COMMONWEALTH of AUSTRALIA

Patents Act 1952

624760

APPLICATION FOR A STANDARD PATENT

I/We

Matsushita Electric Industrial Co., Ltd.

of

1006, Oaza Kadoma, Kadoma-shi, Osaka -fu, Japan

hereby apply for the grant of a Standard Patent for an invention entitled:

Gradation correcting apparatus

which is described in the accompanying complete specification.

Details of basic application(s):-

Number	Convention Country	Date
2-36549	Japan	16 February 1990

The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

DATED this SIXTH day of FEBRUARY 1991

To: THE COMMISSIONER OF PATENTS

.....

a member of the firm of
DAVIES & COLLISON for
and on behalf of the
applicant(s)

Davies & Collison, Melbourne

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

DECLARATION IN SUPPORT OF CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT

Insert title of invention.

In support of the Application made for a patent for an invention entitled: "Gradation correcting apparatus"

Insert full name(s) and address(es) of declarant(s) being the applicant(s) or person(s) authorized to sign on behalf of an applicant company.

I Akira KOKAJI

Matsushita Electric Industrial Co., Ltd.
of 1006, Oaza Kadoma, Kadoma-shi, Osaka-fu, Japan

do solemnly and sincerely declare as follows :-

Cross out whichever of paragraphs 1(a) or 1(b) does not apply
1(a) relates to application made by individual(s)
1(b) relates to application made by company; insert name of applicant company.

1. (a) ~~I am the applicant for the patent~~

or (b) I am authorized by

Matsushita electric Industrial Co., Ltd.

the applicant..... for the patent to make this declaration on its behalf.

Cross out whichever of paragraphs 2(a) or 2(b) does not apply
2(a) relates to application made by inventor(s)
2(b) relates to application made by company(s) or person(s) who are not inventor(s); insert full name(s) and address(es) of inventors.

2. (a) ~~I am the actual inventor of the invention~~

or (b) Atsuhisa Kageyama
of 8-15, Hoshimi-cho,
Ibaraki-shi, Osaka-fu,
Japan

is the actual inventor..... of the invention and the facts upon which the applicant.....
is entitled to make the application are as follows :-

State manner in which applicant(s) derive title from inventor(s)

The actual inventor assigned the invention to the said applicant.

Cross out paragraphs 3 and 4 for non-convention applications. For convention applications, insert basic country(s) followed by date(s) and basic applicant(s).

3. The basic application..... as defined by Section 141 of the Act was made
in Japan on the February 16, 1990
by Matsushita Electric Industrial Co., Ltd.
in ..... on the .....
by .....
in ..... on the .....
by .....

4. The basic application..... referred to in paragraph 3 of this Declaration was the first application..... made in a Convention country in respect of the invention the subject of the application.

Insert place and date of signature.

Declared at Osaka, Japan this 31st day of Janauary 1991.

Signature of declarant(s) (no attestation required)

Akira Kokaji
Assistant Director Intellectual Property Center

Note: Initial all alterations.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-70272/91
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 624760

(54) Title
COLOUR SIGNAL ADJUSTED GRADATION CORRECTING APPARATUS

International Patent Classification(s)
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(56) Prior Art Documents
AU 569143 39171/85 H04N 5/222
AU 610565 12620/88 H04N 9/77

(57) Claim

1. A gradation correcting apparatus for correcting gradation of a video signal, said apparatus comprising:

histogram memory for obtaining the histogram of an input brilliance signal, an input/output address of said histogram memory being determined in accordance with the level of said input brilliance signal;

correcting color detecting means having in use the color signal and/or the brilliance signal as input, for detecting a picture component having at least one of a predetermined color or brilliance and for outputting detection data corresponding thereto;

controlling means for outputting correcting summing data in accordance with said detection data from said correcting color detecting means;

an adder for adding said summing data to histogram output data corresponding to said input/output address of said histogram memory, to form cumulative histogram data;

arithmetic means for normalizing the cumulative histogram data, said arithmetic means normalizing said cumulative histogram data in accordance with a maximum brilliance level; and

a look-up table for storing the normalized cumulative histogram data at a memory address corresponding to said input brilliance signal.

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COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

COMPLETE SPECIFICATION

NAME & ADDRESS
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COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

Gradation correcting apparatus

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

BACKGROUND OF THE INVENTION

The present invention generally relates to a gradation correcting apparatus which is capable of correcting the gradation of picture signals in picture apparatuses such as television image receiving machines, video tape recorders and so on.

In recent years, the gradation correcting apparatus is regarded as important in terms of the more dynamic expression of the picture signals on a cathode-ray tube (CRT) as the television image receiving machines become larger in size, higher in picture quality.

The conventional gradation correcting apparatus will be described hereinafter in one example with reference to the drawings.

Fig. 3 is a block diagram of the conventional gradation correcting apparatus. In Fig. 3, reference numeral 1 is an analog-to-digital (AD) converter for converting an input brilliance signal a which is an analog signal into a digital data so as to output a brilliance signal data b. Reference numeral 2 is a histogram memory. The histogram memory is a memory where a memory input/output address is set corresponding to the brilliance signal data b, the data of the input/output address shows a histogram corresponding to the respective input brilliance, the data of the brilliance is read as a histogram memory output data e in accordance with the input/output address corresponding to the input brilliance. In the histogram memory 2, after a particular summing data has been calculated into a histogram memory output data e by an externally provided adder 9, it is received by the histogram memory 2 as histogram memory input data f, and stored at said input/output address corresponding to the brilliance of the input brilliance signal. Here the particular summing data means, for example, "1". Reference numeral 4 is a cumulative summing and normalizing arithmetic unit, which cumulatively adds the input histogram data c from the histogram memory 2, and normalizes the sum such that the maximum value after the cumulative addition thereof may become a maximum value of the output brilliance so as to output normalized cumulative histogram data d. Reference numeral 5 is a look up table which has memories therein. The look up table 5 has addresses corresponding to said input/output addresses, established in accordance with the brilliance of the brilliance data b, and stores the normalized cumulative histogram data d in the address, reads the data of the address corresponding to the brilliance data so as to be synchronized with the input of the brilliance data b, and outputs it as an output brilliance signal data g. Reference numeral 6 is a digital-to-analog (DA) converter, which converts the output brilliance signal data g into the output brilliance signal h of the analog so as to output it.

The gradation correcting apparatus constructed as described hereinabove will be described hereinafter in its operation with reference to Fig. 3 and Fig. 4.

The input brilliance signal a is converted into the brilliance signal data b by the AD converter 1. The data at the input/output address of the histogram memory

2 corresponding to the brilliance signal data b (brilliance thereof) is selected and becomes the histogram memory output data c. The data e has the addition data (1) added by the adder 9, to become histogram memory input data f. The data f is stored again at said input/output address of the histogram memory 2. The histogram is provided about one sheet of or several sheets of pictures in this manner. The histogram obtained in this manner is shown in, for example, Fig. 4 (a). After the histogram has been provided, the data (histogram data c) from the histogram memory 2 is read into the cumulative summing and normalizing arithmetic unit 4 in order from the smaller address (smaller input brilliance). The cumulative histogram is calculated in the arithmetic unit 4, and the maximum value of the cumulative value is normalized so that it becomes the maximum value of the input brilliance signal data. This is Fig. 4 (b). The data whose normalization has been finished is inputted into the look up table 5 as the normalized cumulative histogram data d. The look up table 5 is composed of random access memory (RAM), where the input brilliance is used to determine the address, and the data of the address is used to become the normalized cumulative histogram data d. When the setting of the data d is finished in the look up table 5, the gradation correction is effected. In the gradation correction, the input brilliance signal data b is inputted into the look up table 5, an address is set in accordance with the data b to read the data of the address. This becomes an output brilliance signal data g (Fig. 4 (c)). The data g is inputted into the DA converter 6, is converted into analog amount. The output brilliance signal h is obtained, which allows the gradation correction to be effected. The above described processing is generally called histogram conversion processing in the field of the picture processing.

In such a conventional gradation correcting apparatus, no problems are caused in the processing of white, black signals. When the processing has been applied to the color picture signals, problems are provided in that the portion where the gradation wants to be actually enlarged, the portion near the I shaft of NTSC system regarded as colors sensitive to, for example, the human faces, eyes are not sufficiently enlarged in gradation, and so on, because the color information is not inputted.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided a gradation correcting apparatus for correcting gradation of a video signal, said apparatus comprising:

histogram memory for obtaining the histogram of an input brilliance signal, an input/output address of said histogram memory being determined in accordance with the level of said input brilliance signal;

correcting color detecting means having in use the color signal and/or the brilliance signal as input, for detecting a picture component having at least one of a predetermined color or brilliance and for outputting detection data corresponding thereto;

controlling means for outputting correcting summing data in accordance with said detection data from said correcting color detecting means;

an adder for adding said summing data to histogram output data corresponding to said input/output address of said histogram memory, to form cumulative histogram data;

arithmetic means for normalizing the cumulative histogram data, said arithmetic means normalizing said cumulative histogram data in accordance with a maximum brilliance level; and

a look-up table for storing the normalized cumulative histogram data at a memory address corresponding to said input brilliance signal.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention is hereinafter described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram of a gradation correcting apparatus in one embodiment of the present invention;

Fig. 2 shows characteristic graphs for illustrating the operation of Fig. 1;

Fig. 3 is a block diagram of the conventional gradation correcting apparatus; and

Fig. 4 shows characteristic graphs for illustrating the operation of Fig. 3.

DETAILED DESCRIPTION OF THE INVENTION

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

Referring now to the drawings, there is shown in Fig. 1, a block diagram of a gradation correcting apparatus according to one preferred embodiment of the present invention, which includes an AD converter 1, a histogram memory 2, a cumulative summing and normalizing arithmetic unit, a look up table 5, a DA converter 6, which are similar to

those in the conventional embodiment. Reference numeral 3 is an addition summing data controller, which is adapted to add the addition data corresponding to the correction color detecting data k into the histogram memory output data e so as to output the histogram memory input data f. Reference numeral 7 is an AD converter, which is adapted to effect the AD conversion of an input color signal i (color carrier wave signal, color difference signals R-Y, B-Y, G-Y or I, Q signals) so as to output an input color signal data j. Reference numeral 8 is a correction color detecting circuit, where the input brilliance signal data b, the input color signal data j are provided as inputs, a color portion for strengthening the gradation correction which is an object is detected from the size of these signals so as to output the detection result as the correction color detection data k.

The gradation correcting apparatus constructed as described hereinabove will be described hereinafter in its operation with reference to Fig. 1 and Fig. 2.

Fig. 2 shows the current of the histogram conversion in the present embodiment in the order of (a) → (b) → (c). The difference between the conventional embodiment and the present embodiment is in that the addition summing data controller 3, instead of the adder 9 in the conventional embodiment, is provided in the present embodiment, and the addition summing data is varied with the input color signal i and the input brilliance signal a. The input color signal

i is inputted into the color signal AD converter 7, and is converted into the input color signal data j. The input color signal data j and the input brilliance signal data b are inputted into the correcting color detecting circuit 8 so as to detect a portion having the particular color and brilliance or either of them. In order to detect, for example, the portion of the flesh tint, the computation of

$$\alpha_1 \cdot (R - Y) - \beta_1 \cdot (B - Y) \quad \ldots\ldots\ldots \quad (1)$$

where the input color signal i shows the color difference signals R - Y and B - Y. (α, β are assumed to be positive constants). When the result in the equation is large, it is judged to be close to the flesh tint. As the flesh tint is comparatively high in brilliance, a judgment result that the brilliance is bright is added to the judgment result. Namely, a portion where the size of the input brilliance signal data b inputted into the correction color detecting circuit 8 is large is detected through the construction of a comparing circuit and so on, so that the detecting result becomes correct. In this manner, in the portion having the particular color, brilliance, the detection of the portion is effected so as to output the correcting color signal data k. This signal k is inputted into the addition summing data controller 3. The addition summing data controller 3 decides the summing data for adding into the histogram memory output data e in accordance with the correcting color signal data k. Although, in the conventional embodiment, a

value 1 has been added, in the present embodiment, the addition summing data is controlled so that it may become larger when the particular portion has been detected. Therefore, the addition summing data of the histogram memory becomes larger in the portion detected by the correction color detecting circuit 8. As a result, the normalized cumulative ~~normalized~~ histogram data d obtained through the cumulation and normalization of the histogram obtained as described hereinabove becomes larger in its inclination (variation amount) in the portion detected by the correcting color detecting circuit 8 as described in Fig. 2 (b). As a result, the brilliance in that portion is to be enlarged as shown in Fig. 2 (c).

According to the present embodiment as described hereinabove, a color signal AD converter 7 for AD converting the color signal is provided. A portion having a particular color is detected by the correction color detecting circuit 8 from the color signal data j to be obtained by it and the input brilliance signal data ~~existing~~ b from the conventional embodiment. When the summing data of the histogram memory 2 is added by the results, the histogram summing data of the brilliance portion becomes larger by the provision of the addition summing data controller 3 for having the larger value, instead of the conventional 1, as the addition data. As a result, the variation amount of the brilliance portion

becomes larger when the cumulative normalizing operation is effected, so that the gradation may be enlarged.

Although it is the color difference signal which is used in the equation (1) in the present embodiment, it may be I, Q signals, or a color carrier wave signal. Also, it may be a plurality of signals or either of them. Also, although the addition summing data controller 3, the cumulative adder 4, the normalizing arithmetic unit 4, the correction color detecting circuit 8 are respectively shown additionally, a general purpose arithmetic apparatus such as microprocessor or the like may be used for them and one portion thereof. Also, although the histogram memory 2 and the look up table 5 are shown separately, they may use one memory in common.

As is clear from the foregoing description, according to the arrangement of the present invention, by the addition summing data controller, the color signal AD converter, the correction color detecting circuit are provided in addition to the construction of the gradation correcting apparatus using the conventional histogram memory, the portion of the picture having the particular color and brilliance or either of them is detected, the histogram addition data in having the histogram is corrected so that the gradation of the portion may be enlarged, so that what wants to be really enlarged can be sufficiently corrected in gradation.

Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be noted here that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the present invention, they should be construed as included therein.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A gradation correcting apparatus for correcting gradation of a video signal, said apparatus comprising:

histogram memory for obtaining the histogram of an input brilliance signal, an input/output address of said histogram memory being determined in accordance with the level of said input brilliance signal;

correcting color detecting means having in use the color signal and/or the brilliance signal as input, for detecting a picture component having at least one of a predetermined color or brilliance and for outputting detection data corresponding thereto;

controlling means for outputting correcting summing data in accordance with said detection data from said correcting color detecting means;

an adder for adding said summing data to histogram output data corresponding to said input/output address of said histogram memory, to form cumulative histogram data;

arithmetic means for normalizing the cumulative histogram data, said arithmetic means normalizing said cumulative histogram data in accordance with a maximum brilliance level; and

a look-up table for storing the normalized cumulative histogram data at a memory address corresponding to said input brilliance signal.

2. A gradation correcting apparatus according to claim 1, wherein said correcting color detecting means includes a comparing means for detecting the predetermined brilliance of said input brilliance signal, said predetermined brilliance being greater than a brilliance threshold.

3. A gradation correcting apparatus according to claim 1, comprising a means for detecting a high input brilliance signal portion using a comparing circuit on the basis of color and/or brilliance data input into the above described correcting color detecting means so as to output said detection data from said correcting color detecting means, said adder receiving a signal from the controlling means so as to decide, on the basis

of said detection data, the summing data to be added to the histogram output data.

4. A gradation correcting apparatus according to claim 3, wherein the correcting color detecting means and the controlling means are adapted to process digital input data.

5. A gradation correcting apparatus substantially as hereinbefore described with reference to the drawings.

DATED this 24th day of March, 1992

MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
By its Patent Attorneys
DAVIES COLLISON CAVE

Fig. 1

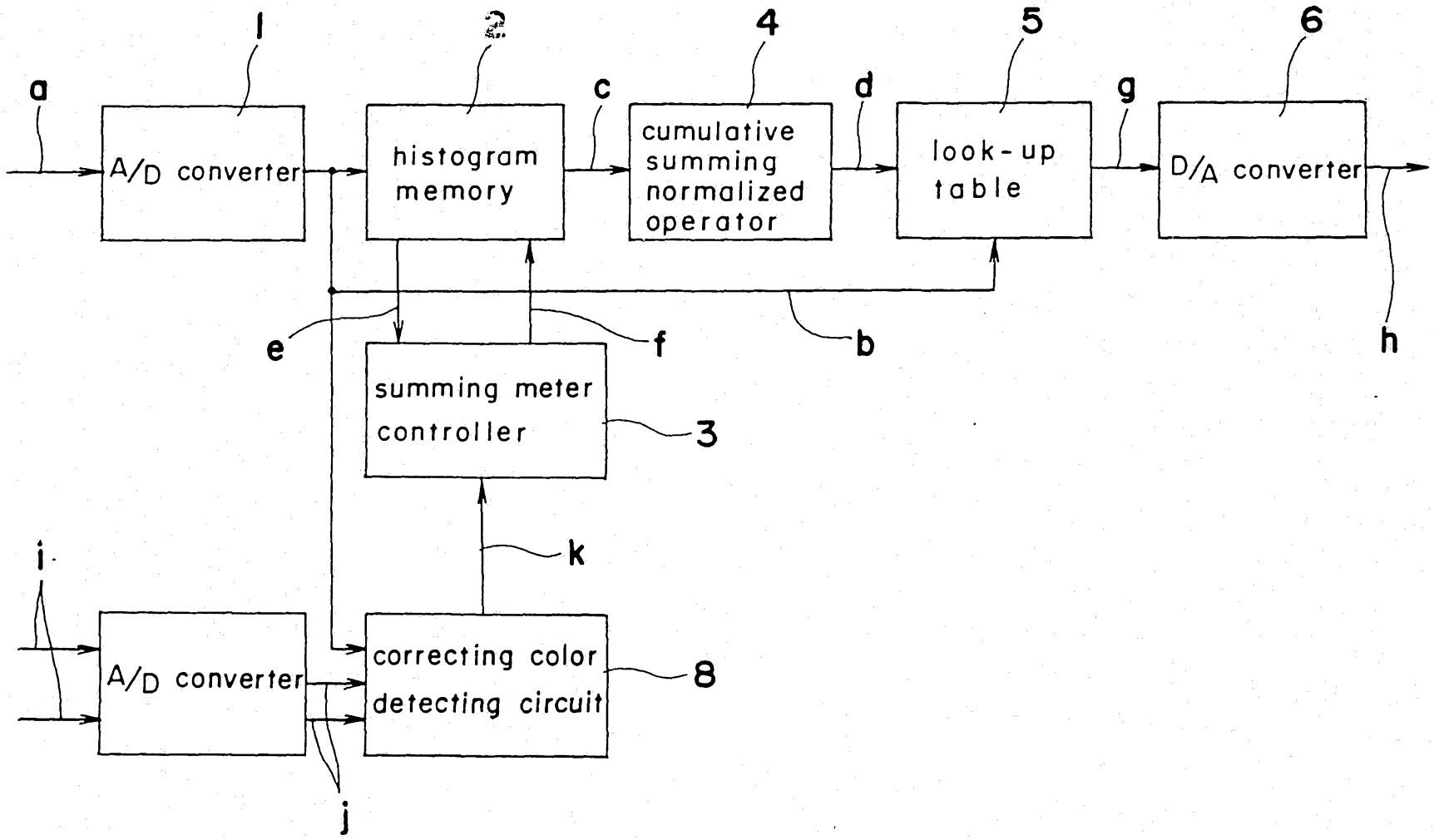


Fig. 2

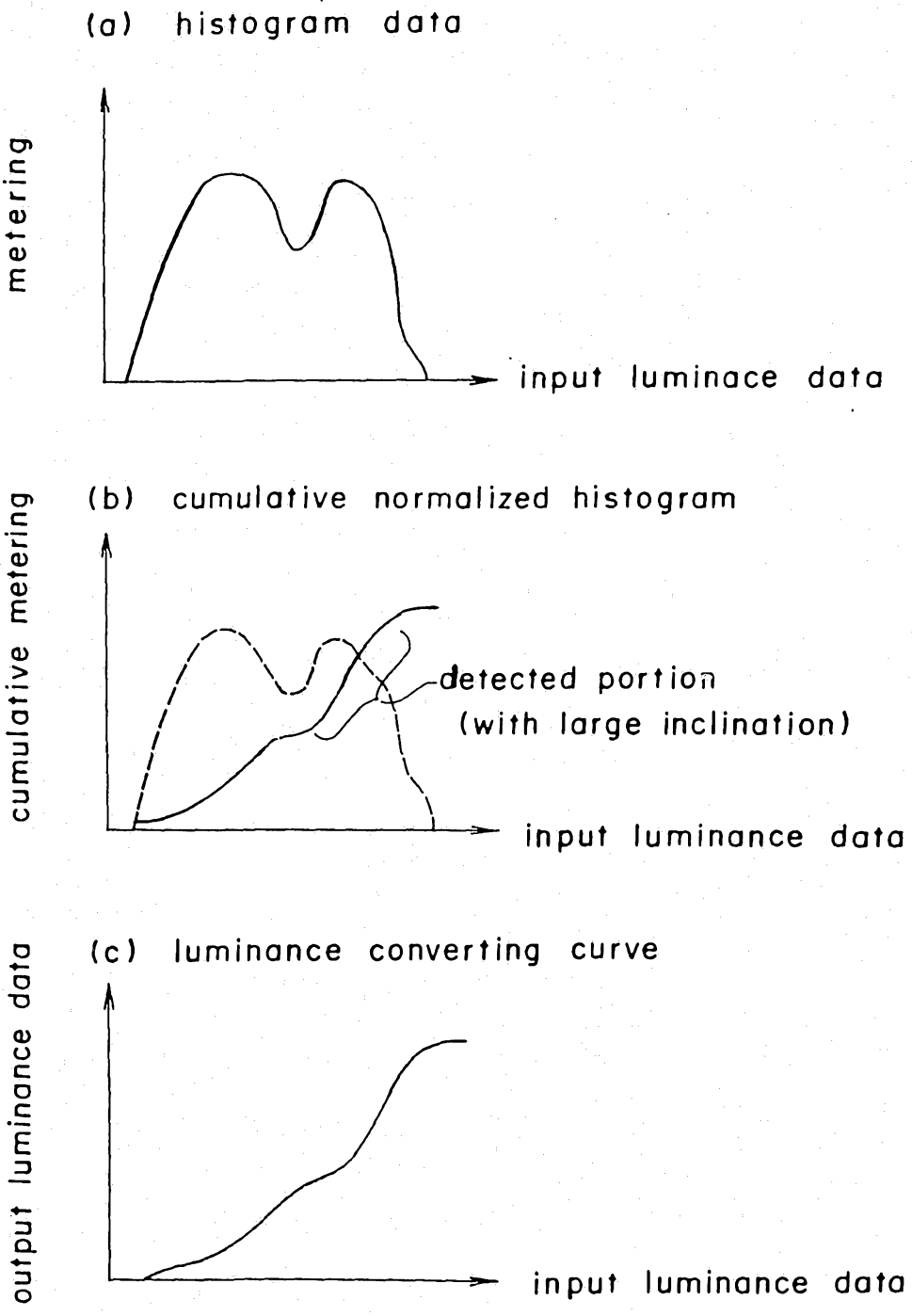

(a) histogram data
metering
input luminace data
(b) cumulative normalized histogram
cumulative metering
detected portion
(with large inclination)
input luminance data
(c) luminance converting curve
output luminance data
input luminance data

Fig. 3

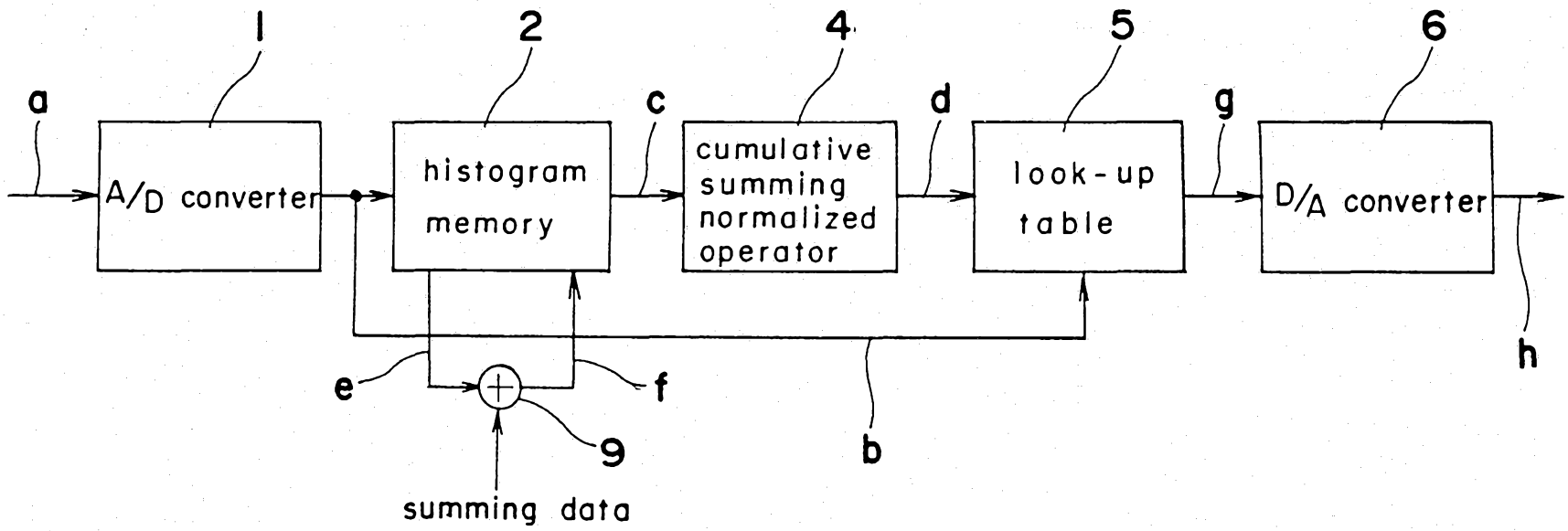
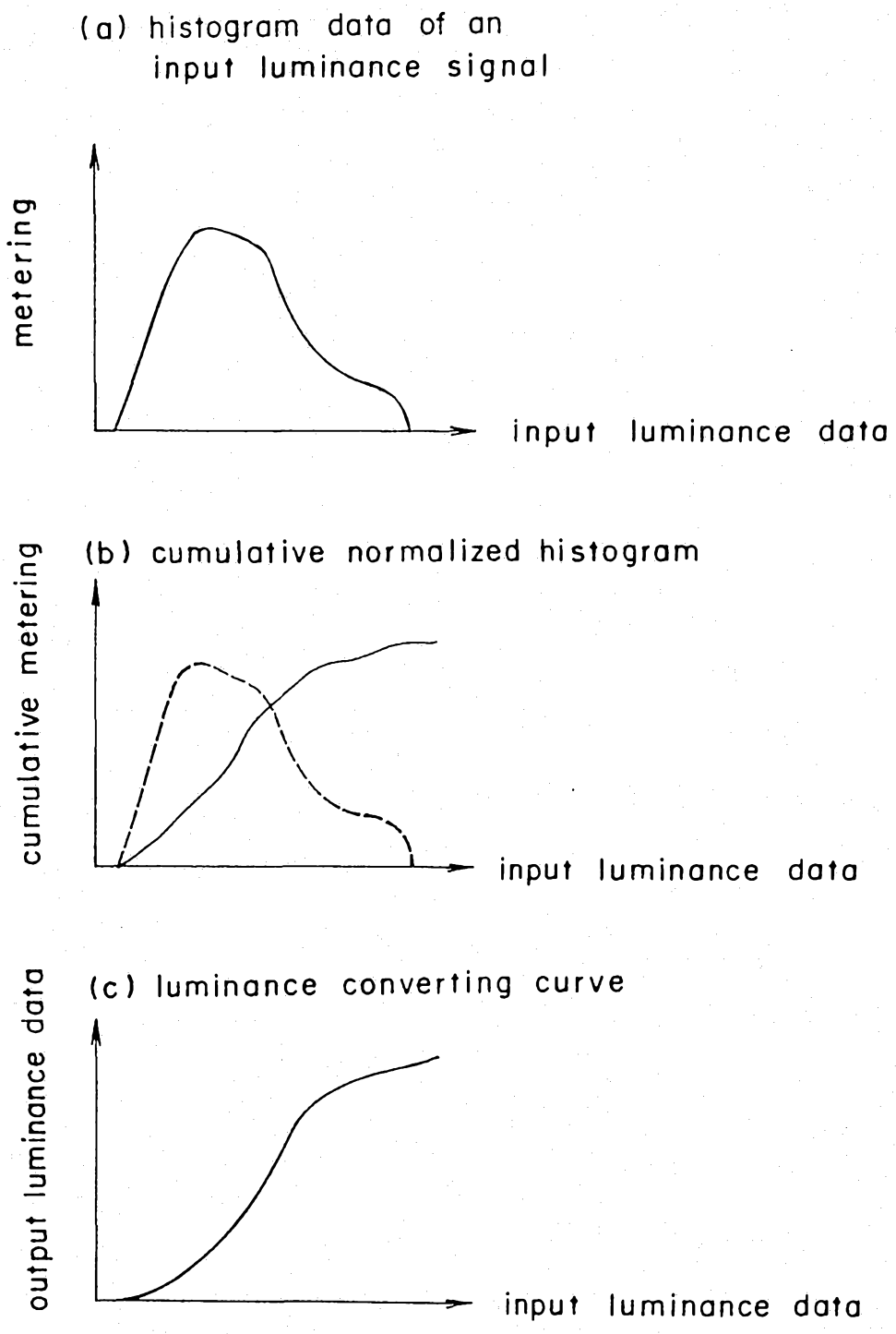

1
2
4
5
6
a
c
d
g
A/D converter
histogram memory
cumulative summing normalized operator
look-up table
D/A converter
h
e
f
9
b
summing data

Fig. 4


(a) histogram data of an input luminance signal
metering
input luminance data
(b) cumulative normalized histogram
cumulative metering
input luminance data
(c) luminance converting curve
output luminance data
input luminance data