

1 Pattern Generation Method and
 Pattern Generation Apparatus

BACKGROUND OF THE INVENTION

5 Field of the Invention

 The present invention relates to a pattern generation method and apparatus which can be applied to an output device capable of expressing gradation.

Related Background Art

10 When a gray scale font which can express gradation is assumed, it can be stored in a character generator in a bit map format, i.e., in a format that multi-value data is added to one dot.

 However, when font data is stored in the bit map format, the following problems are posed.

15 (1) A font cannot be enlarged or reduced to an arbitrary size.

 (2) Since multi-value data is stored in the bit map format, a data size is increased, and a memory having a large capacity is required for storing fonts.

20 SUMMARY OF THE INVENTION

 According to the present invention, a font such as a vector font which can be arbitrarily enlarged or reduced can be expressed by gray scale levels by utilizing binary pattern data without increasing a memory capacity necessary for fonts.

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1 It is an object of the present invention to
provide a pattern generation apparatus which converts a
vector font into a binary bit map pattern, and
generates, based on the binary bit map pattern, digital
5 multi-value data in correspondence with a density based
on a bit pattern distribution.

It is another object of the present invention to
provide a pattern generation method and apparatus, for
generating multi-value data on the basis of a vector
10 font, converting the multi-value data into an analog
image signal, and comparing the analog image signal
with a triangular wave having a predetermined period to
pulse-width modulate it, thereby outputting a gradation
pattern.

15 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a character generator
according to an embodiment of the present invention;

20 Figs. 2A to 2C are views showing a procedure for
generating a gray scale font according to the present
invention;

Figs. 3 and 4 are flow charts showing control
sequences of the present invention; and

Fig. 5 is a sectional view for explaining an
arrangement of an output apparatus.

25 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 best illustrates the characteristic feature
of the present invention. In Fig. 1, an input device 1

1 receives an instruction to a character generator. A
binary bit map font generator 2 generates a bit map
font on the basis of vector data. A vector font data
memory 3 stores vector font data of characters to be
5 generated by the binary bit map font generator 2. A
RAM 4 stores the bit map font data generated by the
binary bit map font generator 2, and supplies the bit
map data to a gray scale font generator 5. The gray
scale font generator 5 generates a gray scale font on
10 the basis of the bit map data generated by the binary
bit map font generator 2. A bit map divider 6 divides
the bit map data according to gray scale levels. A
density detector 7 detects the densities of areas
divided by the bit map divider 6. A data output device
15 8 supplies the densities detected by the detector 7 to
an output apparatus comprising the character generator
shown in Fig. 1. In general, the character generator
is assembled in a printer or a display device.

20 Figs. 2A to 2C show a procedure of operations of
the character generator according to the present
invention. Fig. 2A illustrates bit map font data
generated by the binary bit map font generator 2, and a
binary character of a bit map is generated based on a
vector font. In this case, in order to obtain a
25 necessary gray scale level, a character is generated
with a resolution higher than an output resolution.
When the size (resolution) of a character on a memory

1 is set to be $m \times n$, gradation of $m \times n + 1$ levels can
be obtained. That is, m and n are set to satisfy a
relation (output resolution of the device) $\leq m \times n + 1$.
In this embodiment, since 25%, 50%, and 75% gray levels
5 are adopted, five gray levels are available together
with 0% and 100% levels, and $m = n = 2$ is set.
Therefore, a character is generated at a x2 resolution
in both vertical and horizontal directions. Fig. 2B
shows a bit map divided by the bit map divider. Since
10 a character has x2 resolutions in both the vertical and
horizontal directions, the character is divided in
units of 2 dots (vertical direction) x 2 dots
(horizontal direction) areas. Fig. 2C shows detected
densities based on the density-divided bit map. If
15 there is one dot in a divided area, this area can be
expressed by a 25% gray level; if there are two dots,
it can be expressed by a 50% gray level; and if there
are three dots, it can be expressed by a 75% gray
level. As a matter of course, if there is no dot, the
20 area is expressed by white, and if there are four dots,
it is expressed by black. Densities detected in this
manner can be directly output to an apparatus
comprising this character generator (e.g., a print
buffer) as outputs of the character generator, e.g.,
25 digital multi-value (e.g., 4-bit) data. Thus, a memory
capacity can be reduced as compared to a case wherein

1 digital multi-value data is adopted as a font, and a
high-quality output can be obtained.

5 Figs. 3 and 4 are flow charts showing a sequence
for generating a gray scale font according to the
present invention. This processing is executed by a
CPU for controlling the overall output apparatus (not
shown) on the basis of a program. Fig. 3 shows a
sequence from the beginning to the end of character
generation. In step S101 in Fig. 3, the input device 1
10 inputs a code of a character to be generated. In step
S102, the input device 1 designates the size of a
character to be generated. In step S103, a bit map
font whose character size is enlarged twice in both the
vertical and horizontal directions is generated by the
15 binary bit map font generator 2 on the basis of vector
font data stored in the vector font data memory 3, and
is stored in the RAM 4. More specifically, original
one dot is expressed by 2 x 2 dots, and a dot
distribution in the 2 x 2 dot area is checked. The
20 character size is enlarged twice in both the vertical
and horizontal directions since the five gray levels,
i.e., 0%, 25%, 50%, 75%, and 100% are available. If
the number of gray levels is changed, an enlargement
magnification is also changed. In step S104, a gray
25 scale font is generated on the basis of the bit map
generated in step S103. Fig. 4 shows in detail the
processing in step S104.

1 Fig. 4 is a flow chart showing a sequence for
generating gray scale font data, and this processing is
executed by the gray scale font generator 5. In step
S110 in Fig. 4, a vertical check position YC is set to
5 be 0. In step S111, a horizontal check position XC is
set to be 0. The bit map divider 6 executes step S112
using the bit map font generated on the RAM 4. In step
S112, the number of black dots included between a
position (XC,YC) to a position (XC+1,YC+1) is counted.
10 The number of black dots included between the position
(XC,YC) to the position (XC+1,YC+1) can take a value
falling within a range of 0 to 4. In step S113, the
density detector 7 checks if the number of black dots
is 0. If YES in step S113, step S114 is executed. In
15 step S114, a gray level at the position (XC,YC) of the
gray scale font is set to be 0%. In step S115, the
density detector 7 checks if the number of black dots
is 1. If YES in step S115, step S116 is executed. In
step S116, the gray level at the position (XC,YC) is
20 set to be 25%. In step S117, the density detector 7
checks if the number of black dots is 2. If YES in
step S117, step S118 is executed. In step S118, the
gray level at the position (XC,YC) is set to be 50%.
In step S119, the density detector 7 checks if the
25 number of black dots is 3. If YES in step S119, step
S120 is executed. In step S120, the gray level at the
position (XC,YC) is set to be 75%. In step S121, the

1 density detector 7 checks if the number of black dots
is 4. If YES in step S121, step S122 is executed. In
step S122, the gray level at the position (XC,YC) is
set to be 100%. The set value is output from the data
5 output device 8. In step S123, "2" is added to XC. In
this case, a value to be added is a horizontal
enlargement magnification in step S103 in Fig. 3. In
step S124, it is checked if XC exceeds the width of the
bit map font. If YES in step S124, step S125 is
10 performed. If NO in step S124, step S112 is executed.
In step S125, "2" is added to YC. In this case, a
value to be added is a vertical enlargement
magnification in step S103 in Fig. 3. In step S126, it
is checked if YC exceeds the length of the bit map
15 font. If YES in step S126, gray scale font data
generation processing is ended; otherwise, step S111 is
executed.

An apparatus for generating a bit map font based
on a vector font has already been used in "Laser Writer
20 (registered trademark)" (available from Apple Computer
Inc.) or in "EZPS (registered trademark)" (available
from CANON INC.) An apparatus of this type selectively
generates bit map data according to one vector font
data based on data, e.g., a character code, and is
25 known to those who are skilled in the art. In this
embodiment, a bit map font is generated based on a
vector font. Alternatively, a bit map font having a

1 predetermined size may be stored in the RAM 4 in step
S103 in Fig. 3.

 As described above, a gray scale font having an
arbitrary size can be easily generated by a simple
5 system.

 A printer as an example of the data output device
8 shown in Fig. 1 will be briefly described below with
reference to Fig. 5. A PWM (pulse-width modulation)
circuit 778 converts a multi-value digital image signal
10 (signal illustrated in Fig. 2C) from a printer I/F (not
shown) into an analog image signal, and compares this
analog image signal with a triangular wave having a
predetermined period, thus forming a PWM signal. Note
that the printer I/F includes a print buffer. The PWM
15 signal is applied to a laser output device 711 to
ON/OFF-modulate a laser, thereby forming a gradation
image. The laser output device or scanner 711 includes
a laser output unit for converting an image signal from
the PWM circuit 778 into a light signal, a polygonal
20 (e.g., octahedral) mirror 712, a motor (not shown) for
rotating this mirror 712, and an f/θ lens (focusing
lens) 713, and the like. The printer also includes a
reflection mirror 714 for changing the optical path of
a laser beam, and a photosensitive drum 715. A laser
25 beam emerging from the laser output unit is reflected
by the polygonal mirror 712, and linearly scans
(raster-scans) the surface of the photosensitive drum

1 715 via the lens 713 and the mirror 714, thereby
forming a latent image corresponding to an original
image.

5 The printer also includes a primary charger 717,
an entire surface exposure lamp 718, a cleaner unit 723
for recovering residual toner which is not transferred,
and a pre-transfer charger 724. These members are
arranged around the photosensitive drum 715.

10 A developing unit 726 develops an electrostatic
latent image formed on the surface of the
photosensitive drum 715. The developing unit 726 is
constituted by developing sleeves 731Y, 731M, 731C, and
731Bk which selectively contact the photosensitive drum
715 to develop the latent image, toner hoppers 730Y,
15 730M, 730C, and 730Bk for storing replenishing toners,
and screws 732 for transferring the toners. These
members are arranged around a rotational shaft P of the
developing unit. For example, when a yellow toner
image is to be formed, yellow toner development is
20 performed at the illustrated position. When a magenta
toner image is to be formed, the developing unit 726 is
rotated about the shaft P shown in Fig. 5, so that the
developing sleeve 731M in the magenta developing device
is placed at a position where it can contact the
25 photosensitive drum 715. The same applies to cyan and
black development operations.

1 The printer further includes a transfer drum 716
for transferring a toner image formed on the
photosensitive drum 715 onto a paper sheet, an actuator
plate 719 for detecting a moving position of the
5 transfer drum 716, a position sensor 720 which comes
closer to the actuator plate 719 to detect that the
transfer drum 716 is moved to a home position, a
transfer drum cleaner 725, a sheet press roller 727, a
discharger 728, and a transfer charger 729. These
10 members 719, 720, 725, 727, and 729 are arranged around
the transfer roller 716.

 The printer also includes paper feed cassettes 735
and 736 for storing paper sheets, paper feed rollers
737 and 738 for feeding paper sheets from the cassettes
15 735 and 736, and timing rollers 739, 740, and 741. A
paper sheet fed and conveyed via these rollers is
guided by a paper guide 749, is wound around the
transfer drum 716 while its leading end is carried by a
gripper (to be described later), and is then subjected
20 to an image formation process.

 A drum motor 550 synchronously rotates the
photosensitive drum 715 and the transfer drum 716. A
separation pawl 750 separates a paper sheet from the
transfer drum 716 after the image formation process. A
25 conveyor belt 742 conveys the separated paper sheet.
An image fixing unit 743 fixes an image formed on the
paper sheet conveyed by the conveyor belt 742. The

1 image fixing unit 743 comprises a pair of
thermocompression rollers 744 and 745. As a printer
for outputting a gradation image, an ink-jet printer
for performing recording using an ink may be employed,
5 and an ink dot size or the number of ink droplets may
be controlled to output a gradation image.

As described above, according to the present
invention, there can be provided a pattern generation
apparatus comprising storage means for storing binary
10 bit map data, judgment means for dividing an area of
the bit map data stored in the storage means, and
judging a density in a predetermined area, and
generation means for generating corresponding digital
multi-value data in accordance with the density judged
15 by the judgment means.

As described above, according to the present
invention, there can be provided a pattern generation
method comprising the steps of generating corresponding
binary bit map data based on desired one of vector font
20 data, dividing an area of the binary bit map data on a
memory, judging a density in a predetermined area, and
generating digital multi-value data in correspondence
with the judged density.

As described above, when a pattern division means
25 and a density detection means are added to a character
generator for generating a binary character pattern, a

gray scale font having an arbitrary size or gray level can be generated.

5 It will be understood that the invention differs substantially from using a binary representation of the gray scale for each pixel of the image, because according to the encoding method used the number of bits set is monotonically related (i.e. directly proportional) to the image density at a pixel whereas
10 a binary code is not monotonically related to the value it represents. It is believed that the monotonisity of the relationship enables the font to be scaled to expand or reduce its size whilst retaining the gray level information.



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1 WHAT IS CLAIMED IS:

1. A pattern generation apparatus comprising:
storage means for storing binary bit map data;
judgment means for dividing an area of the bit map
5 data stored in said storage means, and judging a
density in a predetermined area; and
generation means for generating corresponding
digital multi-value data in accordance with the density
judged by said judgment means.

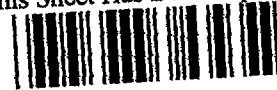
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2. An apparatus according to claim 1, further
comprising conversion means, having vector fonts, for
converting desired data of the vector font into the
binary bit map data.

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3. An apparatus according to claim 1, further
comprising printer means for receiving said multi-value
data, converting said multi-value data into an analog
image signal, and comparing the analog image signal
20 with a triangular wave having a predetermined period to
form a pulse-width modulated signal.

4. An apparatus according to claim 1, further
comprising printing means for controlling ink injection
25 in accordance with said multi-value digital data to
express gradation.



- 1 5. A pattern generation method comprising the
steps of:
- generating corresponding binary bit map data based
on desired one of vector font data;
- 5 dividing an area of the binary bit map data on a
memory;
- judging a density in a predetermined area; and
 generating digital multi-value data in
correspondence with the judged density.
- 10 6. A method according to claim 5, wherein the
step of judging the density comprises the step of
judging a distribution state of a pattern in the
predetermined area.
- 15 7. A method according to claim 5, further
comprising printer means for receiving said multi-value
data, converting said multi-value data into an analog
image signal, and comparing the analog image signal
- 20 with a triangular wave having a predetermined period to
form a pulse-width modulated signal.
8. A pattern generation method comprising the
steps of:
- 25 generating multi-value digital data on the basis
of vector data; and



1 converting the multi-value digital data into an
analog image signal, and comparing the analog image
signal with a triangular wave having a predetermined
period to pulse-width modulate the analog image signal,
5 thereby outputting a gradation pattern.

9. A method according to claim 8, wherein the
multi-value digital data is obtained by generating a
binary bit map pattern based on the vector data, and
10 judging a density based on a distribution of the binary
bit map pattern.

10. A pattern generation apparatus comprising:
generation means for generating multi-value
15 digital data on the basis of vector data;
means for converting the multi-value digital data
into an analog image signal, and comparing the analog
image signal with a triangular wave having a
predetermined period to obtain a pulse-width modulated
20 signal; and

laser output means for outputting a gradation
image based on the pulse-width modulated signal
obtained by said converting means.

25 11. An apparatus according to claim 10, wherein
said generation means converts the vector data into the
binary bit map data, and judges a density based on a

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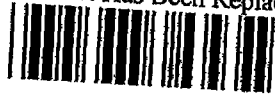
distribution of a bit pattern so as to generate the multi-value digital data.

5 12. An image processing apparatus including a store means in which the arrangement of stored data is such that successive bits relate to continuous spacial lines of the image, characterised in that a plurality of bits are allocated to represent a single image point and in that the number of said plurality of bits
10 which are set relates monotonically to the density of the image at that point.

13. Apparatus according to claim 12 in which N bits are allocated to each image point, and each image
15 point can exhibit N+1 possible density levels, each density level corresponding uniquely to a given number of said bits being set.

14. A method of generating a digitally stored image
20 representation comprising the steps of setting, for each image point, the value of a binary location within a memory in which an array of such locations are mapped onto corresponding image points, characterised in that it comprises also the steps of
25 determining the density of the image at the point, and

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setting a predetermined number of bits proportional to the density within the memory.

- 5 15. A bit map image processing apparatus comprising means for expanding a bit map image so that a plurality of bits correspond to a given pixel.

ABSTRACT:

1 PATTERN GENERATION METHOD AND PATTERN GENERATION APPARATUS

In a pattern generation method, corresponding
binary bit map data is generated based on desired one
of vector font data, an area of the binary bit map data
5 on a memory is divided to judge a density in a
predetermined area, and digital multi-value data is
generated in correspondence with the judged density.
There is also disclosed a pattern generation apparatus
for carrying out this method.

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FIG. 1

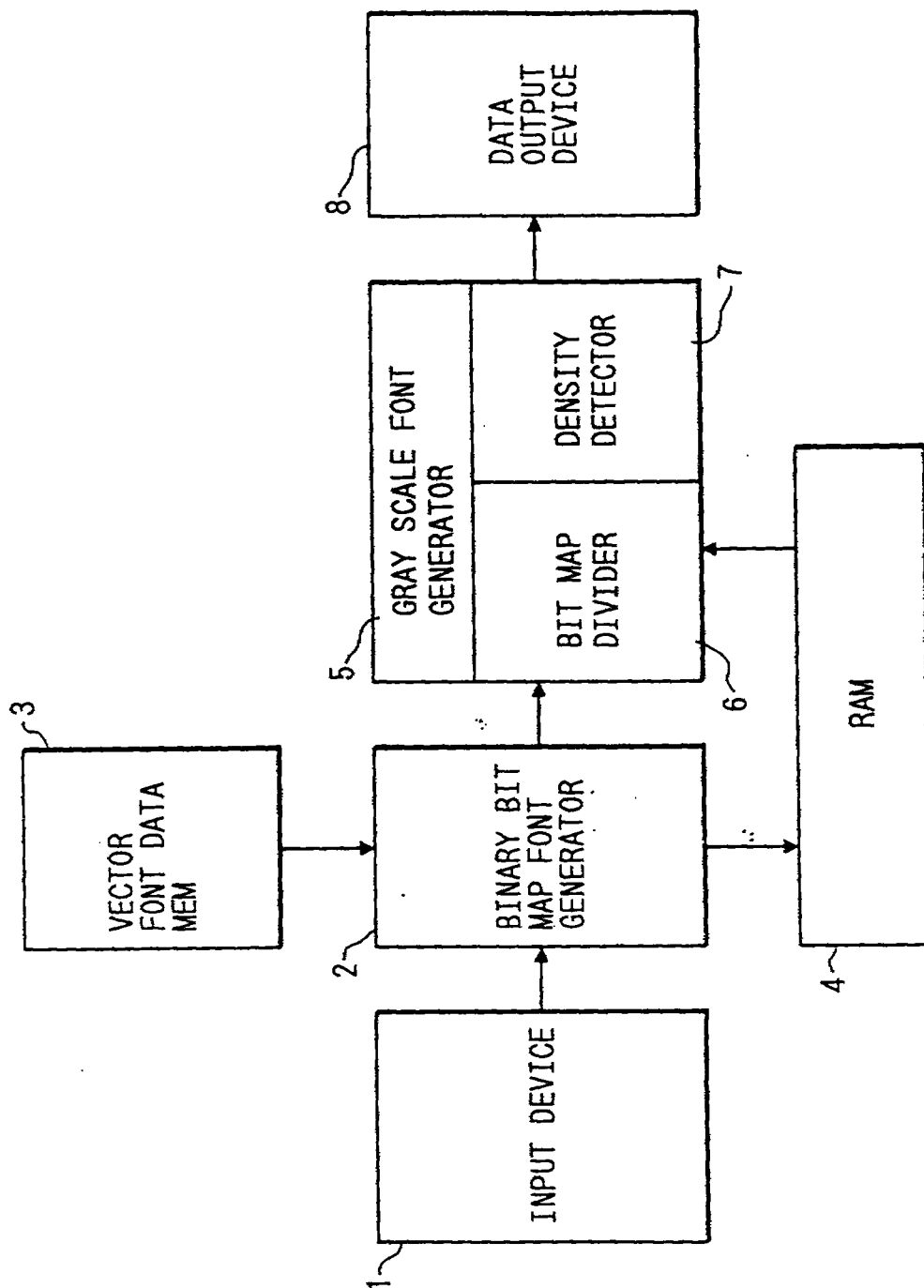


FIG. 2A

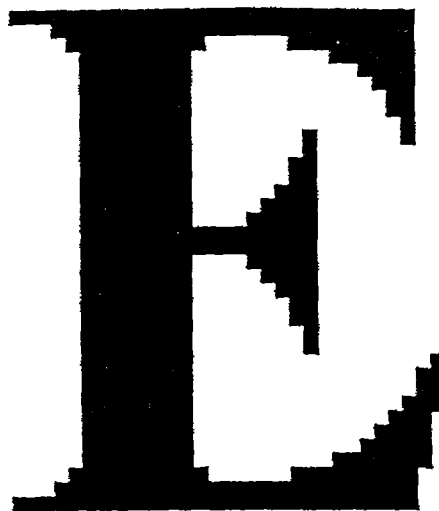


FIG. 2B

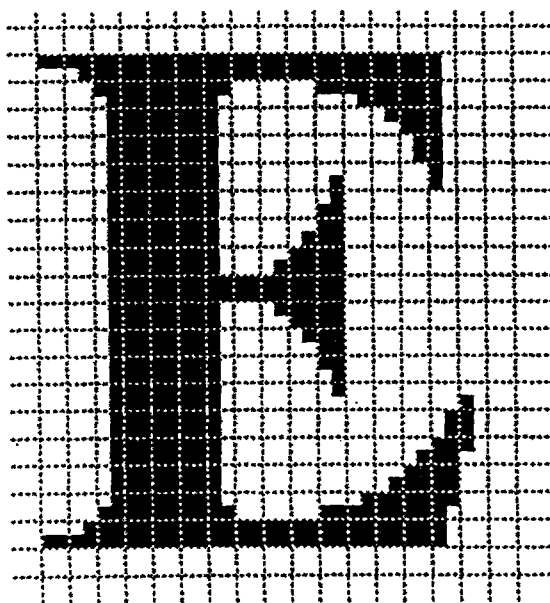
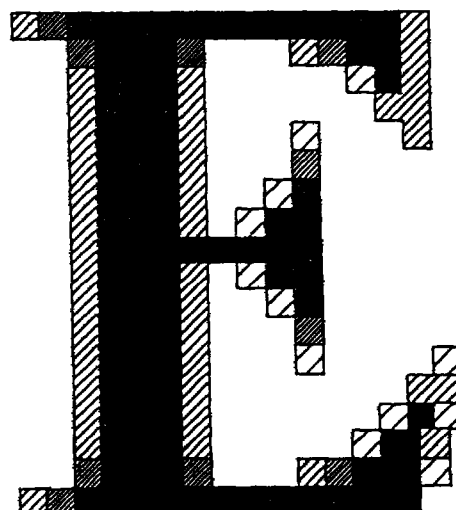


FIG. 2C



□ 25% GRAY

▨ 50% GRAY

■ 75% GRAY

FIG. 3

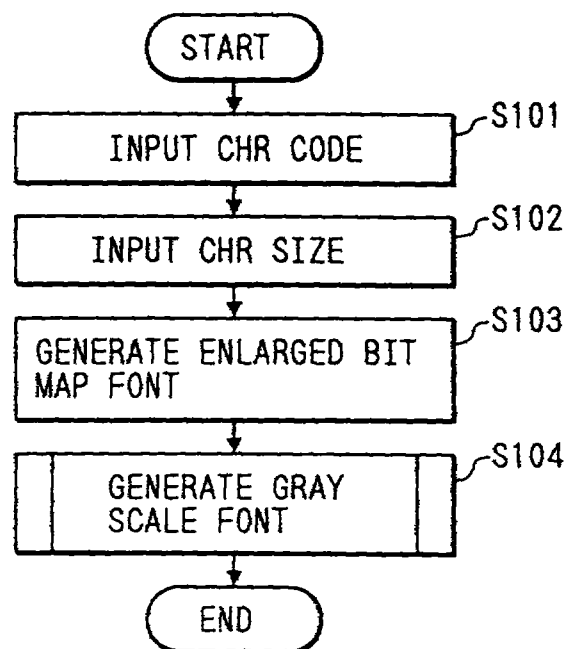


FIG. 4

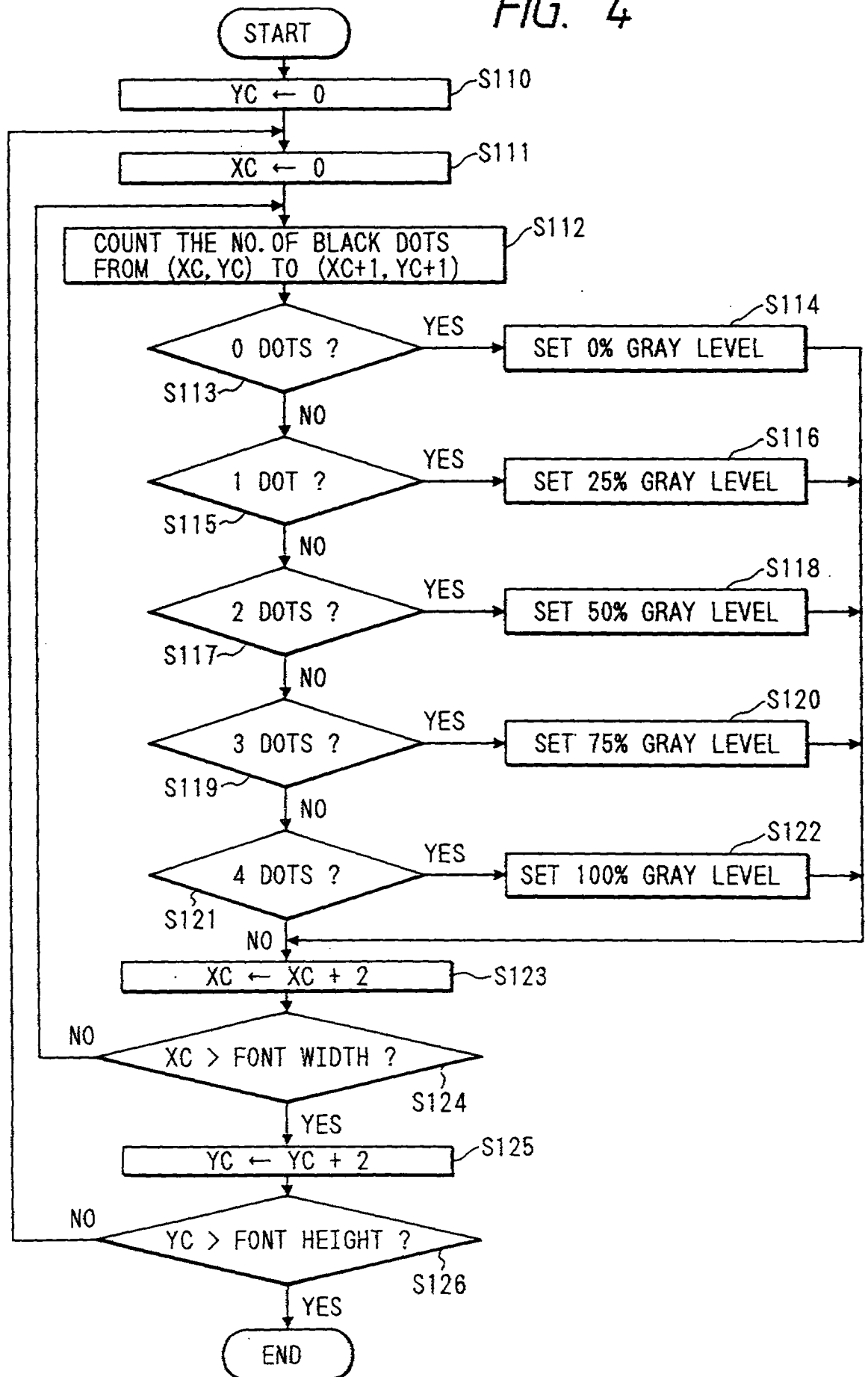
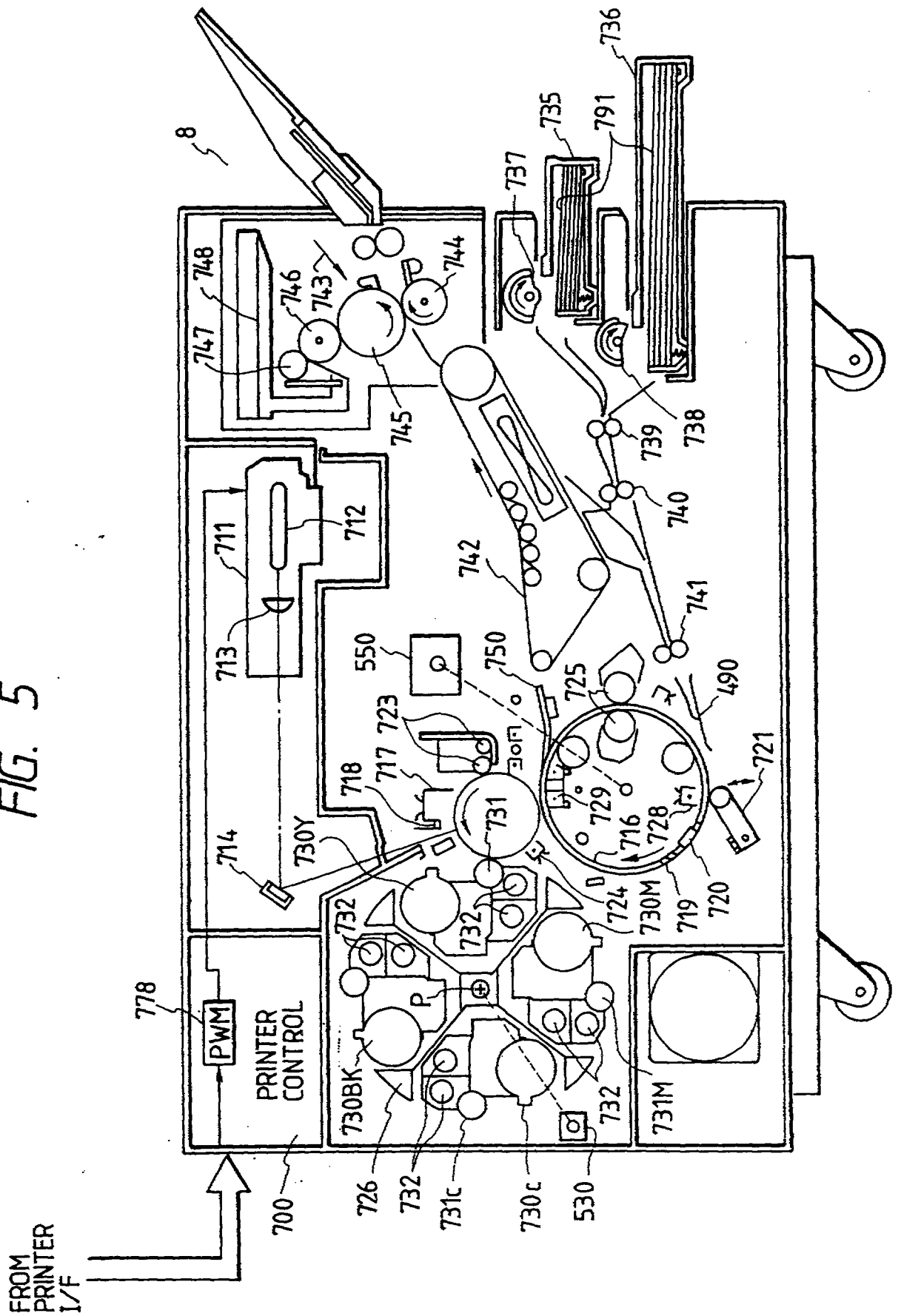


FIG. 5



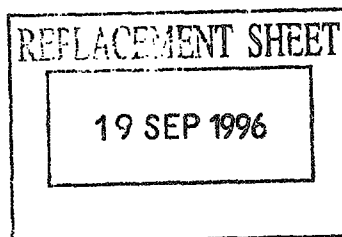
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ABSTRACT

PATTERN GENERATION METHOD AND PATTERN GENERATION APPARATUS

IN A PATTERN GENERATION METHOD, CORRESPONDING BINARY BIT MAP DATA IS GENERATED BASED ON DESIRED ONE OF VECTOR FONT DATA, AN AREA OF THE BINARY BIT MAP DATA ON A MEMORY IS DIVIDED TO JUDGE A DENSITY IN A PREDETERMINED AREA, AND DIGITAL MULTI-VALUE DATA IS GENERATED IN CORRESPONDENCE WITH THE JUDGED DENSITY. THERE IS ALSO DISCLOSED A PATTERN GENERATION APPARATUS FOR CARRYING OUT THIS METHOD.

FIGURE 4



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What is claimed is:

1. A pattern generation apparatus for generating gray scale pattern data in accordance with vector data, said apparatus comprising:

means for inputting information on a size of a character to be generated;

means for deriving information on a size in converting vector data into bit map data on the basis of the output gradation capability of an output apparatus, the size represented by the derived information being larger than the size represented by the input information;

means for converting vector data into bit map data of the size represented by the derived information; and

means for generating gray scale pattern data of the size represented by the input information on the basis of the bit map data converted by said converting means.

2. An apparatus according to claim 1, further comprising conversion means, having vector fonts, for converting desired data of the vector font into the binary.

3. An apparatus according to claim 1, further comprising printer means for, receiving the gray scale data, converting the multi-value data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to form a pulse-width modulated signal.

4. An apparatus according to claim 1, further comprising printing means for controlling ink injection in accordance with the gray scale digital data to express gradation.

5. A pattern generation method for use in generating gray scale pattern data in accordance with vector data, said method comprising the steps of:

inputting information on a size of a character to be generated;

deriving information on a size in converting vector data into bit map data on the basis of the output gradation capability of an output apparatus, the size represented by the derived information being larger than the size represented by the input information;

generating bit map data of the size represented by the derived information; and

generating gray scale pattern data of the size represented by the input information on the basis of the bit map data generated in said first-mentioned generating step.



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6. A method according to claim 5, further comprising the step of judging a distribution state of a pattern in each of a plurality of areas of image.

7. A method according to claim 5, further comprising the step of receiving the gray scale data, converting the gray scale data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to form a pulse-width modulated signal.

8. A pattern generation method comprising the steps of: dividing an area of a binary character pattern, having a resolution larger than a resolution with which data is to be output, obtained by scaling vector data, into plural predetermined areas;

judging a density in a predetermined area obtained in said dividing step;

generating digital multi-value data in correspondence with the density judged in said judging step so as to generate a gray scale character pattern; and

converting the multi-value digital data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to pulse-width modulate the analog image signal, thereby outputting a gradation pattern.

9. A method according to claim 8, wherein the multi-value digital data is obtained by generating a binary character pattern based on the vector data, and judging a density based on a distribution of the binary character pattern.

10. A pattern generation apparatus comprising:

means for dividing an area of a binary character pattern, having a resolution larger than a resolution with which data is to be output, obtained by scaling vector data into plural predetermined areas;

means for judging a density in a predetermined area obtained by said dividing means;

means for generating digital multi-value data in correspondence with the density judged by said judging means so as to generate a gray scale character pattern;

means for converting the multi-value digital data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to obtain a pulse-width modulated signal; and



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laser output means for outputting a gradation image based on the pulse-width modulated signal obtained by said converting means.

11. An apparatus according to claim 10, wherein said generation means converts the vector data into the binary character pattern, and judges a density based on a distribution of the character pattern so as to generate the multi-value digital data.

12. A pattern generation method comprising:

dividing a character pattern area of a binary character pattern, having a resolution larger than a resolution with which data is to be output, stored in a memory into a plurality of areas, and judging a density in each of the plurality of areas; and

generating corresponding digital multi-value data in accordance with the density judged in said dividing step so as to generate a gray scale character pattern.

13. A method according to claim 12, further comprising the step of converting desired data of vector fonts stored in another memory into the binary bit map data.

14. A method according to claim 12, further comprising the step of receiving the multi-value data, converting the multi-value data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to form a pulse-width-modulated signal.

15. A method according to claim 12, further comprising the step of controlling ink ejection in accordance with the multi-value digital data to express gradation.

16. A pattern generation apparatus comprising:

means for generating a corresponding binary character pattern having a resolution larger than a resolution with which data is to be output based on a desired one of vector font data;

means for storing the binary character pattern generated by said character pattern generating means;

means for dividing a character pattern area of the binary character pattern stored in said storage means into a plurality of areas; and

means for judging a density in each of the plurality of areas; and

means for generating digital multi-value data in correspondence with the judged density so as to generate a



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gray scale character pattern.

17. An apparatus according to claim 16, wherein said judging means judges a distribution state of a pattern in the predetermined one area.

18. An apparatus according to claim 16, further comprising means for receiving the multi-value data, converting the-multi-value data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to form a pulse-width-modulated signal.

19. A pattern generation method comprising the steps of:
judging a density in a predetermined one of areas obtained by dividing a binary character pattern having a resolution larger than a resolution with which data is to be output obtained by scaling vector data;

generating digital multi-value data in correspondence with the density judged in said judging step so as to generate a gray scale character pattern; and

converting the multi-value digital data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to pulse-width modulate the analog image signal, thereby outputting a gradation pattern.

20. A pattern generation method comprising the steps of:
dividing an area of a binary character pattern having a resolution larger than a resolution with which data is to be output obtained by scaling vector data, into plural predetermined areas;

generating digital multi-value data in correspondence with a density in each of the plural areas so as to generate a gray scale character pattern; and

converting the multi-value digital data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to pulse-width modulate the analog image signal, thereby outputting a gradation pattern.

21. A pattern generation apparatus comprising:

means for judging a density in a predetermined one of areas obtained by dividing a binary character pattern having a resolution larger than a resolution with which data is to be output obtained by scaling vector data;

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means for generating digital multi-value data in corresponding with the density judged by said judging means so as to generate a gray scale character pattern;
means for converting the multi-value digital data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to obtain a pulse-width-modulated signal; and
laser output means for outputting a gradation image based on the pulse-width modulated signal obtained by said converting means.

22. A pattern generation apparatus comprising:

means for dividing an area of a binary character pattern having a resolution larger than a resolution with which data is to be output obtained by scaling vector data, into plural predetermined areas;

means for generating digital multi-value data in correspondence with a density in each of the plural areas so as to generate a gray scale character pattern;

means for converting the multi-value digital data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to obtain a pulse-width-modulated signal; and
laser output means for outputting a gradation image based on the pulse-width modulated signal obtained by said converting means.

23. A method according to claim 19, further comprising the step of inputting a character code.

24. A method according to claim 20, further comprising the step of inputting a character code.

25. An apparatus according to claim 21, further comprising means for inputting a character code.

26. An apparatus according to claim 22, further comprising means for inputting a character code.

27. A method according to claim 19, further comprising the step of generating information indicating a size of a character to be output.

28. A method according to claim 20, further comprising the step of generating information indicating a size of a character to be output.

29. An apparatus according to claim 21, further comprising means for generating information indicating a size of a character to be output.

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30. An apparatus according to claim 22, further comprising means for generating information indicating a size of a character to be output.

31. An apparatus according to claim 1, wherein the generated bit map data are output to a display.

32. A method according to claim 5, wherein the generated bit map data are output to a display.

33. A method according to claim 22, wherein the generated digital multi-value data are output to a display.

34. An apparatus according to claim 16, wherein the generated digital multi-value data are output to a display.

35. An apparatus according to claim 1, wherein the bit map data generated by said generation means are output in color.

36. A method according to claim 5, wherein the data generated in said generating step are output in color.

37. A method according to claim 8, wherein the output data are output in color.

38. An apparatus according to claim 10, in which the output gradation image is output in color.

39. A method according to claim 12, in which the data generated in said generating step are output in color.

40. An apparatus according to claim 16, in which the data generated by said generating means are output in color.

41. A method according to claim 19, wherein the gradation pattern is output in color.

42. A method according to claim 20, wherein the gradation pattern is output in color.

43. An apparatus according to claim 21, wherein the gradation image is output in color.

44. An apparatus according to claim 22, wherein the gradation image is output in color.

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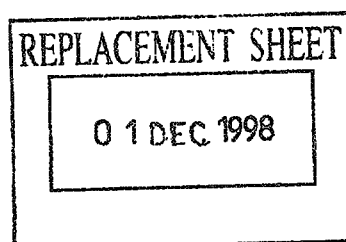
ABSTRACT

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PATTERN GENERATION METHOD AND PATTERN GENERATION APPARATUS

IN A PATTERN GENERATION METHOD, CORRESPONDING BINARY BIT MAP DATA IS GENERATED BASED ON DESIRED ONE OF VECTOR FONT DATA, AN AREA OF THE BINARY BIT MAP DATA ON A MEMORY IS DIVIDED TO JUDGE A DENSITY IN A PREDETERMINED AREA, AND DIGITAL MULTI-VALUE DATA IS GENERATED IN CORRESPONDENCE WITH THE JUDGED DENSITY. THERE IS ALSO DISCLOSED A PATTERN GENERATION APPARATUS FOR CARRYING OUT THIS METHOD.

FIGURE 4



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gray scale character pattern.

17. An apparatus according to claim 16, wherein said judging means judges a distribution state of a pattern in the predetermined one area.

18. An apparatus according to claim 16, further comprising means for receiving the multi-value data, converting the multi-value data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to form a pulse-width-modulated signal.

19. A pattern generation method comprising the steps of: judging a density in a predetermined one of areas obtained by dividing a binary character pattern having a resolution larger than a resolution with which data is to be output obtained by scaling vector data;

generating digital multi-value data in correspondence with the density judged in said judging step so as to generate a gray scale character pattern; and

converting the multi-value digital data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to pulse-width modulate the analog image signal, thereby outputting a gradation pattern.

20. A pattern generation method comprising the steps of: dividing an area of a binary character pattern having a resolution larger than a resolution with which data is to be output obtained by scaling vector data, into plural predetermined areas;

generating digital multi-value data in correspondence with a density in each of the plural areas so as to generate a gray scale character pattern; and

converting the multi-value digital data into an analog image signal, and comparing the analog image signal with a triangular wave having a predetermined period to pulse-width modulate the analog image signal, thereby outputting a gradation pattern.

21. A pattern generation apparatus comprising:

means for judging a density in a predetermined one of areas obtained by dividing a binary character pattern having a resolution larger than a resolution with which data is to be output obtained by scaling vector data;

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