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OUTPUT APPARATUS

BACKGROUND OF THE INVENTIONField of the Invention

5 The present invention relates to an image forming apparatus for forming images at a plurality of resolutions.

Related Background Art

Printers are known as an apparatus for receiving data from an upper level apparatus (host computer or
10 the like) and forming images. Apparatus of this type include typeface printers, wiredot printers, ink jet printers, laser printers and the like, depending upon a difference of a mechanism for forming images. Of these printers, a laser beam printer turns on and off
15 a laser beam in synchronism with an image signal, causes the laser beam to scan in the horizontal direction by using a polygon mirror, forms a latent image on a photo-sensitive drum, and forms an image by using electrophotography technique.

20 Recently, there has been disclosed a technique wherein the rotation rate of a polygon mirror is made variable to change the main scan resolution, and the transport speed of paper is made variable to change the sub-scan resolution.

25 A laser beam printer forms each character by a set of laser beam dots so that a character of a desired size and style can be printed out. For this reason,



1 it is possible to down-load character patterns from
an upper level apparatus, and use an external storage
device, a detachable cartridge type character pattern
supplying apparatus, or the like. An image forming
5 apparatus has been proposed which outputs a font list
in order for a user to understand which character pattern
(font) can be used.

A conventional font list is limited only to
those lists having a fixed resolution so that fonts
10 can not be outputted at a plurality of resolutions.
In the case of scalable fonts, only a font list of fonts
having a predetermined size can be printed out, without
allowing font lists having sizes desired by users. If
an apparatus can print out characters only at one resolu-
15 tion, there occurs no problem. However, if an apparatus
can print out at a plurality of resolutions, it occurs
the case where if fonts designed for a particular
resolution are used at a different resolution, the
resultant characters become improper.

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SUMMARY OF THE INVENTION

It is therefore an object of the present invention
to provide an output apparatus capable of outputting
font list information suitable for a plurality of
25 resolutions.

It is therefore another object of the present
invention to provide an output apparatus comprising:

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storage means for storing font information; means for generating a predetermined pattern in accordance with said font information stored in said storage means; means for instructing to output a font list of said font information; image forming means for outputting said pattern generated by said generating means at a plurality of resolutions; means for instructing to output a list of said font information; and output means responsive to an instruction from said instructing means
0 for outputting a font list having a desired resolution.

It is therefore a further object of the present invention to provide an output apparatus capable of outputting said font list by changing the pattern size to the size corresponding to the resolution at the time
15 of outputting said font list.

It is therefore another object of the present invention to provide an output apparatus comprising means for designating one font information from a plurality of sizes, said apparatus outputting said font list at
20 the size designated by said designating means.

It is a still further object of the present invention to provide an output apparatus wherein when a list of font information is instructed to be outputted, a predetermined pattern is generated in accordance with
25 the stored font information, and the generated pattern is outputted to form an image and output a font list having a desired resolution.



1 BRIEF DESCRIPTION OF THE INVENTION

Fig. 1 is a block diagram showing the structure of an image forming apparatus according to the embodiment of this invention;

5 Fig. 2 shows the contents of the font management table of the embodiment;

Fig. 3 is a flow chart illustrating the procedure of forming the font management table of the embodiment;

10 Fig. 4 is a flow chart illustrating the detailed procedure of forming the font management table of the embodiment;

Fig. 5 is a flow chart illustrating the procedure of outputting a font list of the embodiment; and

Fig. 6 shows an example of the font list.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The embodiment of this invention will be described with reference to the accompanying drawings.

<Description of Structure (Figs. 1 and 2)>

20 Fig. 1 is a block diagram showing the outline of the structure of the image forming apparatus of an embodiment. In Fig. 1, reference numeral 100 represents a controller having a function of analyzing and converting an input signal 120 from an upper level apparatus (not
25 shown) into an image signal 121, and a function of sending a control signal 122 to an image forming device 106 to notify a designated resolution. The image forming



1 device 106 receives the control signal 122 and image
signal 121 and forms an image having a designated
resolution.

The controller 100 of this embodiment is
5 constructed of an input interface 101 for receiving
data, a CPU 102 for controlling procedures to be described
later in accordance with programs included therein,
a character generator 103 for generating a character
in accordance with a designated character code and
10 character size, an image memory 104 for temporarily
storing a character pattern, image data and the like,
an output interface 105 for reading an image from the
image memory 104 and outputting the image signal 121
at the timing of an image clock corresponding to a
15 designated resolution, a font table 107 for managing
available fonts, a font memory 108 for registering fonts
which are down-loaded as the input data 120 from an
upper level apparatus, an interface socket 110 for the
connection to a detachable font cartridge 109, a panel
20 111 for entering an operation command, and a re-writable
and non-volatile memory 112 which holds the data even
if power is turned off.

The resolution is set to a predetermined value
when power is turned on. This resolution is being stored
25 in the non-volatile memory 112 or the like which stores
the data even if power is turned off.

The resolution is sent to the image forming



1 device 106 via the output interface 105 in the form
of the control signal 122 under the control of CPU 102.
Upon reception of the control signal 122, the image
forming device 106 sets the resolutions in the main
5 and sub-scan directions.

If the preset resolution is to be changed, an
operator enters an instruction signal 123 from the panel
111 to make CPU 102 change the resolution. Alternatively,
the resolution may be changed in accordance with a
10 resolution change control command sent from an upper
level apparatus. Upon reception of the instruction
signal 123 or the control command, CPU 102 instructs
the image forming device 106 to change the resolution.

<Description of Font>

15 Two types of character fonts are generally known.
One type is a dot font which is composed of a set of
dots, a black dot being represented by "1" and a white
dot by "0". The other type is a scalable font or a
stroke font. For the scalable font, the contour of
20 a character is stored in the form of straight lines
and curves. For the stroke font, the contour of a
character is stored in the form of skeletons and thick-
ness. Both dot fonts and scalable fonts have merits
and demerits and are used in common in the same apparatus.
25 Scalable fonts can generate characters of a desired
size, but it takes a time to develop a character. Dot
fonts can generate characters in short time, but the



1 size of a character is fixed. A dot font character
 changes its size when a resolution is changed. Assuming
 that one point is 1/72 inch, the relationship between
 the number of dots S, the resolution D, and the point
 5 size P is given by the following equation (1).

$$P = S/D \times 72 \quad \dots (1)$$

Table 1

No. of DOTS	Point SIZE P		
	240 dpi	300 dpi	400 dpi
24	7.2	5.8	4.3
30	9.0	7.2	5.4
32	9.6	7.7	5.8
40	12	9.6	7.2
50	15	12	9
67	20	16	12

In Table 1, there are shown point sizes for
 the numbers of dots frequently used at respective
 20 resolutions 240 dpi, 300 dpi, and 400 dpi (dpi = dot/inch).
 The term "point" is generally used in the art of this
 field as a unit indicative of the size of a character.

The point size changes with the resolution even
 if the same dot number is used. Therefore, it is neces-
 25 sary to consider the resolution when a font list is
 outputted.



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The font mangement table 107 storing a list of available fonts is shown in Fig. 2. This font management table 107 is generated or updated when power
5 is turned on or fonts are down-loaded.

As shown in Fig. 2, in the font management table 107 there are provided an area 201 for setting a sort data which discriminates between a dot font and scalable font, and between built-in font, font from font cartridge,
10 and down-loaded font, an area 202 for setting a font name represented by character codes, an area 203 for storing a basic resolution of a dot font character, an area 203 for setting the dot number (size) of a dot font character, and an area 205 for setting the actual
15 address of a font. Font information of each font character is stored in an area 210. The number of fonts in the table 107 is stored in an area 206 and incremented by 1 each time the font information of a font character is stored.

20 For example, at the basic resolution of 240 dpi in Table 1, the dot numbers "24", "32", and "40" are used frequently. If the resolution is changed to 300 dpi, the corresponding dot numbers become "30", "40", and "50". Thus, the size of a character changes
25 with the resolution. In the case of a character having a large possibility of being used at three resolutions, such as a character having a dot number of "40", dots



1 are designed to have a slightly larger thickness for
240 dpi resolution since they will become a little bit
larger. Whereas spaces between dots are designed to
be larger for 400 dpi resolution since they will become
5 smaller and thus have superposition therebetween. In
this manner, characters are developed in accordance
with resolutions.

<Forming Management Table (Figs. 3 and 4)>

Fig. 3 is a flow chart illustrating the procedure
10 of forming the font management table 107.

The procedure starts at step S301 when power
is turned on. At step S301, the informance of fonts
stored in the character generator 103 are stored in
the font management table 107. At step S302, it is
15 checked if the font cartridge 109 is connected to the
socket 110. If not, the procedure terminates. If
connected, the information of the fonts stored in the
font cartridge 109 are added to the font management
table 107 at step S303.

20 If fonts are down-loaded via the input interface
101, CPU 102 controls the procedure to start at step
S304 whereat the fonts are stored in the font memory
108. Next, at step S305 the down-loaded fonts are added
to the font management table 107 in the similar manner
25 as the above-described built-in fonts.

The font management table forming routine at
steps S301, S303, and S305 is described in detail with



1 reference to the flow chart shown in Fig. 4.

In this routine, the address at which a font is actually present is called as a parameter. For example, at step S301, the font address of the non-volatile memory
5 112 is used as a parameter.

At step S401, by using a set address, the font information such as indicated at 210 in Fig. 2 is read. Next, at step S402, the number of fonts in the area 206 of the font management table 107 is incremented
10 by 1. In accordance with the incremented number, there is obtained the area in which the font information is set. At step S403 the sort data of the font information is copied onto the sort code area 201. At step S404 the font name is copied onto the font name area 202.

15 Next, at step S405 it is checked from the sort data if the font is a dot font. If not, the control advances to step S408. If it is a dot font, the control advances to step S406 whereat the basic resolution is copied onto the basic resolution area 203. At the next
20 step S407, the dot size is copied onto the dot size area 204.

After the above procedure, the actual font address is set in the address area 205 at step S408 to complete the information setting procedure for one font. At
25 step S409, it is checked if the font is the last one. If not, the control returns to step S401 to repeat the above procedure.

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After forming the font management table 107 in the manner described above, it becomes possible to output a font list which will be described later.

<Printing Font List (Figs. 5 and 6)>

Next, the procedure of printing a font list of the font management table 107 will be described with reference to the flow chart shown in Fig. 5.

In this embodiment, when a font list switch on the panel 111 is depressed, the procedure illustrated in Fig. 5 starts. Upon completion of this procedure, a clear and distinctive font list such as shown in Fig. 6 is printed out. The size of the printed-out font list matches the resolution used at that time.

Sample characters are printed out in their particular sizes, but characters used for the name, size, and the like are printed out with predetermined standard fonts. Scalable fonts are printed out in the size stored in the non-volatile memory 112. This size can be changed by entering a change instruction from the panel 112.

At step S501 the number of fonts in the font management table 107 is set in a register. At the next step S502, standard fonts are selected, and the character patterns for the resolution 601 and items 602 shown in Fig. 6 are developed via the character generator 103 into the image memory 104 at predetermined addresses. The next position to the developed area is designated.



1 At step S503 the first font in the font management table 107 is pointed out.

Next, at step S504 the sort code is checked to see if the font is a scalable font or a dot font.

5 In the case of a dot font, the control advances to step S505 whereat standard fonts are selected again. At step S506, the font name is read so that a character pattern corresponding to the font name is developed via the character generator 103 into the image memory
10 104, and thereafter the address is incremented. At step S507, the size is read and the equation (1) is solved to obtain the point size. At step S508 the character pattern corresponding to the obtained point number code is written in the image memory 104.

15 After writing the character pattern, the control advances to step S509 whereat fonts of the obtained size are selected. At step S520 character patterns corresponding to sample character train codes (predetermined train codes) are written via the character generator
20 103 into the image memory 104.

At the next step S521, the address of the image memory is decreased downward by one line to move to the top of the next line. At the next step S522 the contents of the register are reduced by 1 to thereafter
25 point the next font information. If the contents of the register is not "0", the control returns to step S504 to repeat the character pattern development procedure.



1 If the font is a scalable font at step S504,
the control advances to step S510 whereat the size stored
in the non-volatile memory 112 is set. At the next
step S511 the font name is read from the table 107.
5 A dot pattern corresponding to a character code and
having the size set for the scalable font is generated
by the character generator 103 and written in the image
memory 104.

At step S512 a sample character pattern having
10 the size set at step S510 is generated by the character
generator 103 and developed in a dot pattern in the
work memory. At step S520 the dot pattern is written
in the image memory 104.

At step S523 after writing the last font in
15 the above manner, dot patterns developed in the image
memory 104 are outputted via the output interface 105
to the image forming device 106 and printed out.

As described so far, in an image forming apparatus
capable of forming images at a plurality of resolutions
20 as in this embodiment, it is possible to print a font
list having a proper size at each resolution, thereby
avoiding to select an erroneous character from the upper
level apparatus.

In printing out a font list of scalable fonts,
25 it is possible to print fonts of desired sizes. In
printing out a font list of dot fonts, it is possible
to use only those fonts designed for a particular



1 resolution and print out a font list.

In the above embodiment, fonts can be used at any resolution. Instead, if dot fonts having a basic resolution suitable for the present resolution only
5 are allowed to be used, the basic resolution only is referred to. In printing out a font list of fonts at only such a resolution, the following step is inserted before step S505.

In this step, the present resolution is compared
10 with a basic resolution in the management table 107. If the resolution is the same, the following steps are executed. If not, the control advances to step 522 to move to the next font information. With this processes, although other resolutions cannot be used, a most beautiful
15 font can be selected.

Furthermore, the size of a scalable font is set from the panel in this embodiment. Instead, the size may be set in accordance with input data from an upper level apparatus. The size may also be set by
20 using switches such as a dual-in-line switch and the like.

As appreciated from the foregoing description of this invention, it is possible to print out a font list of fonts at a plurality of resolutions. The resolution and character style may be designated in order
25 to print out a font list of only those fonts having a desired character style.



1 CLAIMS:

1. An output apparatus comprising:
storage means for storing font information;
means for generating a predetermined pattern
5 in accordance with said font information stored in said
storage means;
means for instructing to output a font list
of said font information; and
output means responsive to an instruction
10 from said instructing means for outputting a font list
having a desired resolution.
2. An output apparatus according to claim 1,
wherein said output means outputs said font list by
15 changing the pattern size to the size corresponding
to the resolution at the time of outputting said font
list.
3. An output apparatus according to claim 1,
20 wherein said output means includes means for designating
one font information from a plurality of sizes, and
outputs said font list at the size designated by said
designating means.
- 25 4. An output apparatus according to claim 1,
further comprising means for designating a desired
resolution, and output control means for controlling



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1 said output means in order to output said font list
at a resolution designated by said designating means.

5 5. A method of outputting a font list comprising
steps of:
storing font information;
generating a predetermined pattern in accordance
with said stored font information;
instructing to output a font list of said
10 font information; and
responsive to said instruction, outputting
a font list having a desired resolution.

15 6. A method of outputting a font list according
to claim 5, wherein said font list is outputted by
changing the pattern size to the size corresponding
to the resolution at the time of outputting said font
list.

20 7. A method of outputting a font list according
to claim 5, wherein said step of outputting said font
list includes a step of designating one font information
from a plurality of sizes, and outputting said font
list at said designated size.

25 8. A method of outputting a font list according
to claim 5, further comprising a step of designating





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a desired resolution, and a step of controlling to output said font list at said designated resolution.

5 9. Control apparatus for a multi-font printer capable of printing in a plurality of resolutions, comprising means for instructing the printer to print a list of available fonts in a font-representative format, and means for scaling the format to one of the plurality of resolutions.

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10. Apparatus according to claim 9 in which the selected resolution is the resolution at which the printer is currently arranged to operate.

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11. Apparatus for generating a printed list of printable fonts, characterised in that the apparatus is operable to select a size, resolution or shape parameter of the printed list and print the list accordingly.

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12. A method of listing the fonts available on a multi-font, multi-resolution printer, comprising the step of selecting the resolution at which to print the font list.



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