman can not be knocked off the watching according to the watching object.

In the above image monitoring system, the load of the watchman is so large that it may happen that a change which occurs in a moment can not be detected.

In such a monitoring system, by realizing an automatic alarming (or some kind of signals) when a change in an optional part on a monitoring screen occurs, a constitution can be realized in which signal values of each pixel are compared by storing the image signal from the monitoring camera to the frame memory.

However, by realizing such constitution, an image processing apparatus which uses a computer or a microprocessor for image processing is required, so that a system is expected to be complicated. Furthermore, it is required that a construction or an electric wiring for distributing the image signal from the monitoring camera of the image monitoring system which is already performed to the image processing system.

For the above reasons, it is desired to realize a motion detecting apparatus which has a simple constitution and can be easily attached on a display.

The invention is provided in accordance with the above problems, so that an object of the invention is to realize a motion detecting apparatus which can be easily attached on an optional part of a display screen of a display and detected of a motion on the display screen.

As a result of a study in order to improve defects of a prior image monitoring system, an arrangement is realized which can be easily attached without changing a constitution of an apparatus of the prior image monitoring system and can detect an expected motion in an optional part on the display screen. Thus, a first aspect of the invention provides a motion detection apparatus comprising a light-receiving means for detecting a change of a displayed image by attaching on an optional part on a display screen of an image displaying means and a detecting means for outputting a detecting signal in accordance with a change which is detected by the light-receiving means as mentioned above, wherein a motion is detected by the change of the displayed image at an optional part in the display screen.

Furthermore, a change of the displayed image which is detected by the detecting means is a change of, for example, a luminance, a density and a color (a hue, a brightness, a chromaticity) and a variety of change such as generation of a predetermined pattern.

A second aspect of the invention provides an apparatus comprising a receiving means for detecting a change of a displayed image by attaching on an optional part on the display screen of the image displaying means, a peak keeping means for keeping a peak value in accordance with a cyclical change according to a displaying method of the image displaying means based on the receiving result of the light-receiving means, a delaying means for outputting a delayed signal which is delayed at two differential time constant by receiving a kept result of the peak keeping means, a detecting means for outputting a detected signal when a difference between the delayed signals which is more than a predetermined level is generated, by comparing the two different time constant from the delaying means, wherein a motion which has a level more than a predetermined level, of the displayed image is detected by a change of the displayed image at an optional part in the display screen.

Moreover, also in the case above, the change of the displayed image which is detected by the detecting means is a change of, for example, a luminance, a density and a color (a hue, a brightness, a chromaticity) and a variety of changes such as generation of a predetermined pattern.

In a motion detecting apparatus according to the first aspect of the invention, the light-receiving means detects the luminance, the density and the color of the displayed image in a situation that said means is attached on an optional part in the display screen of the image display means, so that the detecting means outputs the detected signal in accordance with the change of the displayed image. Thus, a motion in an optional part of the displayed image can be detected.

In a motion detecting apparatus according to the second aspect of the invention, a light receiving means detects a change of the luminance, a density and a color in a situation that the said means is attached to an optional part in the display screen. The peak holding means holds a peak value in accordance with an cyclical change which is generated by a displaying method of the image displaying means about the light-receiving result of the light-receiving means. The delaying means outputs a delayed signal which is delayed by two differential time constant in accordance with the held result of the peak holding means. The detecting means compares delayed signals from the delaying means which has a different time constant and outputs a detected signal when a difference between the delaying signals which is more than a predetermined level is generated. As a result, a motion which can be detected by a change of a displayed image which is larger than a pre-

determined level in an optional part of the displayed image.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

In the drawings,

Fig. 1 shows a block diagram which shows an example of a constitution of a motion detecting apparatus according to the invention;

Fig. 2 shows a conceptional view which shows an example of a light receiver of the motion detecting apparatus according to the invention;

Fig. 3 shows a graph which shows an output wave from the light receiver;

Fig. 4 shows a graph which shows a wave when a peak of an output of the light receiver is held;

Fig. 5 shows a circuit which shows a constitution of a peak hold circuit which is used in an embodiment according to the invention;

Fig. 6 shows a graph which shows waves in predetermined parts according to the invention;

Fig. 7 shows another embodiment of the waves in the predetermined parts according with the invention; and

Fig. 8 shows a block diagram which shows a constitution of a delay circuit which is used in an embodiment according to the invention.

Fig. 1 shows a block diagram which shows a motion detecting apparatus according to the invention. In Fig. 1, a light-receiving means 1 is attached on an optional part on the display screen of the image displaying apparatus, and detects a change of a luminance, density and color of the displayed image in accordance with the attached part. The light-receiver 1 is provided with a sensor 1a, a light shielding board 1b which shields an influence of an ambient disturbance light by means of shielding a predetermined area which surrounds the sensor 1a.

The change of the displayed image which is detected by the light-receiver 1 differs when a displaying method is changed, for example change of a luminance, density and color. Moreover, as a change of the color, a hue, a brightness and a chromaticness are considered. Furthermore, when a predetermined pattern is generated on the displayed image, a change of the pattern or the pattern can be detected.

As the sensor 1a, a sensor like a photo-transistor, photo-diode and CDS can be used when a luminance of the displayed image is detected. Moreover, when a changing of the color is detected, a color meter can be used. Furthermore, the photo-transistor, the photo-diode and CDS can be used. In this case, the sensor can be provided with a characteristics in accordance with a wave length and can be provided with a color filter. Furthermore, if a generation or a change of the pattern of the sensor are detected, OCR (Optical Character Reader) can be used.

In this embodiment, it is preferable that the sensor 1a has a light receiving area in accordance with a area of a plurality of scanning lines (few to few tenth lines) on the display screen of the image display apparatus. If the area is too small, when the displayed image is deviated by swinging the pick-up side, there is a possibility that the sensor would be malfunctioned. Furthermore, in order to realize an attaching the light-receiver 1 on the display screen of the image display (surface of CRT) , it is recommended that the sensor 1a or the masking board 1b has a sickness or adsorption.

Moreover, description is continued by referring to an embodiment for detecting a luminance as follows.

A luminance adjusting amplifier 2 is a gain adjusting type amplifying means for adjusting a gain in accordance with a light-electric converted signal which is generated by the light receiver 1. A peak hold circuit 3 is means for holding a peak value in accordance with a cyclical change of a repeated displayed by means of a displaying method of the image display in one cycle.

Furthermore, if necessary, an automatic gain control (AGC) can be realized by feeding back a part of an output of the peak holding circuit 3 to a gain control terminal of the luminance control amplifier.

A delaying circuits 4 and 5 are circuits for outputting a peak hold value from the peak holding circuit 3 in accordance with respecting different time constants. For example, the delaying circuit 4 is constituted so as to output a peak hold value which tracks a change of the peak hold value. The delaying circuit 5 is constituted so as to output a signal which is changed by delaying from a few to a few tenth fields in accordance with a change of the peak hold value. A window comparator 6 is a means for outputting a detected signal when the difference which is longer than a predetermined level is generated between the delayed signals by comparing delayed signals which has a different time constant from the delaying means 4 and 5. Furthermore, realizing an external buzzer or siren to be performed by means of a detected signal which is output to the window comparator 6.

Nextly, a performance of the above motion detecting apparatus is described. In this part, for example, the case when the motion is detected by means of a change of a luminance of the displayed image is described.

When the image display which is provided with the light receiver 1 is a normal CRT display, a scanning of an electrical beam so called raster scanning is performed. When the scanning is performed, it is shown that all areas of the display screen are shining, but the shining is limited to that the electrical beam is impacted on the phosphor surface and after that the luminance or a chromaticness of brightness is decreased gradually.

Extension of the decreasing of the luminance and brightness are different in accordance with a decay characteristic of the phosphor, when CRT which has a characteristics of a short decay or a middle decay is used, a characteristics as shown in Fig. 3 is provided. Thus, a luminance of a noted pixel is prospered in a pre-

determined timing of a field term, after that, the luminance is decreased. A holed wave as shown in Fig. 4 is generated by holding the peak value of Fig. 3 by the peak holding circuit 3. Furthermore, in this situation, for a change of a peak value of a next field, a holding term of the peak value shall be kept in one field term.

For example, a circuit which is constituted by a switch and a capacitor as shown in Fig. 5 can be used as the peak holding circuit 3. Furthermore, by detecting a leading edges of respective fields, a repeated motion is performed as follows.

(1) Initialling of a pre-peak : SW1=ON, SW2=OFF
(2) From charging to holding of a peak : SW1=OFF, SW2=ON

A peak holding of one field term is performed by changing the stats of the switching.

Furthermore, when the peak value of the light-electric converted signal is a value as shown in Fig. 6(a), a holding value of the peak holding circuit 3 is a value as shown in Fig. 6(b). In this embodiment, by setting a delaying value of the delaying circuit small, for realizing a output wave which tracks the value. Moreover, the delaying circuit 5 is set so as to output a wave which tracks with few fields delay. By means of this arrangement, when the change of the peak value of the light-electric converting signal is occurs, the delayed signal of a continuous line of Fig. 6(c) is generated by the delaying circuit 4 and a delayed signal of a dotted line of Fig. 6(c) is generated by the delaying circuit 5 and these delayed signals are inputted to window comparator 6. In a position where the continuous line and the dotted line are overlapped, the continuous line is drawn.

These two types delayed signals are parts which change a peak value of the light-electrical converted signal of the light receiver 1, and a different wave is generated. Thus, in Fig. 6, a difference of the delayed signal waves between a wave which is in a term when the peak value is decreased and a wave which is in a term when the peak value is increased is generated. In a middle part between those parts, the two types of delayed signals are overlapped.

Furthermore, the delayed signal of the delay circuit 5 can be traced with the slow change of, for example, the change of the sun-shine by moving of the Sun in a day, so that no difference between waves of two types of delay signals.

Moreover, the case when delayed value of the delay circuit is set to another value which is described by referring Fig. 7. In this embodiment, the delay circuit 4 is set so as to output a wave which tracks an input wave, by setting a small delay value same as a value of Fig. 6. the delay circuit 4 is provided with a low delayed value same as Fig. 6. Furthermore, the delay circuit 5 is set for realizing to output a wave which is delayed more than a few tenth fields and is set as the wave can not be tracked at short timing.

By realizing above, when a changing of the peak value of the light electric converting signal is occurs, the delayed signal which is shown by a continuous line of Fig. 7 (c) is generated by the delay circuit 4 and the delayed signal which is shown by a doted line of Fig. 7(c) is generated by the delay circuit 5. These delay signals are inputted to the window comparator 6. Moreover, a part where the continuous line and the doted line are overlapped, the continuous line is drawn.

These two delay signals generate a portion which has a different of the wave in a changed part of the peak value of the light-electric converting signal of the light receiver. Thus, in an embodiment which is shown in Fig. 7, at a term between a term in which the peak value is increased and a term in which the peak value is recovered, a different between two signals are generated.

Moreover, the delaying signal of the delay circuit 5 can be traced with the slow changing of, for example, the changing of the sun-shine by moving of the Sun in a day, so that a difference between waves of two delay signals is occurred.

An example of two delay circuits, it is easily realized by a circuit which is provided with the peak detector 8a, the timer 8b and the switches 8c and 8d which are shown in Fig. 8. In this situation, by changing large a term (ratio) of a switching between the switches 8c and 8d by changing a time constant of the timer 8b to a few to a few tenth, the two delay time can be set.

For example, in accordance with object, a setting which can not be tracked the changing of the sun shine, but can be tracked the motion of a man.

Furthermore, the wind comparator 6 outputs a detecting signal when the different value which is larger than a predetermined value between the two waves in Fig. 6 (d) is detected by receiving the two delay signals in Fig. 6(c). Thus, in a term in which the luminance is changed (There is a motion), the detected signals d1 and d2 which are shown in Fig. 6 is generated by the window comparator 6.

Moreover, the window comparator outputs the detecting signal when a different value which is larger than a predetermined value between the two waves is generated as shown in Fig. 7(d) by receiving two delay signals as shown in Fig. 7(c). Thus, in a term which are changed the luminance (There is a motion) the detecting signal d1 is generated as shown in Fig. 7(d).

Furthermore, an object to provide a different which is larger than a predetermined value is to avoid a malfunction by a noise component as a received light noise. However, if the different is to large, a problem in which a sensitivity for a motion detecting is increased. Moreover, by controlling the different, a setting is realizing in which a response is not generated by a slow motion of, for example, a luminance changing of a motion of a cloud.

As a result of the above, when a luminance changing which faster than a changing of the sun shine is happen in an attached part of the light receiver 1 on the display screen of the image display, a detecting signal is output from the window comparator.

The following applications of the motion detecting apparatus according to the invention are given as examples.

(1) An entrance or a checkouts part of a store.
(2) An entrance or a low of a home or company.
(3) For realizing a sensing of a baggage accident in a storage.
(4) For realizing a sensing of a fire accident or an explosion in a factory.
(5) For realizing a sensing of a constricted material in a construction line of a factory.
(6) For realizing a sensing of a reaction in a chemical plant.
(7) For realizing a sensing of a shadow of a fish on a fish finder.
(8) For realizing a sensing of a moving means or a fixed means on a radar.
(9) For realizing a sensing of a pattern of a radar system for selecting a friend and a enemy.

In the above embodiments, by detecting a changing of the luminance, a density or a color, the motion can be detected. Furthermore, when a changing a color in which the luminance and the density is kept, the detection of the color is an useful embodiment. Moreover, in situation (9), it is a useful embodiment to detect a predetermined pattern is happen or changed. However, the setting position is no limited the above position, but it can be set on any position.

The detecting signal can be used as follows.

(1) An announcing by a buzzer, a siren or a alarming light.
(2) A recording a displayed image.
(3) Starting of Stopping of some system.

In the above situation, a result of a sensing can be detected in time without a sensing by a man.

Furthermore, a video recording of a result of a sensing in a waste term in which a changing is not happen, so that a power of a searching man or a video tape can not be saved. Moreover, when a recording of a video is realized, a long recording can be realized and a predetermine recorded position can be easily fined.

With the motion detecting apparatus as explained above, the following effects as 1), 2) and 3) below can be realized.

1) A light-receiving part can be easily attached to a display screen of a display apparatus. In this case, it can be attached to the part required to be monitored. Therefore, no operation such as changing wiring of an existing monitoring system is required. Furthermore, it can change an monitoring position by changing a part to be attached.
2) It can detect motions caused by changes in displayed image in a required part. Therefore, it can be realized with an easy constitution.
3) Since it is realized with an easy circuit constitution, it can be realized by a battery drive. Therefore, it can be easily attached to a prior system. Moreover, it can be attached to an monitoring system which has an insufficient power supply. Also, it is easily detached so that it is easy to be retired to a previous situation.

Other Favorable Examples

Each embodiment above was assumed with using a CRT display as an display apparatus. However, the motion detecting apparatus can be used as an attachment to a LCD or a projection display.

In case that CRT which has long after glow is used, that display which does not generate flicker is used, or that in the light-receiver 1 display apparatus with slow reaction is used, intensity control amplifier 2 and peak holding circuit 3 can be omitted. And delay circuit 4 and 5, and window comparator 6 can be substituted by various circuits which can detect time constant of light receiving signals.

Also such motion detecting apparatus can be used in a monitoring system, which displays with switching images from plural cameras in a certain period, by a device such as holding photoelectric changing signals in a certain period.

In addition, although the purpose of this invention is detecting motions in a display screen, a motion detecting apparatus, structure of which is detecting motions in accordance with changes of signals (image signals) forming images displayed, can also be expected.

Effects of the Invention

The motion detecting apparatus as explained in detail above can detect changes of image display in a situation that light receiving means is attached to an optional part of a display screen of image display means, and can detect motion in an optional part of displayed image by outputting detecting signals according to changes of displayed image. Therefore, the motion detecting apparatus which can be easily attached to an optional part of a display screen of a display apparatus and can detect motions in a display screen.

The motion detecting apparatus detects changes of displayed image in a situation that light-receiving means is attached to an optional part of a display screen of image display means. The peak holding means holds a peak value, which accords to periodic changes caused by display method of image display means, in light receiving results of light-receiving means. The delay means receives holding results of peak holding means and outputs delayed signals delayed with two kinds of different time constant. The detecting means compares delayed signals of different time constant from the delay means and outputs detecting signals when more than certain level of difference occurs in each delayed signal. According to the above process, motions can be

detected from more than certain level of changes in an optional part of a display screen. Therefore, the motion detecting apparatus, which can be easily attached to an optional part of a display screen of display means and detect motions in a display screen, can be realized.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer.

List of reference numerals in the drawings

1: light-receiver, 1a: sensor, 1b: shade plate, 1c: signal line, 2: intensity control amplifier, 3: peak hold circuit, 4, 5: delay circuit, 6: window comparator, 7: surface of display screen.

Claims

1. A motion detecting apparatus having a light-receiving means for detecting a change of a displayed image and which are attached to an optional part of the display screen of an image display means; and a detecting means for outputting a detected signal in accordance with the change detected by the light-receiving means wherein a motion is detected by the change of the displayed image at an optional part of the display screen.

2. A motion detecting apparatus as claimed in claim 1, wherein a change of the displayed image which is detected by the detecting means is a change of, for example, a luminance, a density and a color (a hue, a brightness, a chromaticity) and a variety of change such as generation of a predetermined pattern.

3. A motion detecting apparatus comprising a receiving means for detecting a change of a displayed image by attaching on an optional part on the display screen of the image displaying means, a peak keeping means for keeping a peak value in accordance with a cyclical change according to a displaying method of the image displaying means based on the receiving result of the light-receiving means, a delaying means for outputting a delayed signal which is delayed at two differential time constant by receiving a kept result of the peak keeping means, a detecting means for outputting a detected signal when a difference between the delayed signals which is more than a predetermined level is generated, by comparing the two different time constant from the delaying means, wherein a motion which has a level more than a predetermined level, of the displayed image is detected by a change of the displayed image at an optional part in the display screen.

4. A method of detecting motion, comprising the steps of:

   detecting a change of a displayed image at an optional part of the display screen of an image display means; and
   outputting a detected signal when a change is detected;
   wherein a motion is detected by the change of the displayed image at an optional part of the display screen.

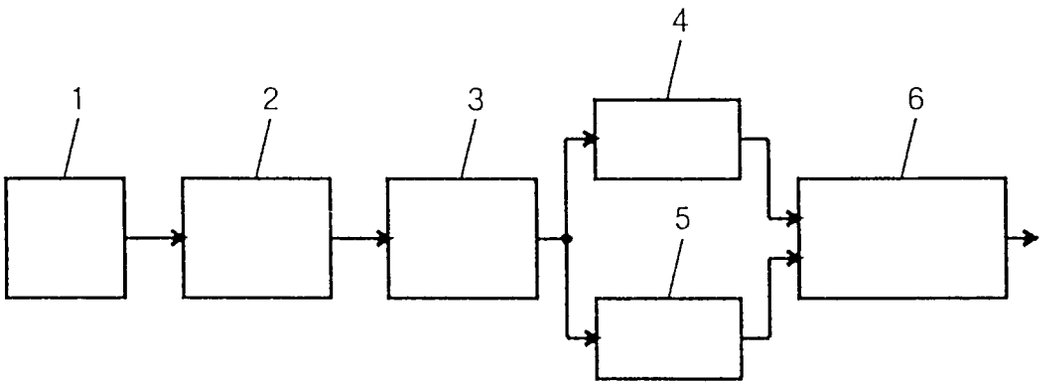


FIG. 1

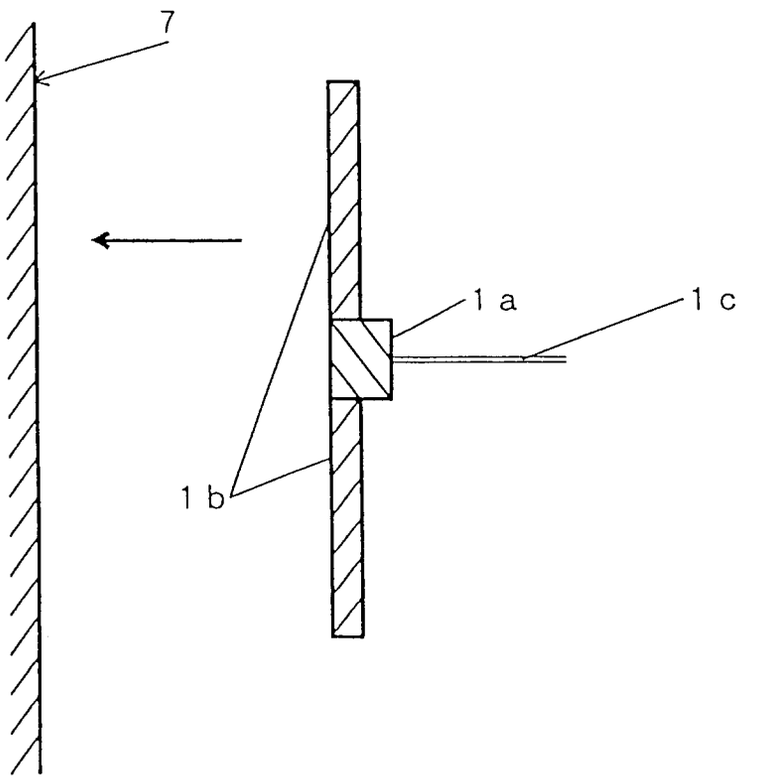


FIG. 2

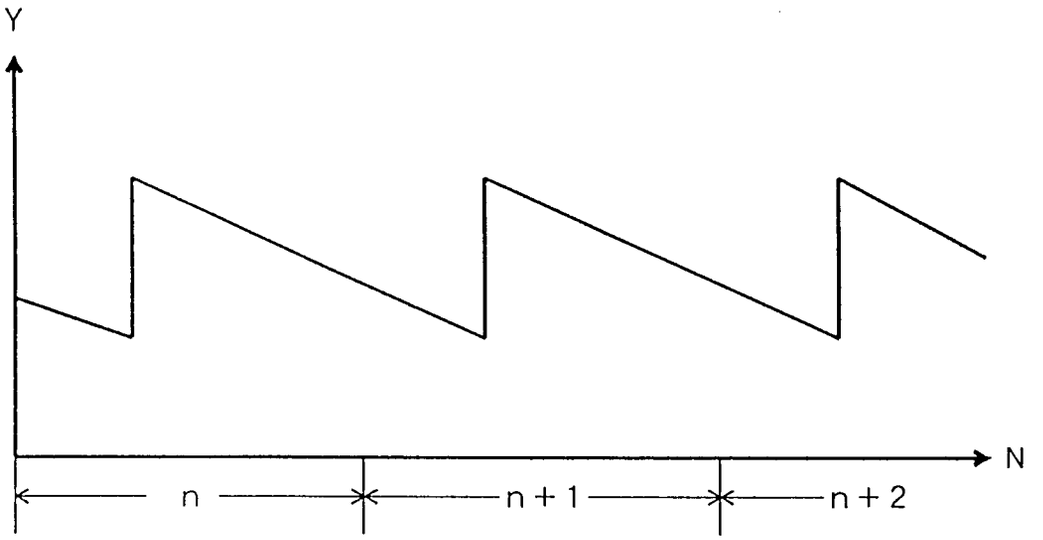


FIG. 3

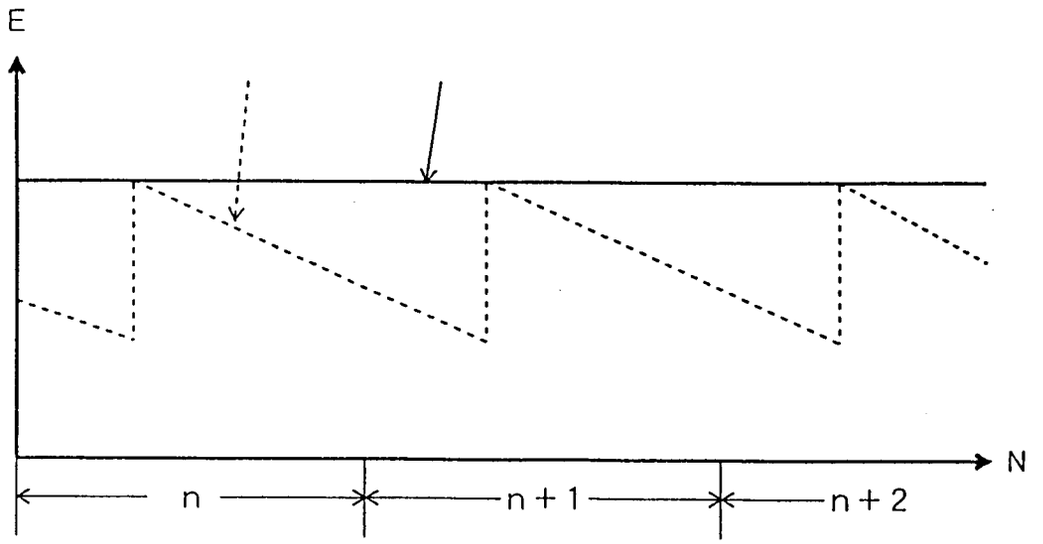


FIG. 4

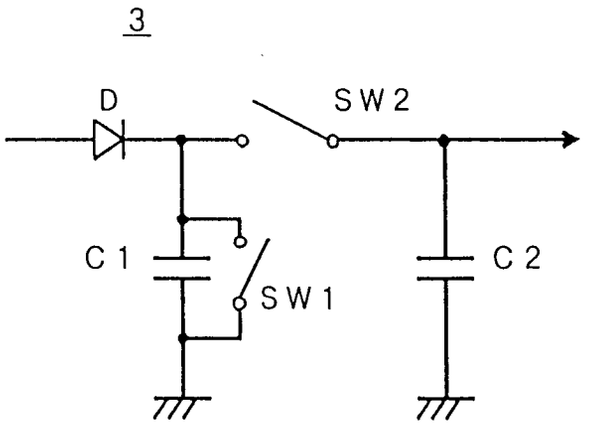


FIG. 5

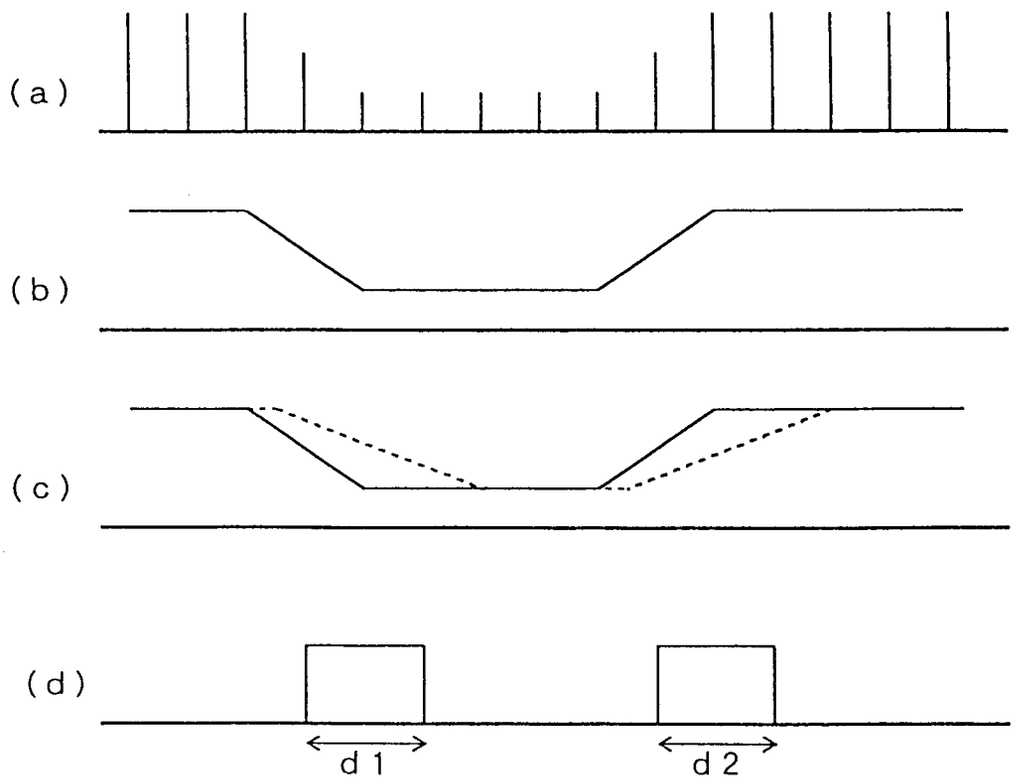


FIG. 6

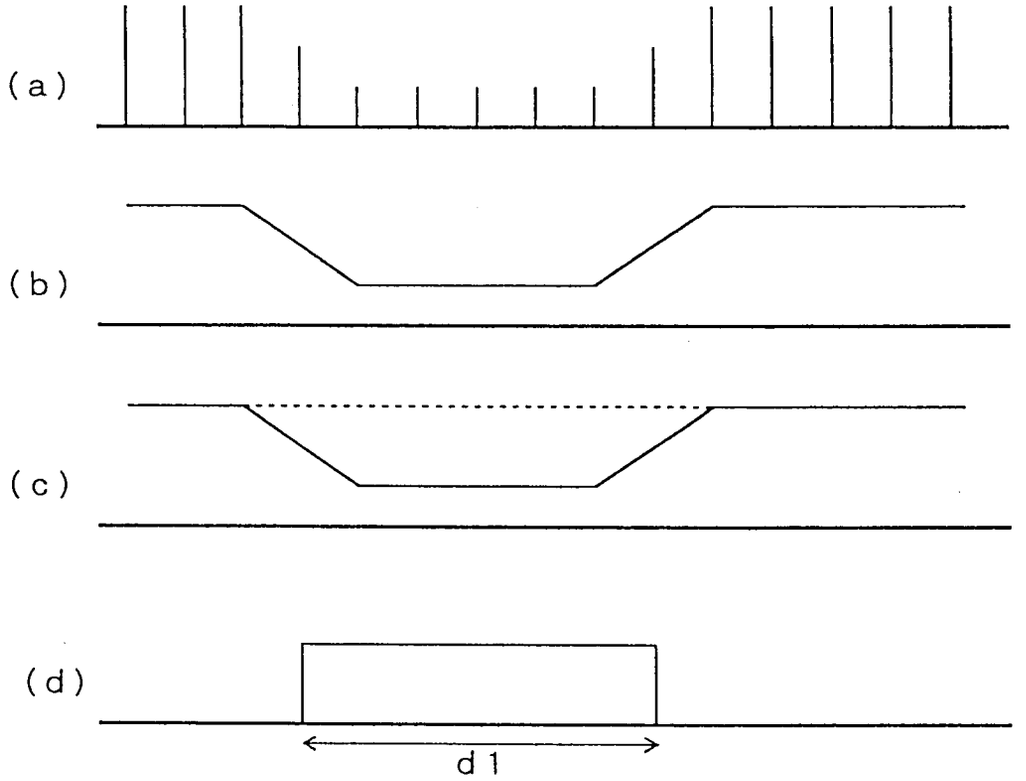


FIG. 7

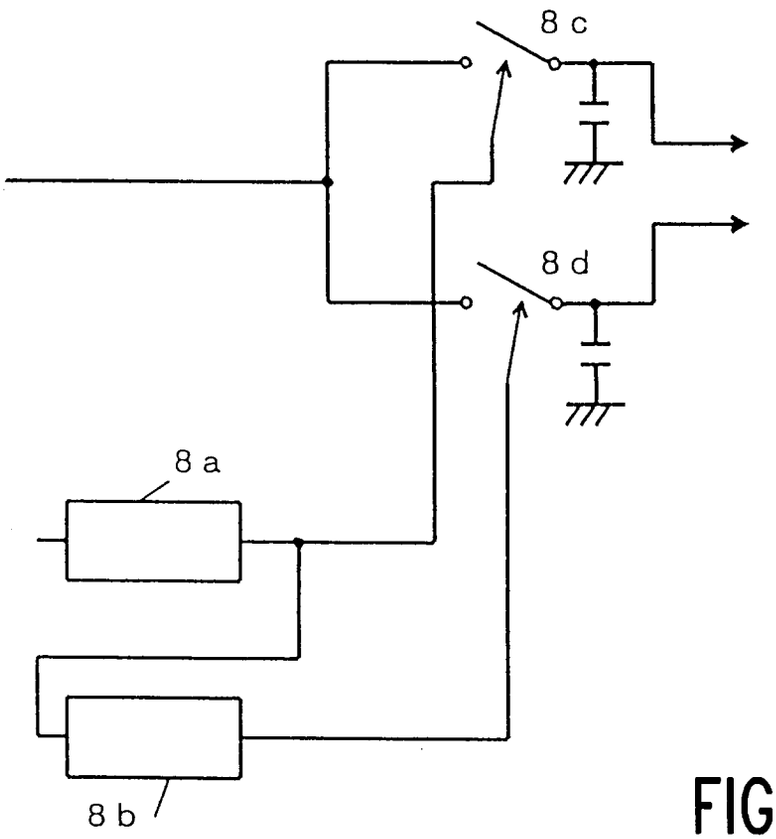


FIG. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0811

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.6)
X	GB-A-1 306 975 (KABUSHIKI KAISHA TOTSU) * the whole document *	1-4	G08B13/194
P,X	DE-A-44 47 053 (MÜLLER F.) * the whole document *	1-4	
A	GB-A-1 527 600 (MULLARD LIMITED) * page 4, line 112 - line 130; figure 15 *	3	
A	US-A-4 641 186 (D. PRITCHARD) * abstract *	3	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

G08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 July 1996	Sgura, S

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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