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An Ink Jet Recording Apparatus Capable
of Altering the Recording Control and
An Ink Jet Recording Method for said Apparatus ✓

5 BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an ink jet recording apparatus and an ink jet recording method capable of recording the half-tone image in such a manner as to change the number of recording dots per unit area, as well as recorded matters.

Related Background Art

In the conventional ink jet recording methods, the recording is performed in such a manner as to discharge the ink through a plurality of discharge orifices formed in a recording head in accordance with data signal and attach ink droplets onto the recording medium such as a paper. This recording method has been utilized for printers, facsimile apparatuses, or copying machines, for example.

For the above apparatuses, there is a method involving the use of electricity-heat energy converters in which heat generating elements (electrothermal energy converters or electricity-heat energy converters) are provided in the neighborhood of discharge orifices to discharge the ink and apply



1 an electrical signal to those heat generating
elements to heat the ink locally, thus causing a
pressure change therein to discharge the ink through
discharge orifices, or the use of electromechanical
5 converters such as piezo-electrical elements.

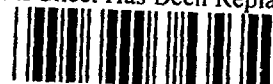
In this type of recording method, the half-
tone recording is controlled in accordance with a dot
density control method in which the half-tone is
represented by controlling the number of recording
10 dots per unit area with the recording dot of fixed
size, or a dot diameter control method in which the
half-tone is represented by controlling the size of
recording dots.

Herein, the latter dot diameter control
15 method has some restrictions because of its complex
control required to minutely change the size of
recording dot, and therefore the former dot density
control method is generally employed.

When the electricity-heat energy converters
20 are used as ink discharge means, they can be easily
manufactured and allows for the high density, and
thus the high resolution, but has the difficulty in
controlling the amount of pressure change, so that
the diameter of recording dot can not be readily
25 modulated. Hence, the dot density control method is
mainly employed for the half-tone recording with the
ink jet recording method.



1 Typical of the binarization method for the
half-tone representation for use with this dot
density control method is an organizational dither
method, but this method has a problem that the number
5 of gradations is limited by the matrix size. That
is, to increase the number of gradations requires to
increase the matrix size, but there is a problem that
if the matrix size is increased, one pixel of
recording image which is constituted of one matrix is
10 larger, thereby resulting in lower resolution. Also
another typical binarization method is a conditioned
decision type dither method such as an error
diffusion method. This is a method in which the
threshold is changed in consideration of peripheral
15 pixels around the input pixel, whereas the above-
mentioned organizational dither method is an
independent decision type dither method in which the
binarization is made using a threshold value
irrespective of the input pixel. The conditioned
20 decision type dither method represented by this error
diffusion method has the advantage that there is good
compatibility between gradation and resolution, and
that when the original image is a printed image,
there are quite less moire patterns produced in the
25 recorded image, whereas it has the drawback that the
graininess becomes conspicuous in the light part of
image, degrading the evaluation of image quality.



1 This problem was remarkable particularly in the
recording apparatus having low recording density.

To make the above graininess inconspicuous,
a recording method has been proposed in which two
5 recording heads for discharging the inks which are
thin and thick in the dye concentration respectively
are provided for the recording. With this method,
the portion from the light part of image to the half-
tone part has recording dots formed by the thin ink
10 in the dye concentration, while the portion from the
half-tone part to the dark part has recording dots
formed by the thick ink. The dots formed by the thin
ink in the dye concentration are light in the image
density, while the dots by the dark ink in the dye
15 concentration is dark in the image density.

Fig. 23 is a constitutional view showing the
essence of a conventional color ink jet recording
apparatus of the serial print type employing the
dark/light ink.

20 Kk is a recording head for discharging a
color ink of dark black, Ku is a recording head for
discharging a color ink of light black, Ck is a
recording head for discharging a color ink of dark
cyan, Cu is a recording head for discharging a color
25 ink of light cyan, Mk is a recording head for
discharging a color ink of dark magenta, Mu is a
recording head for discharging a color ink of light



1 magenta, Yk is a recording head for discharging a
color ink of dark yellow, and Yu is a recording head
for discharging a color ink of light yellow. Each of
the recording heads is installed a predetermined
5 distance apart on a carriage 241.

The ink is supplied to each recording head
from an ink cartridge 248 corresponding to respective
color. Also, the control signal to recording head is
provided via a flexible cable 249.

10 A recording medium composed of paper or
plastic thin plate is passed by a conveying roller
(not shown) and carried therewith by paper exhausting
rollers 242 to be fed in a direction of the arrow by
the driving of a conveying motor not shown.

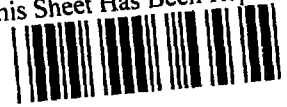
15 Carriage 241 is guided and supported by means
of a guide shaft 243, and an encoder not shown.

Carriage 241 is caused to reciprocate along
the guide shaft 243 by the driving of a carriage
motor 245 via a drive belt 244.

20 The inside of an ink discharge orifice of the
recording head or a liquid channel through which the
ink flows is provided with a heat generating element
(electricity-heat energy converter) for generating
the heat energy for use in discharging the ink.

25 In accordance with the read timing of
encoder, the above-mentioned heat generating elements
are driven on the basis of a recording signal to





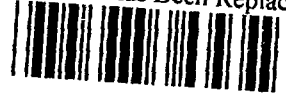
1 discharge ink droplets onto the recording medium in
the order of dark black, light black, dark cyan,
light cyan, dark magenta, light magenta, dark yellow,
and light yellow, thereby forming an image.

5 At a home position of carriage selected out
of the recording area, a recovery unit 246 having a
cap portion 247 is disposed to effect the recovery of
ink discharge performance and maintain the stability
of ink discharge.

10 In the case of a so-called pictorial image
in which the output image is represented in
gradation, the reproduction of image with reduced
graininess can be effected by making the effective
use of the dark/light ink.

15 On the other hand, it is often preferred to
perform the recording only by the use of dark ink,
in the case of an image not requiring any gradation
representation such as a document, graphics or
listing which is composed of characters and line
20 drawing, or an image already expanded in binary form
by the computer.

For the purposes of achieving the compactness
and the low price of the apparatus, and performing
the recording by using the dark/light ink, a method
25 is provided in which a recording head is used having
a plurality of discharge orifice arrays for
discharging different inks onto the same discharge



1 orifice formation face of the same recording head.
In this case, there is a problem that though the
apparatus is smaller, the array of discharge orifices
is divided corresponding to used ink color and the
5 number of discharge orifices for each ink color is
reduced, whereby the recording width per scan is
narrower and the recording speed is decreased.
Accordingly, the apparatus with its principal usage
found only on the recording by the use of such
10 dark/light ink is unsuitable for the output of
document, graphic and listing image.

SUMMARY OF THE INVENTION

An object of the present invention is to
15 resolve the aforementioned problems, and provide a
compact ink jet recording apparatus and an ink jet
recording method which is capable of producing an
image excellent in gradation and resolution with
reduced graininess, and producing the image for
20 document, graphic and listing at high speed and good
quality, as well as recorded products obtained by
carrying out said ink jet recording method.

To accomplish the above object, the present
invention provides an ink jet recording apparatus
25 which can perform the recording by discharging the
ink onto the recording medium in accordance with the
recording data, characterized by comprising a



1 mounting portion for exchangeably mounting either
first recording means for discharging a single kind
of ink or second recording means capable of
discharging a plurality of kinds of inks,
5 discriminating means for discriminating whether
recording means to be mounted on said mounting
portion is said first recording means or said second
recording means, and recording control changing means
for changing the recording control in accordance with
10 said discriminating means.

Also, the present invention provides an ink
jet recording apparatus which can perform the
recording by discharging the ink onto the recording
medium in accordance with the recording data,
15 characterized by comprising a mounting portion for
exchangeably mounting either first recording means
for discharging a single kind of ink or second
recording means capable of discharging a plurality of
kinds of inks, information generating means for
20 generating information as to whether recording means
to be mounted on said mounting portion is said first
recording means or said second recording means, and
recording control changing means for changing the
recording control in accordance with the information
25 of said information generating means.

Also, the present invention provides an ink
jet recording method which can perform the recording



1 by discharging the ink onto the recording medium in
accordance with the recording data, by using
recording means mounted on a mounting portion for
exchangeably mounting either first recording means
5 for discharging a single kind of ink or second
recording means capable of discharging a plurality of
kinds of inks, characterized by including a
discrimination step of discriminating whether
recording means to be mounted on said mounting
10 portion is said first recording means or said second
recording means, and a recording control changing
step of changing the recording control in accordance
with said discrimination step.

Also, the present invention provides an ink
15 jet recording method which can perform the recording
by discharging the ink onto the recording medium in
accordance with the recording data, by using
recording means mounted on a mounting portion for
exchangeably mounting either first recording means
20 for discharging a single kind of ink or second
recording means capable of discharging a plurality of
kinds of inks, characterized by including an
information generation step of generating information
as to whether recording means to be mounted on said
25 mounting portion is said first recording means or
said second recording means, and a recording control
changing step of changing the recording control in



-1 accordance with the information of said information generation step.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Fig. 1 is a block diagram showing the configuration of a color ink jet recording apparatus in accordance with an embodiment of the present invention.

10 Fig. 2 is a diagram exemplifying an image signal processing circuit in the color ink jet recording apparatus in accordance with the embodiment of the present invention.

Figs. 3A and 3B are explanation views of a dark/light distribution table.

15 Fig. 4 is a flowchart for selecting the dark/light distribution table.

Fig. 5 is a perspective view showing the essence of the color ink jet recording apparatus of the present invention.

20 Fig. 6 is a constitutional view of an ink jet unit capable of discharging the dark/light ink.

Fig. 7 is a constitutional view of a grooved top for a head unit capable of discharging the dark/light ink.

25 Fig. 8 is a constitutional view of an ink jet unit for discharging the ink of single density.

Fig. 9 is a constitutional view of a grooved



1 top for a head unit for discharging the ink of single
density.

Fig. 10 is a view of the ink discharge
orifice array for the ink jet unit capable of
5 discharging the dark/light ink, as looked from the
side of the recording medium.

Fig. 11 is a view of the ink discharging
orifice array for the ink jet unit for discharging
the ink of single density, as looked from the side of
10 the recording medium.

Fig. 12 is a diagram showing an image
formation process where the ink jet unit capable of
discharging the dark/light ink is mounted.

Fig. 13 is a diagram showing an image
15 formation process where the ink jet unit for
discharging the ink of single density is mounted.

Figs. 14A and 14B are explanation views of
means for passing designated information of ink jet
unit to the apparatus main.

20 Fig. 15 is a view showing the constitution of
an integral ink jet cartridge capable of discharging
the dark/light ink in accordance with another
embodiment of the present invention.

Fig. 16 is a view showing how the integral
25 ink jet cartridge as shown in Fig. 15 is mounted on
the carriage.

Fig. 17 is a view showing an integral ink jet



1 cartridge for discharging the ink of single density.

Fig. 18 is a view showing how the integral ink jet cartridge as shown in Fig. 17 is mounted on the carriage.

5 Fig. 19 is a view showing how an integral ink jet cartridge capable of discharging the inks of two densities in accordance with another embodiment of the present invention is mounted on the carriage.

Fig. 20 is a view showing the state of the
10 integral ink jet cartridge as shown in Fig. 10 where all the ink cartridges are mounted on the carriage.

Fig. 21 is a view of the ink discharge orifice arrays in the integral ink jet cartridge as shown in Fig. 19, as looked from the side of
15 recording medium.

Fig. 22 is a view exemplifying an image formation process using the integral ink jet cartridge as shown in Fig. 19.

Fig. 23 is a perspective view showing the
20 essence of a conventional color ink jet recording apparatus using the dark/light ink.

Fig. 24 is a block diagram showing a schematic configuration where a recording apparatus of the present invention is applied to an information
25 processing apparatus.

Figs. 25 and 26 are external views of the information processing apparatus.



1 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

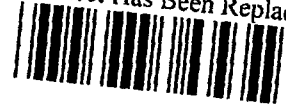
The preferred embodiments of an ink jet recording apparatus of the present invention will be described below in detail with reference to the drawings.

[First embodiment]

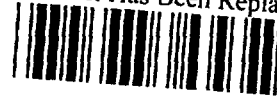
(Configuration of recording apparatus)

Fig. 1 is a block diagram showing the configuration of a color ink jet recording apparatus in accordance with this embodiment.

In the figure, 1 is an image input unit for optically reading an original image by a CCD, or inputting an image luminance signal (RGB) from a host computer or a video equipment, and 2 is an operation unit having a variety of keys for setting various parameters and instructing the print start. 3 is a CPU for controlling the whole of this recording apparatus in accordance with various programs stored in a ROM, this CPU constituting discriminating means and image formation condition setting means in the present invention. 4 is a ROM for storing programs for operating this recording apparatus in accordance with a control program error processing program, and image formation conditions. In this ROM, 4a is an input/output gamma conversion table to be referred to in the processing of an input/output gamma conversion circuit, 4b is a masking coefficient to be referred



1 to in the processing of a color correction (masking)
circuit, 4c is a black formation and UCR table to be
referred to in the processing of a black formation
and UCR circuit, 4d is a dark/light distribution
5 table to be referred to in the processing of a
dark/light distribution circuit, 4e is a program
group in which various programs for performing the
above-described processings are stored. The
processing in each circuit will be described later in
10 detail. 5 is a RAM useful for the work area for
various programs in the ROM and the temporary save
area at the error handling. 6 is an image signal
processing unit as will be described later and 7 is a
printer unit for forming the dot image based on the
15 image signal processed by the image signal processing
unit at the recording. 8 is a bus line for
transmitting an address signal, data and a control
signal within the apparatus. 9 is designated
information generating means for any one of a host
20 computer connecting to the recording apparatus, a dip
switch provided on the recording apparatus, an
operation panel for the recording apparatus, memory
means provided on the recording apparatus, and ink
discharging means or an ink cartridge mounted on the
25 recording apparatus, and 10 is a detection unit for
detecting the type of ink jet unit. The designated
information from the designated information



1 generating means 9 is designated command information
from the host computer, dip switch information from
the dip switch, panel information from the operation
panel, memory information from the memory means, or
5 a designated signal from the ink discharging means or
ink cartridge.

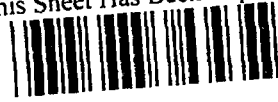
(Image signal processing unit)

An image signal processing unit will be now
described.

10 Fig. 2 shows an example of an image signal
processing circuit in a color ink jet recording
apparatus in this embodiment.

Red image luminance signal R, green image
luminance signal G, and blue image luminance signal B
15 are converted into a cyan image density signal 21C, a
magenta image density signal 21M and a yellow image
density signal 21Y in an input gamma correction
circuit 1.

Further, after the color processing in a
20 color correction (masking) circuit 12 and a black
formation and UCR (Under Color Removal) circuit 13,
they are converted into the new image density signals
23C, 23M, 23Y and 23K of cyan, magenta, yellow and
black. Then, they are converted into image density
25 signals 24C, 24M, 24Y and 24K of cyan, magenta,
yellow and black by undergoing gamma correction in an
output gamma correction circuit 14.



1 Figs. 3A and 3B are diagrams for exemplifying
a dark/light distribution table to be used in a
dark/light distribution circuit 15 in accordance with
a designated signal. A conversion table of Fig. 3A
5 is selected when the monochrome ink is only used,
while that of Fig. 3B is used when the inks of two
different densities are used for the conversion into
a dark/light signal in the dark/light distribution
circuit 15.

10 This table has set the image density signal
value and the optical reflection density value of
image recorded so as to exhibit the proportional
linear relation.

A table is selected by the dark/light
15 distribution circuit 15 in accordance with designated
information from the designated information
generating means 17 which is issued by a designated
signal. When the dark/light distribution table 15a
of Fig. 3A is selected by the dark/light distribution
20 circuit 15, the density signals of cyan, magenta,
yellow and black are directly output without
distribution into dark and light. When the
dark/light distribution table 15b of Fig. 3B is
selected, they are converted into the image density
25 signals 25Ck, 25Mk, 25Yk and 25Kk of dark cyan, dark
magenta, dark yellow and dark black which are at
higher dye density, and the image density signals



1 25Cu, 25Mu, 25Yu and 25Ku of light cyan, light
magenta, light yellow and light black which are at
lower dye density.

Each image density signal output from the
5 dark/light distribution circuit is binarized by a
binarization circuit 16, and a corresponding color
ink is discharged in accordance with a signal value
from each ink jet unit to effect the formation of
image. Binarization circuit 16 is a common circuit,
10 irrespective of whether the recording uses the inks
of two different densities or the ink of single
density.

Fig. 4 is a flowchart when the dark/light
distribution table is selected in this embodiment.

15 At step S41, the sort of ink jet unit is
detected by a detection unit, and at step S42,
designated information in accordance with a detected
result is generated. Next, if the dark/light ink is
determined to be dischargeable based on this
20 designated information at step S43, a distribution
table B, or a table of Fig. 3B is selected and set
in the dark/light distribution circuit 15 at step
S44, while if the dark/light ink is determined to be
undischARGEABLE at step S43, a dark/light
25 distribution table A, or a table of Fig. 3A is
selected and set at step S45.

Because the dark/light distribution table is



1 set prior to recording the image, each processing of
input gamma correction, color correction (masking),
black formation and UCR, dark/light distribution, and
binarization is performed in accordance with the
5 dark/light distribution table set at step S44 or step
S45, to complete the recording.

(Printer unit)

Fig. 5 is a perspective view showing the
essence of a color ink jet recording apparatus in
10 this embodiment.

In Fig. 5, this apparatus is constituted to
effect the image recording using the dark/light ink.

An ink jet unit 50K has integrally a
discharge orifice array for discharging the dark
15 black ink and a discharge orifice array for
discharging the light black ink. Also, an ink jet
unit 50C has integrally a discharge orifice array for
discharging the dark cyan ink and a discharge orifice
array for discharging the light cyan ink. Also, 50M
20 is an ink jet unit for magenta ink having integrally
a discharge orifice array for discharging the dark
magenta ink and a discharge orifice array for
discharging the light magenta ink, and 50Y is an ink
jet unit for yellow ink having integrally a discharge
25 orifice array for discharging the dark yellow ink and
a discharge orifice array for discharging the light
yellow ink. Each of the ink jet units is installed



1 a predetermined distance apart on the carriage 51.

A corresponding color ink is supplied from an ink cartridge 58 to a corresponding nozzle array for each ink jet unit 50. Each ink cartridge 58 is
5 divided internally into two sections by a partition, two sections containing the dark (thick) ink and the light (thin) ink, respectively.

The ink jet unit 50 and the ink jet cartridge 58 can be exchanged by an ink jet unit corresponding
10 to the ink of single density and an ink cartridge, as required.

The control signal to the ink jet unit 50 is sent via a flexible cable 59.

The recording medium composed of a paper or
15 plastic thin plate is passed by a conveying roller (not shown) and carried by paper exhausting rollers 52 to be fed in a direction of the arrow by the driving of a conveying motor, not shown.

Carriage 51 is supported to be guided by
20 means of a guide shaft 53, and an encoder not shown.

The carriage 51 is caused to reciprocate along the guide shaft 53 by the driving of a carriage motor 55 via a drive belt 54.

The inside (liquid channel) of an ink
25 discharge orifice of each ink jet unit 50 is provided with a heat generating element (electricity-heat energy converter) for generating the heat energy for



1 use in discharging the ink.

In accordance with the read timing of encoder, the above-mentioned heat generating elements are driven on the basis of a recording signal to
5 discharge ink droplets onto the recording medium in the order of dark and light black, dark and light cyan, dark and light magenta, and dark and light yellow, thereby forming an image.

At a home position of carriage selected out
10 of the recording area, a recovery unit 56 having a cap portion 57 is disposed to maintain the stability of ink discharge.

Each of ink jet units and ink cartridges is exchangeable as required.

15 (Ink jet unit)

Fig. 6 is an explanation view for the constitution of an ink jet unit capable of discharging a plurality of inks of different densities for use in this embodiment, and Fig. 8 is
20 an explanation view for the constitution of an ink jet unit for discharging the ink of single density for use in this embodiment.

Both ink jet units have common parts and constitution, though partially different, and will be
25 described together.

One end of a wiring board 60, 80 is interconnected to the wiring part of a heater board



1 61, 81, and further at the other end of the wiring
board 60, 80 there are provided a plurality of pads
corresponding to electricity-heat energy converters
for accepting an electrical signal from the main
5 device. Thereby, an electrical signal from the main
device is supplied to respective electricity-heat
energy converter.

A metallic support 62, 82 for supporting the
back side of the wiring board 60, 80 in a plane
10 serves as a bottom plate of the ink jet unit. A
presser spring 63, 83 has a portion bent into a
substantial U-character shape in cross section to
apply a pressing force resiliently and linearly on
the area in the neighborhood of the ink discharge
15 orifices for a grooved top 64, 84, a hook claw
through the use of a relief hole provided on the base
plate, and a pair of back legs for receiving a force
applied on the spring in the base plate.

By virtue of this spring force, the wiring
20 board 60, 80 and the grooved top 64, 84 are placed
into close contact under pressure. Also, the
attachment of the wiring board 60, 80 to the support
can be bonded by an adhesive.

In the ink jet unit capable of discharging
25 the dark/light ink in this embodiment, two ink supply
tubes 65, 66 for supplying the ink are provided
corresponding to the dark ink and the light ink.



1 On the other hand, in the case of an ink jet unit
corresponding to the ink of single density, only one
ink supply tube 85 is provided.

At the other end of the ink supply tube 65,
5 85, a filter 66, 86 is provided to prevent impurities
from entering the head.

An ink supply member 67, 87 is made by
molding and the grooved top has also formed with a
flow passageway for conducting the ink into each ink
10 supply opening. The fixture of the ink supply member
67, 87 to the support 62, 82 can be simply performed
by passing two pins (not shown) on the back side of
the ink supply member 67, 87 into and out of holes
68, 88 provided in the support 62, 82 and heat
15 welding them.

In this case, the interval between an orifice
plate portion 680, 880 and a chip tank 67, 87 is
formed evenly. A sealing agent is filled through a
sealing agent filler hole provided above the ink
20 supply member 127 to seal the wire bonding as well as
the gap between an orifice plate 680, 880 and a chip
tank 67, 87, further passing through a groove 69, 89
provided on the support 62, 82 to completely seal the
gap between the orifice plate portion 680, 880 and
25 the front end of support 62, 82.

Fig. 7 is a perspective view of a groove top
64 capable of discharging the dark/light ink for use



1 in this embodiment, as looked from the side of heater
board 61. In this unit, two liquid chambers are
provided for the dark ink and the light ink, each
liquid chamber being divided by a partition 70. Each
5 liquid chamber is provided with supply openings 71a,
71b for supplying the ink.

A groove 72 is provided on the pressing
contact plane of the partition 70 for partitioning
this liquid chamber with the heater board 61. This
10 groove communicates to the outer peripheral portion
of the grooved top 64. After the grooved top 62 is
forced into close contact with the heater board, the
outer peripheral portion is sealed by a sealing
agent, as previously described. In doing so, the
15 sealing agent percolates into the groove to fill the
gap between the grooved top and the heater board. By
this technical process, the liquid chamber can be
completely separated. The structure of this groove
is different with the material of sealing agent, and
20 is necessary to have a corresponding shape.

In this way, by dividing the liquid chamber
into plural sections, the ink which is different for
each discharge orifice array can be supplied by one
ink jet unit.

25 Fig. 9 is a perspective view of a grooved top
84 of a head unit for discharging the ink of single
density for use in this embodiment, as looked from



1 the side of heater board 81. The liquid chamber
provided in this unit is a liquid chamber 90
dedicated for the ink of single density. The liquid
chamber 90 is provided with a supply opening 91 for
5 supplying the ink.

After the grooved top 84 is forced into close
contact with the heater board, the outer peripheral
portion is sealed by the same sealing agent as
described in connection with Fig. 7.

10 Fig. 10 is a view of ink discharge orifice
arrays of an ink jet unit capable of discharging the
dark/light ink, as looked from the side of the
recording medium.

There are provided an ink jet unit 100 for
15 discharging the black ink, an ink unit 101 for
discharging the cyan color ink, an ink jet unit 102
for discharging the magenta color ink, and an ink jet
unit 103 for discharging the yellow color ink.

Also, 100Ku, 101Cu, 102Mu and 103Yu are
20 discharge orifice arrays for discharging the light
ink, and 100Kk, 101Ck, 102Mk and 103Yk are discharge
orifice arrays for discharging the dark ink.

Each discharge orifice array corresponding
to each dark/light ink has 64 discharge orifices at a
25 pitch of 360 dots per inch (360 dpi), wherein there
is a blank of 8 dots between each color array by
virtue of the partition of liquid chamber.



1 Fig. 11 is a view of ink discharge orifice
arrays wherein an ink jet unit for discharging the
ink of single density is arranged for each color, as
looked from the side of the recording medium.

5 There are provided an ink jet unit 110 for
discharging the black ink, an ink jet unit 111 for
discharging the cyan color ink, an ink jet unit 112
for discharging the magenta color ink, and an ink jet
unit 113 for discharging the yellow color ink.

10 Each ink jet unit has discharge orifices
arranged at a pitch of 360 dots per inch (360 dpi),
with 128 discharge orifices provided for each one of
head units.

 Fig. 12 is a view showing an image formation
15 process wherein an ink jet unit capable of
discharging the dark/light ink is mounted.

 In the explanation of this figure, the image
formation process will be described, supposing that
no blank is provided between each color.

20 Noting the (N+1)th line, the recording in
dark black, dark cyan, dark magenta and dark yellow
and the conveying operation (line feed, hereinafter
abbreviated as LF) of the recording medium by a
predetermined amount is performed at the first scan
25 line, and the recording in light black, light cyan,
light magenta and light yellow and the LF is
performed at the second scan line, whereby such two

1 scan recordings can complete an image. The amount of
LF after each scan recording is 64 dots wide, and
the image 64 dots wide is recorded by the second scan
recording.

5 The recording in all colors which is not
completed by one time of the scan recording will
result in less degradation in image quality due to
blur and thus produces an excellent image. Further,
in the actual ink jet unit, owing to a blank provided
10 between each color, the connecting position of the
recording scan for each color is not coincide for
each color, as depicted in this figure, and located
at a different position, so that there is the effect
that the occurrence of connection streaks of the
15 recording scan is relieved.

Fig. 13 is a diagram showing an image
formation process wherein an ink jet unit for
discharging the ink of single density is mounted.

By the first scan and the LF, the recording
20 in black, cyan, magenta and yellow is performed to
complete the image at the (N+1)th line. Then, by the
second scan recording and the LF, and the third scan
recording and the LF, the images at the (N+1)th line
and at the (N+1)th line are completed. The amount of
25 LF after each scan recording is 128 dots wide,
whereby the image 128 dots wide is recorded by one
time of the scan recording.





1- Figs. 14A and 14B are explanation views of means for transmitting designated information of an ink jet unit to the apparatus main, shown partially in cross section.

5 141 is a carriage, 140 is a switch provided on the carriage 141, and 62, 82 is a support for the ink jet unit. When the ink jet unit is mounted on the carriage, the number of switches which are turned on is determined by the number of signal pins
10 provided on the support 62, 82 of the ink jet unit.

Fig. 14A shows the state where an ink jet unit for discharging the ink of single density is mounted, with all the switches 140 turned on. In this case, the apparatus main is informed that the
15 ink jet unit for discharging the ink of single density is mounted, and a dark/light distribution table of Fig. 3A is selected, whereby the recording through the image formation process as described in Fig. 13 is performed.

20 Fig. 14B is a view wherein an ink jet unit capable of discharging a plurality of inks of different densities is mounted, with only one switch turned on. The apparatus main is informed that the ink jet unit capable of discharging the inks of
25 different densities is mounted, and a dark/light distribution table of Fig. 3B is selected, whereby the recording through the image formation process as



1 described in Fig. 12 is performed.

This embodiment as above described has been configured to provide the signal pin on the support of the ink jet unit as designated information
5 generating means for changing the recording control in accordance with the ink jet unit mounted therein, when the ink jet unit for discharging the ink of single density or the ink jet unit capable of discharging the inks of different densities is
10 mounted.

With this embodiment, information can be passed to the recording apparatus main by changing the number of signal pins provided on the ink jet unit in accordance with the designated content of the
15 recording control, whereby an appropriate dark/light distribution table can be selected and the recording control method can be set simply by mounting the ink jet unit on the carriage.

Note that the designated information
20 generating means is not limited to that as shown in this embodiment, but a host computer connecting to the recording apparatus, a dip switch for the host computer or the recording apparatus, an operation key on the operation panel, or memory means provided on
25 the recording apparatus may be used. Another configuration is also possible wherein memory means is provided on the ink jet unit, and the information



1 within memory is read by the apparatus main.

With this embodiment, the recorded matter
of image which is excellent in gradation and
resolution and has reduced graininess can be
5 obtained.

(Second embodiment)

The second embodiment of the present
invention will be now described.

Fig. 15 shows the construction of an integral
10 ink jet cartridge wherein ink jet units 154 capable
of discharging the dark/light ink for four colors of
yellow, magenta, cyan and black are integrally
assembled into a frame 150.

Fig. 17 shows the construction of an integral
15 ink jet cartridge wherein ink jet units 174 for
discharging the ink of single density for four colors
of yellow, magenta, cyan and black are integrally
assembled into a frame 170.

The integral ink jet cartridges as shown in
20 Figs. 15 and 17 have common parts and constitution,
though partially different, and will be described
together.

The constitution of the ink jet unit 154, 174
has been described in detail in the previous
25 embodiment, and will be no longer described.

Four ink jet units 154, 174 as shown in Figs.
15 and 17 are mounted a predetermined interval apart



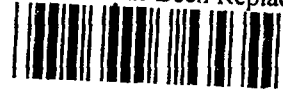
1 within the frame 150, 170, and fixed with the
registration in a direction of nozzle array adjusted.
151, 171 is a frame cover, and 152, 172 is a
connector for connecting pads provided on the wiring
5 board 60, 80 for the four ink jet units 154, 174 with
the apparatus main to provide an electrical signal.
The wiring board 60, 80 and the connector 152, 172
are connected through electrodes 153, 173,
respectively.

10 Fig. 16 shows how an integral ink jet
cartridge 152 capable of discharging the inks of
different densities is mounted on the carriage 51.

Fig. 18 shows how an integral ink jet
cartridge 172 for discharging the ink of single
15 density is mounted on the carriage 51.

An ink tank 160 for storing the inks of
different densities is partitioned into two upper and
lower chambers by a partition 161, an upper chamber
filled with the light ink and a lower chamber filled
20 with the dark ink.

An ink tank 180 for storing the ink of single
density has no partition for serving to receive
different inks. And an ink jet cartridge 152, 172
and four ink tanks 160, 180 of yellow, magenta, cyan
25 and black are connected together on the carriage 51,
and the ink is supplied from the ink tank 160, 180 to
corresponding ink discharge orifice array.



1 As shown in Fig. 18, an electrically
conductive seal 183 is pasted on the integral ink jet
cartridge 172 for discharging the ink of single
density. On the other hand, no electrically
5 conductive seal is pasted on the integral ink jet
cartridge 152 capable of discharging the inks of
different densities, as indicated by 163 in Fig. 16.

The recording apparatus main body in this
embodiment has two electrode contacts at the
10 positions corresponding to the electrically
conductive seal by mounting the integral ink jet
cartridge thereto.

When any electrically conductive seal exists
on a portion indicated by 183 as shown in Fig. 18,
15 two electrode contacts provided on the main body as
above described are placed in conduction, the
apparatus main is informed that the integral ink jet
cartridge for discharging the ink of single density
is mounted, and a dark/light distribution table of
20 Fig. 3A is selected, whereby the recording through
the image formation process as depicted in Fig. 13 is
performed. Also, when no electrically conductive
seal exists on a portion indicated by 163 as shown in
Fig. 16, two corresponding electrodes provided on the
25 main body are not in conduction, the apparatus main
is informed that the integral ink jet cartridge
capable of discharging the dark/light ink is mounted,



1- and a dark/light distribution table of Fig. 3B is selected, whereby the recording through the image formation process as depicted in Fig. 12 is performed.

5 With this embodiment, by placing the corresponding contacts on the side of the recording apparatus main body in conduction or non-conduction depending on whether or not any electrically conductive seal of the integral ink jet cartridge
10 exists, information can be transferred to the recording apparatus main body, an appropriate dark/light distribution table can be selected, and the recording control method can be set simply by mounting the recording head on the carriage.

15 With this embodiment, the recorded matter of image which is excellent in gradation and resolution and has reduced graininess can be obtained.
(Third embodiment)

 A third embodiment of the present invention
20 will be now described.

 Fig. 19 shows how an integral ink jet cartridge 152 is mounted on a carriage 51, wherein ink jet units capable of discharging two different inks through corresponding arrays of discharge
25 orifices with a liquid chamber divided into two sections are integrated.

 This ink jet units and the integral ink jet



1 cartridge 152 are identical to the ink jet units
capable of discharging the inks of different
densities and the integral ink jet cartridge thereof
as described in the previous embodiment,
5 respectively.

Fig. 21 is a view of ink discharge orifice
arrays for an integral ink jet cartridge capable of
discharging two different inks used in this
embodiment through corresponding arrays of discharge
10 orifices, as looked from the side of recording
medium.

There are provided an ink jet unit 210Y for
discharging the yellow color ink, an ink jet unit
210M for discharging the magenta color ink, an ink
15 jet unit 210C for discharging the cyan color ink, and
an ink jet unit 210K for discharging the black color
ink.

Each ink jet unit 210 has a first discharge
orifice array and a second discharge orifice array,
20 each array capable of discharging a different ink.

Each discharge orifice array has arranged
discharge orifices at a density of 360 dots per inch
(360dpi). The first discharge orifice array and the
second discharge orifice array are 64 discharge
25 orifices usable for the recording, respectively, with
no blank in a direction of discharge orifice array
provided between discharge orifice arrays usable for



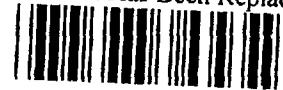
1 the recording, as previously described. That is, an
ink jet unit for discharging the ink of single
density having 128 discharge orifices may be
constructed in such a way that discharge timing
5 correction is made by the amount of deviation in a
main scan direction between the first discharge
orifice array and the second discharge orifice array,
and the same ink is supplied and discharged to and
from the first discharge orifice array and the second
10 discharge orifice array.

In Fig. 19, an ink tank 190 is partitioned
into two upper and lower chambers by a partition 191,
wherein the upper and lower chambers can contain
different inks.

15 And an ink jet cartridge 152 and four ink
tanks 190 of yellow, magenta, cyan and black are
connected together on a carriage 51, the ink being
supplied from the ink tank 190 to a corresponding ink
discharge orifice array.

20 192a, 192b is a marking indicating the
information of ink tank.

In this embodiment, when a marking 192a is
black and 192b is white, an dark/light ink
corresponding ink tank is indicated containing the
25 light ink in the upper chamber and the dark ink in
the lower chamber with the partition within the ink
tank, as shown in Fig. 19. On the other hand, when



1- the markings 192a, 192b are both black, a single density ink corresponding ink tank is indicated containing the thick ink within the upper and lower chambers.

5 Fig. 20 is a view showing the state wherein all the ink tanks are mounted on the carriage.

Markings 192a, 192b for the ink tank 190 are detected by means of an optical sensor 200 provided on the carriage 51.

10 Herein, an image formation process will be described below with reference to Fig. 22, wherein the black ink tank corresponds to the single density ink in which the optical sensor 200 discriminates both the markings 192a, 192b as black, while the
15 other color ink tank corresponds to the dark/light ink in which the optical sensor 200 discriminates the marking 192a as black and the marking 192b as white.

Fig. 22 is a view showing the image formation process.

20 For the black dark/light distribution table, Fig. 3A is selected and set, according to designated information of the ink tank by the optical sensor, and for the dark/light distribution table of yellow, magenta and cyan, Fig. 3B is selected and set.

25 In Fig. 22, noting the (N+2)th line, the recording in dark black, dark cyan, dark magenta and dark yellow and the LF are performed at the second



1- scan, and the recording in light cyan, light magenta,
and light yellow and the LF are performed at the
third scan, whereby an image is completed by two scan
recordings.

5 The amount of LF after each scan recording
is 64 dots wide, and the image 64 dots wide is
recorded by two scan recordings.

 The recording in dark black occurs only at
the second scan in the figure, and thus at every
10 other scan, in which the recording 128 dots wide
which is double that of yellow, magenta and cyan is
performed once.

 With such a constitution, the recording speed
can be increased by varying the amount of LF to the
15 width of 128 dots when printing black characters or
in monochrome.

 With this embodiment, the marking state is
changed according to designated information preset in
the ink tank, and detected by the optical sensor upon
20 mounting the ink tank, whereby an appropriate
dark/light distribution table can be selected and the
recording control method set.

 Further, it is preferable to provide an
automatic suction recovery mode of fully exchanging
25 the ink in a liquid chamber and discharge orifices
within an ink jet unit in such a way as to allow the
recovery unit to perform the suction recovery



1 operation upon discriminating the replacement to the
different ink tank by detecting the marking state of
the ink tank to be changed.

Note that designated information generating
5 means for generating designated information by
detecting the marking is not limited to that shown
in this embodiment, but may be a host computer
connecting to the recording apparatus.

As above described in the embodiment, the
10 recording control can be altered upon detecting the
marking provided, simply by exchanging the ink jet
unit, the ink jet cartridge or the ink tank, when
outputting the image having significance on the
graininess and gradation reproducibility such as a
15 so-called pictorial image composed of gradation
representation or when attaching great importance on
the recording speed such as when printing characters,
graphics and listing, whereby the image can be output
with a desired image quality and at the recording
20 speed.

With this embodiment, the image excellent in
gradation and resolution and with reduced graininess
can be obtained.

The present invention brings about excellent
25 effects particularly in a recording head or a
recording device of the ink jet system for performing
the recording by forming flying fine ink droplets by



1- the use of heat energy among the various ink jet recording systems.

As to its representative constitution and principle, for example, one practiced by use of the basic principle disclosed in, for example, U.S. Patents 4,723,129 and 4,740,796 is preferred. This system is applicable to either of the so-called on-demand type and the continuous type. Particularly, the case of the on-demand type is effective because, by applying at least one driving signal which gives rapid temperature elevation exceeding nucleus boiling corresponding to the recording information on electricity-heat converters arranged corresponding to the sheets or liquid channels holding a liquid (ink), heat energy is generated at the electricity-heat converters to effect film boiling at the heat acting surface of the recording head, and consequently the bubbles within the liquid (ink) can be formed corresponding one by one to the driving signals. By discharging the liquid (ink) through an opening for discharging by growth and shrinkage of the bubble, at least one droplet is formed. By making the driving signals into the pulse shapes, growth and shrinkage of the bubbles can be effected instantly and adequately to accomplish more preferably discharging of the liquid (ink) particularly excellent in response characteristic.



1 As the driving signals of such pulse shape,
those as disclosed in U.S. Patents 4,463,359 and
4,345,262 are suitable. Further excellent recording
can be performed by employment of the conditions
5 described in U.S. Patent 4,313,124 of the invention
concerning the temperature elevation rate of the
above-mentioned heat acting surface.

 As the constitution of the recording head, in
addition to the combination of the discharging
10 orifice, liquid channel, and electricity-heat
converter (linear liquid channel or right-angled
liquid channel) as disclosed in the above-mentioned
respective specifications, the constitution by use of
U.S. Patent 4,558,333 or 4,459,600 disclosing the
15 constitution having the heat acting portion arranged
in the flexed region is also included in the present
invention.

 In addition, the present invention can be
also effectively made the constitution as disclosed
20 in Japanese Laid-Open Patent Application No. 59-
123670 which discloses the constitution using a slit
common to a plurality of electricity-heat converters
as the discharging portion of the electricity-heat
converter or Japanese Laid-Open Patent Application
25 No. 59-138461 which discloses the constitution having
the opening for absorbing pressure wave of heat
energy correspondent to the discharging portion.



1 Further, the recording head of the full line
4 type having a length corresponding to the maximum
 width of a recording medium which can be recorded by
 the recording device may be either the constitution
5 which satisfies its length by a combination of a
 plurality of recording heads as disclosed in the
 above-cited specifications or the constitution as one
 recording head integrally formed.

 Also, addition of a restoration means for the
10 recording head, a preliminary auxiliary means, etc.,
 provided as the constitution of the recording device
 of the present invention is preferable, because the
 effect of the present invention can be further
 stabilized. Specific examples of these may include,
15 for the recording head, capping means, cleaning
 means, pressurization or suction means, electricity-
 heat converters or another type of heating elements,
 or preliminary heating means according to a
 combination of these, and it is also effective for
20 performing stable recording to perform preliminary
 mode which performs discharging separate from
 recording.

 Though the ink is considered as the liquid
 in the embodiments as above described, another ink
25 may be also usable which is solid below room
 temperature and will soften or liquefy at or above
 room temperature, or liquefy when a recording signal



1 is issued as it is common with the ink jet device to
control the viscosity of ink to be maintained within
a certain range of the stable discharge by adjusting
the temperature of ink in a range from 30 °C to 70 °C.

5 In addition, in order to avoid the
temperature elevation due to heat energy by
positively utilizing the heat energy as the energy
for the change of state from solid to liquid, or to
prevent the evaporation of ink by using the ink which
10 will solidify in the shelf state, the use of the ink
having a property of liquefying only with the
application of heat energy, such as liquefying with
the application of heat energy in accordance with a
recording signal so that liquid ink is discharged,
15 or is already solidifying upon reaching the recording
medium, is also applicable in the present invention.
In such a case, the ink may be held as liquid or
solid in recesses or through holes of a porous sheet,
which is placed opposed to electricity-heat
20 converters, as described in Japanese Laid-Open Patent
Application No. 54-56847 or No. 60-71260. The most
effective method for the ink as above described in
the present invention is based on the film boiling.

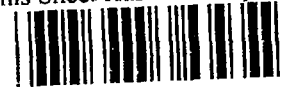
Further, a recording apparatus according to
25 the present invention may be provided integrally or
separately as the image output terminal of
information processing equipment such as a computer



1- or word processor, or the copying machine in
combination with a reader, or the facsimile apparatus
having the transmission and reception feature.

Fig. 24 is a block diagram showing a
5 schematic configuration in which a recording
apparatus of the present invention is applied to an
information processing apparatus having the features
of word processor, personal computer, facsimile
apparatus, copying machine and electronic typewriter.
10 In the figure, 201 is a control unit for controlling
the whole apparatus, comprised of a CPU such as a
microprocessor or various I/O ports, this control
unit controlling each unit by outputting or inputting
control signal or data to or from it. 202 is a
15 display unit for displaying various menus, document
information, and image data read by an image reader
207 on its display screen. 203 is a transparent,
pressure sensitive touch panel provided on the
display unit 202, which enables the entry of items or
20 coordinate values on the display unit 202 by
depressing its surface with a finger or the like.

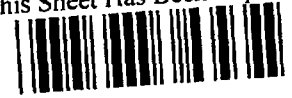
204 is a FM (Frequency Modulation) sound
source unit, which makes the FM modulation for the
music information created with a music editor, this
25 information being stored in a memory 210 or an
external storage device 212 as the digital data and
read therefrom for the FM modulation. An electrical



1 signal from the FM sound source unit 204 is converted
into an audible sound by a speaker unit 205. A
printer unit 206 consists of a recording apparatus
according to the present invention as the output
5 terminal for a word processor, a personal computer,
a facsimile apparatus, a copying machine or an
electronic typewriter.

207 is an image reader unit for
photoelectrically reading original data for the
10 input, which is provided midway on original conveying
passage to read facsimile or copying original, and
other various kinds of originals. 208 is a FAX
transmission or reception unit for FAX transmitting
original data read by the image reader unit 207 or
15 receiving and decoding the facsimile signal
transmitted thereto, this unit having an interface
facility with the outside. 209 is a telephone unit,
comprising various telephone functions, such as an
ordinary telephone function or an automatic answering
20 telephone function. 210 is a memory unit comprised
of a ROM for storing a system program, manager
programs and other application programs, character
fonts, and dictionaries, application programs or
document information loaded from the external storage
25 device 212, and a video RAM.

211 is a keyboard unit useful for inputting
document information or various kinds of command.



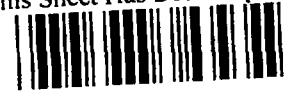
1 212 is an external storage device, which is a storage
medium consisting of a floppy disk or a hard disk,
for the storage of document information, music or
audio data, and user's application programs.

5 Fig. 25 is an appearance view of the
information processing apparatus as shown in Fig. 24.
In the figure, 301 is a flat panel display utilizing
liquid crystal or the like for displaying various
menus, graphic data or documents. On this display
10 301 is installed a touch panel, which enables the
entry of coordinates or item specifications by
depressing the surface of the touch panel with a
finger or the like. 302 is a handset for use when
the apparatus functions as a telephone.

15 A keyboard 303 is detachably connected via
a cord to the main body, and is used to input various
documents or data. Also, the keyboard 303 is
provided with various function keys 304. 305 is an
opening for insertion of the floppy disk.

20 307 is a sheet setting board for placing
thereon a paper to be read by the image reader unit
207, the read paper being exhausted out of the rear
side of device. In the facsimile reception, received
data is recorded by the printer.

25 It should be noted that the display unit 301
as above described may be a CRT, but is preferably a
flat panel of the liquid crystal display using a



1 ferroelectric liquid crystal, because it can be
lighter as well as more compact and thinner. When
the above-noted information processing device
functions as a personal computer or a word processor,
5 various kinds of document information input from the
keyboard 211 are processed according to a
predetermined program by the control unit 201 as
shown in Fig. 24, and output as the image to the
printer unit 206. When such information processing
10 device functions as a receiver for the facsimile
apparatus, facsimile information input from the FAX
transmission/reception unit 208 via the communication
line are received according to a predetermined
program by the control unit 201, and output to the
15 printer unit 206 as the received image.

And when it functions as a copying machine,
the original is read by the image reader unit 207,
and read original data is output via the control
unit 201 to the printer unit 206 as the copied image.
20 Note that it functions as a transmitter for the
facsimile apparatus, original data read by the image
reader unit 207 is processed for transmission
according to a predetermined program by the control
unit 201, and transmitted via the FAX
25 transmission/reception unit 208 to the communication
line. It should be noted that the above-noted
information processing device can be an integral

1 type incorporating a printer within the main body,
as shown in Fig. 26, in which its portability can
be enhanced. In the same figure, corresponding
reference numerals are affixed to the parts having
5 the same functions as those in Fig. 25.

If a recording apparatus of the present
invention is applied to the multifunctional type
information processing device as above described,
higher quality recording image can be obtained so
10 that the functions of the information processing
device can be further enhanced.

As above described, with the present
invention, the image excellent in gradation and
resolution and with reduced graininess can be
15 obtained, and a compact, inexpensive ink jet
recording apparatus can be provided.

Further, this recording apparatus can perform
the recording without any decrease in the speed when
recording the document, graphic and listing image.

20

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1- WHAT IS CLAIMED IS:

1. An ink jet recording apparatus which performs the recording by discharging the ink onto the recording medium in accordance with the recording data, characterized by comprising:

a mounting portion for exchangeably mounting either a first recording means for discharging a single kind of ink or a second recording means capable of discharging a plurality of kinds of inks;

discriminating means for discriminating whether recording means to be mounted on said mounting portion is said first recording means or said second recording means; and

recording control changing means for changing the recording control in accordance with said discriminating means.

2. An ink jet recording apparatus according to claim 1, wherein said second recording means is capable of discharging a plurality of inks of the same type color and having different dye densities.

3. An ink jet recording apparatus according to claim 1, wherein said first recording means and said second recording means have the discharge orifice arrays each composed of a plurality of discharge orifices.



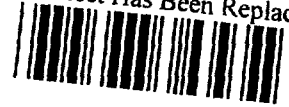
1 4. An ink jet recording apparatus according
to claim 3, wherein said second recording means has
said discharge orifice arrays separately in plural
sections, corresponding to said plurality of kinds of
5 inks.

 5. An ink jet recording apparatus according
to claim 1, wherein said first recording means and
said second recording means have discriminated means,
10 said discriminating means making a discrimination
with said discriminated means.

 6. An ink jet recording apparatus according
to claim 5, wherein said discriminated means is a
15 plurality of pin members provided at contact points
when said first recording means and said second
recording means are mounted on said mounting portion.

 7. An ink jet recording apparatus according
20 to claim 5, wherein said discriminated means is an
electrically conductive or non-electrically
conductive member, and said discriminating means
discriminates the type of said recording means by
detecting the conductivity of said discriminated
25 means.

 8. An ink jet recording apparatus according



1 to claim 1, further comprising:

ink supply means to be exchangeably mounted
on said mounting portion in accordance with the type
of recording means mounted on said mounting portion;

5 wherein said discriminating means makes a
discrimination whether recording means to be mounted
on said mounting portion is said first recording
means or said second recording means by detecting
the type of said ink supply means.

10

9. An ink jet recording apparatus according
to claim 8, wherein said ink supply means has
discriminated means in accordance with the type of
corresponding recording means, said discriminating
15 means making a discrimination for recording means by
detecting said discriminated means.

10. An ink jet recording apparatus according
to claim 9, wherein said discriminated means is a
20 marking in accordance with corresponding recording
means.

11. An ink jet recording apparatus according
to claim 1, further comprising a plurality of image
25 processing means corresponding to said first
recording means and said second recording means,
respectively, wherein said recording control changing



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1 means changes said image processing means in
accordance with said discriminating means.

12. An ink jet recording apparatus according
5 to claim 11, wherein said second recording means is
capable of discharging a plurality of inks of the
same type color and having different dye densities.

13. An ink jet recording apparatus according
10 to claim 12, wherein said plurality of image
processing means consists of a first table
corresponding to said first recording means for
determining the discharging of the ink in accordance
with the density of the image to be recorded, and a
15 second table corresponding to said second recording
means for determining the discharging of said
plurality of inks having different dye densities in
accordance with the density of the image to be
recorded, and said recording control changing means
20 changes said first table and said second table in
accordance with said discriminating means.

14. An ink jet recording apparatus according
to claim 1, wherein said recording means has heat
25 energy generating means for giving heat energy to the
ink, and discharges the ink by the use of said heat
energy.



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1 15. An ink jet recording apparatus according
to claim 14, wherein said recording means causes a
state change in the ink by the use of the heat energy
generated by said heat energy generating means, and
5 discharges the ink owing to a pressure based on said
state change.

 16. An ink jet recording apparatus according
to claim 1, further comprising reading means for
10 reading the original image.

 17. An ink jet recording apparatus according
to claim 1, further comprising transmission and/or
reception means of image information.

15

 18. An ink jet recording apparatus according
to claim 17, further comprising reading means for
reading the original image.

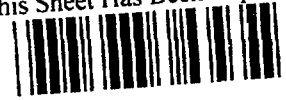
20 19. An ink jet recording apparatus according
to claim 1, further comprising input means for
inputting record data.

 20. An ink jet recording apparatus according
25 to claim 19, wherein said input means is a keyboard.

 21. An ink jet recording apparatus which



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1 performs the recording by discharging the ink onto
the recording medium in accordance with the recording
data, characterized by comprising:

5 a mounting portion for exchangeably mounting
either first recording means for discharging a single
kind of ink or second recording means capable of
discharging a plurality of kinds of inks;

information generating means for generating
information as to whether recording means to be
10 mounted on said mounting portion is said first
recording means or said second recording means; and

recording control changing means for changing
the recording control in accordance with the
information of said information generating means.

15

22. An ink jet recording apparatus according
to claim 21, wherein said second recording means is
capable of discharging a plurality of inks of the
same type color and having different dye densities.

20

23. An ink jet recording apparatus according
to claim 21, wherein said first recording means and
said second recording means have the discharge
orifice arrays each composed of a plurality of
25 discharge orifices.

24. An ink jet recording apparatus according



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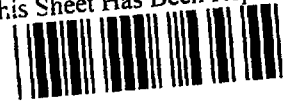
1 to claim 23, wherein said second recording means has
said discharge orifice arrays separately in plural
sections, corresponding to said plurality of kinds
of inks.

5

25. An ink jet recording apparatus according
to claim 21, further comprising a plurality of image
processing means corresponding to said first
recording means and said second recording means,
10 respectively, wherein said recording control changing
means changes said image processing means in
accordance with information generated by said
information generating means.

15 26. An ink jet recording apparatus according
to claim 25, wherein said second recording means is
capable of discharging a plurality of inks of the
same type color and having different dye densities.

20 27. An ink jet recording apparatus according
to claim 26, wherein said plurality of image
processing means consists of a first table
corresponding to said first recording means for
determining the discharging of the ink in accordance
25 with the density of the image to be recorded, and a
second table corresponding to said second recording
means for determining the discharging of said



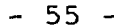
1 plurality of inks having different dye densities in
accordance with the density of the image to be
recorded, and said recording control changing means
changes said first table and said second table in
5 accordance with said information.

28. An ink jet recording apparatus according
to claim 21, wherein said information generating
means is a dip switch provided on the ink jet
10 recording apparatus.

29. An ink jet recording apparatus according
to claim 21, wherein said information generating
means is an operation panel provided on the ink jet
15 recording apparatus.

30. An ink jet recording apparatus according
to claim 21, wherein said information generating
means generates said information based on an
20 instruction from host means connected to the ink
jet recording apparatus.

31. An ink jet recording apparatus according
to claim 21, wherein said recording means has heat
25 energy generating means for supplying heat energy
to the ink, and discharges the ink by the use of said
heat energy.



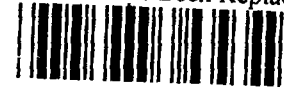
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1 35. An ink jet recording method according
to claim 34, further including image processing steps
for performing an image processing corresponding to
recording means to be mounted in accordance with the
5 image to be recorded, wherein said plurality of image
processing steps determine the discharging of the
ink for the recording means, based on a first table
corresponding to said first recording means for
determining the discharging of the ink in accordance
10 with the density of the image to be recorded, and a
second table corresponding to said second recording
means for determining the discharging of said
plurality of inks having different dye densities
in accordance with the density of the image to be
15 recorded, and wherein said recording control changing
means changes said first table and said second table
in accordance with said discrimination step.

20 36. An ink jet recording method according
to claim 33, wherein said first recording means and
said second recording means have discriminated means,
said discrimination step making a discrimination by
said discriminated means.

25 37. An ink jet recording method according
to claim 33, wherein ink supply means is exchangeably
mounted on said mounting portion in accordance with



1 the type of recording means to be mounted on said
mounting portion, and said discrimination step makes
a discrimination as to whether recording means to
be mounted on said mounting portion is said first
5 recording means or said second recording means by
detecting the type of said ink supply means.

38. An ink jet recording method according
to claim 37, wherein said ink supply means has a
10 marking in accordance with the type of corresponding
recording means, and said discrimination step makes
a discrimination by detecting said marking.

39. An ink jet recording method according
15 to claim 33, wherein said recording means has heat
energy generating means for supplying heat energy
to the ink, and discharges the ink by the use of
said heat energy.

20 40. An ink jet recording method according
to claim 39, wherein said recording means causes a
state change in the ink by the use of the heat energy
generated by said heat energy generating means, and
discharges the ink owing to a pressure based on said
25 state change.

41. An ink jet recording method which



1 performs the recording by discharging the ink onto
the recording medium in accordance with the recording
data by using recording means mounted on a mounting
portion for exchangeably mounting either first
5 recording means for discharging a single kind of
ink or second recording means capable of discharging
a plurality of kinds of inks, characterized by
including:

an information generation step of generating
10 information as to whether recording means to be
mounted on said mounting portion is said first
recording means or said second recording means; and

a recording control changing step of changing
the recording control in accordance with the
15 information of said information generation step.

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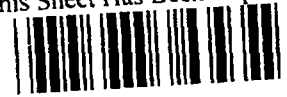
42. An ink jet head for a recording apparatus which performs the recording by discharging the ink onto the recording medium in accordance with recording data, including a carriage mounting portion for exchangeably mounting said head, discriminating means for discriminating whether recording means to be mounted on said mounting portion is of a type for discharging a single kind of ink or of a type for discharging a plurality of kinds of inks; and recording control changing means for changing the recording control in accordance with said discriminating means, said head having discriminated means readable by said discriminating means and being of a kind capable of discharging a single first kind of ink or alternatively of a second kind capable of discharging a plurality of inks of the same type color and having different dye densities.

43. An ink jet head as claimed in claim 42, characterised in that said discriminated means is a plurality of members provided at contact points for engagement with cooperating members on said mounting portion.

44. An ink jet head as claimed in claim 42 or 43, characterised in that said discriminated means is an electrically conductive or non-electrically conductive



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- member, whereby said discriminating means discriminates the type of said recording means by detecting the conductivity of said discriminated means.
- 5 45. An ink jet head as claimed in claim 42, 43 or 44, characterised in that heat energy generating means are provided for giving heat energy to the ink, whereby the ink is discharged by the use of said heat energy.

AN INK JET RECORDING APPARATUS CAPABLE OF ALTERING THE RECORDING CONTROL
AND AN INK JET RECORDING METHOD FOR SAID APPARATUS

1. ABSTRACT OF THE DISCLOSURE

The present invention aims to provide an
ink jet recording apparatus and an ink jet recording
method which can produce an image excellent in
gradation and resolution and allows the image for
text, graphics and listing to be obtained at high
speed and good quality. The present invention
allows a desired recorded image to be obtained by
exchangeably comprising an ink jet unit for
producing the image excellent in gradation, and an
ink jet unit having higher character quality and
capable of recording at high speed, and effecting
recording control in accordance with the ink jet
unit.

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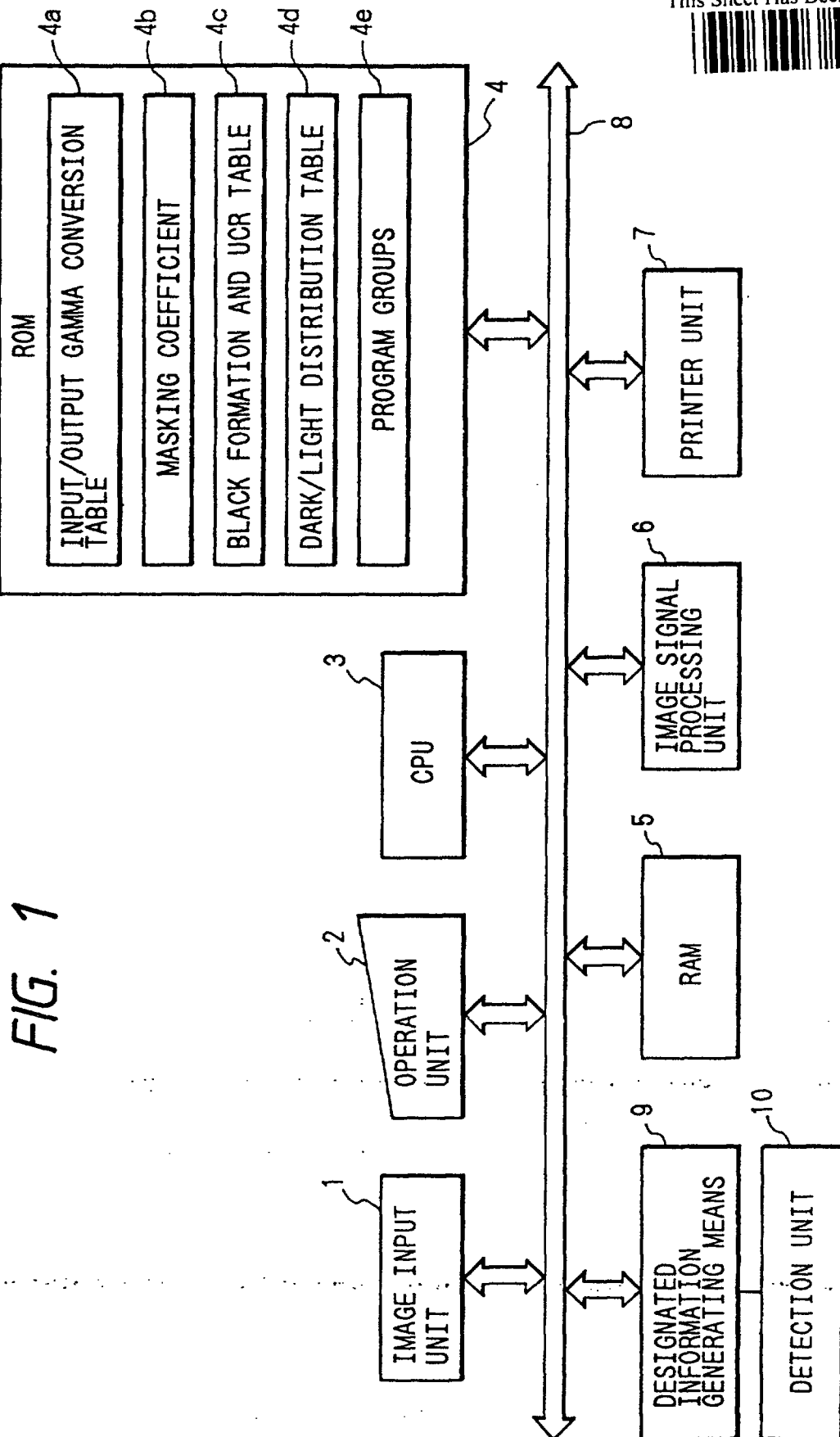


FIG. 2

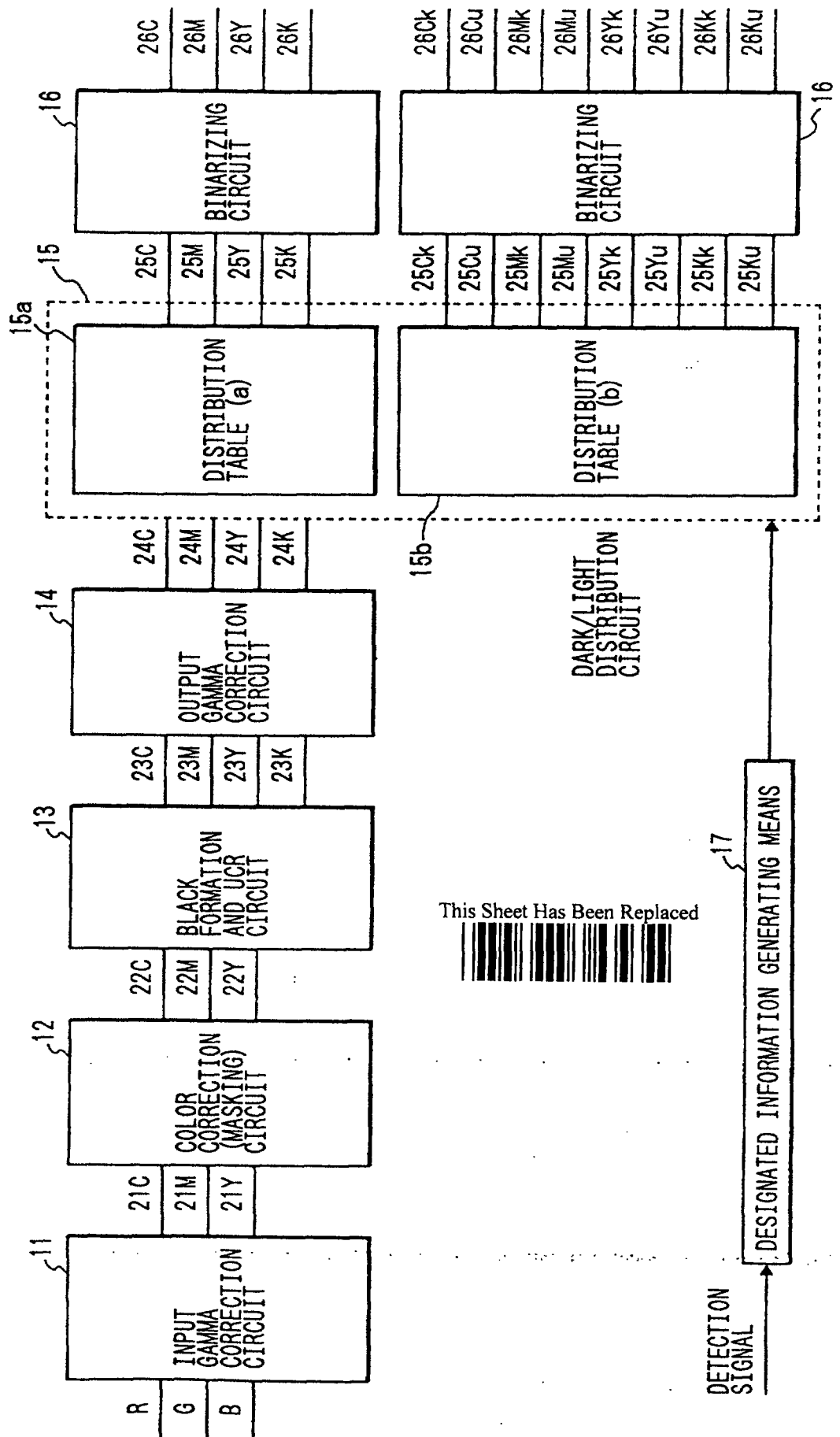
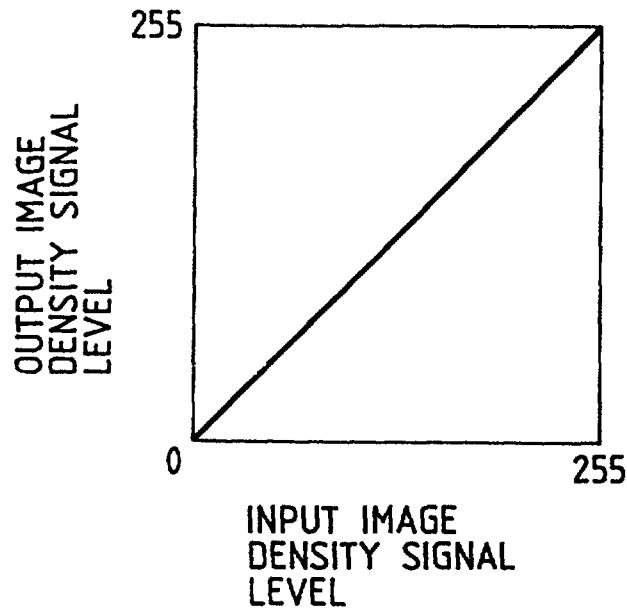


FIG. 3A



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FIG. 3B

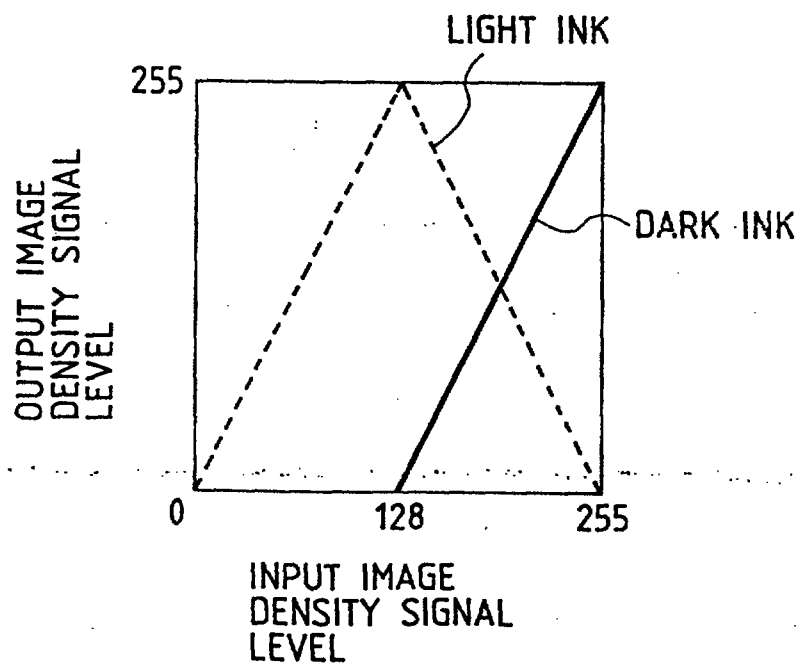
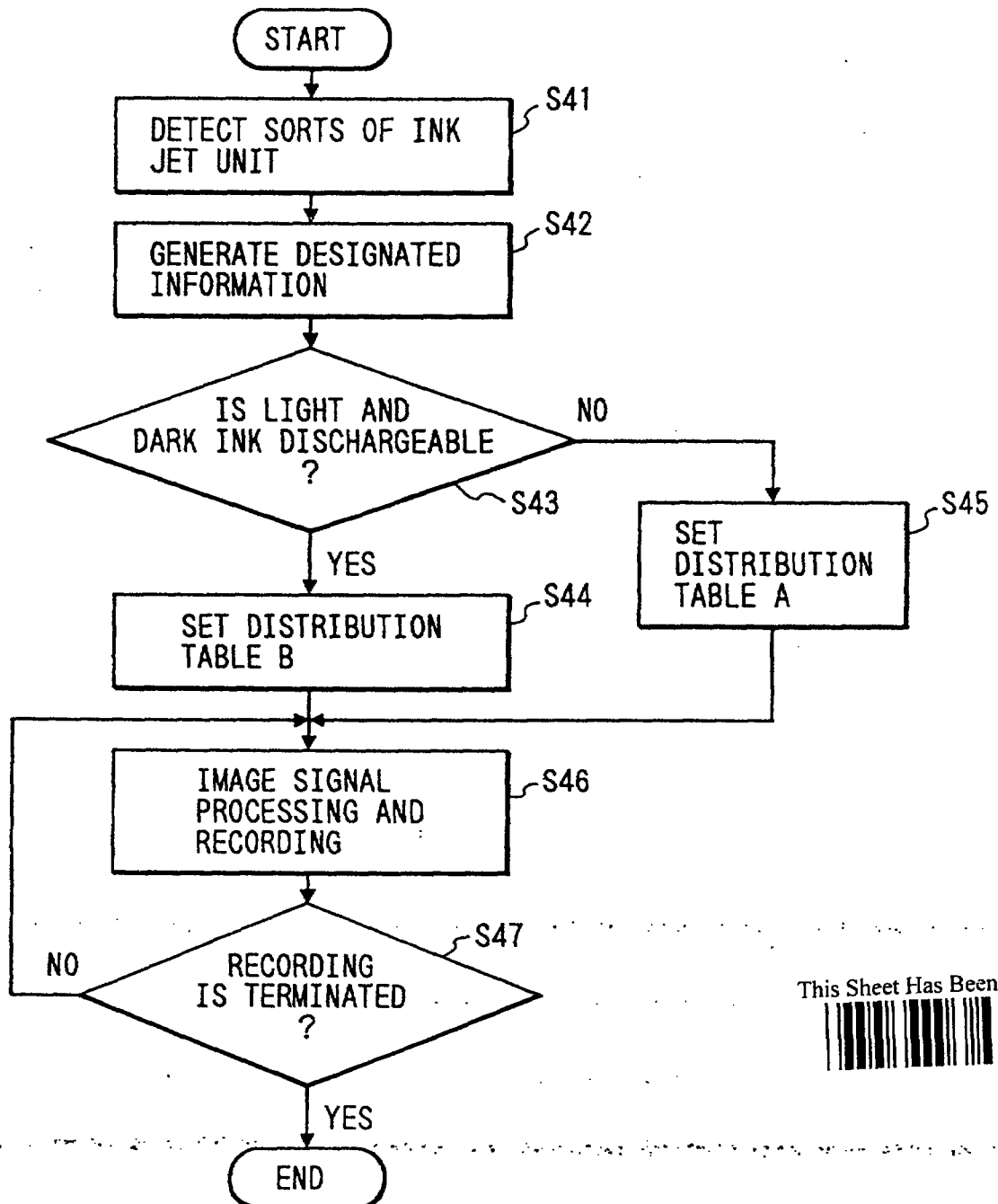


FIG. 4



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FIG. 6

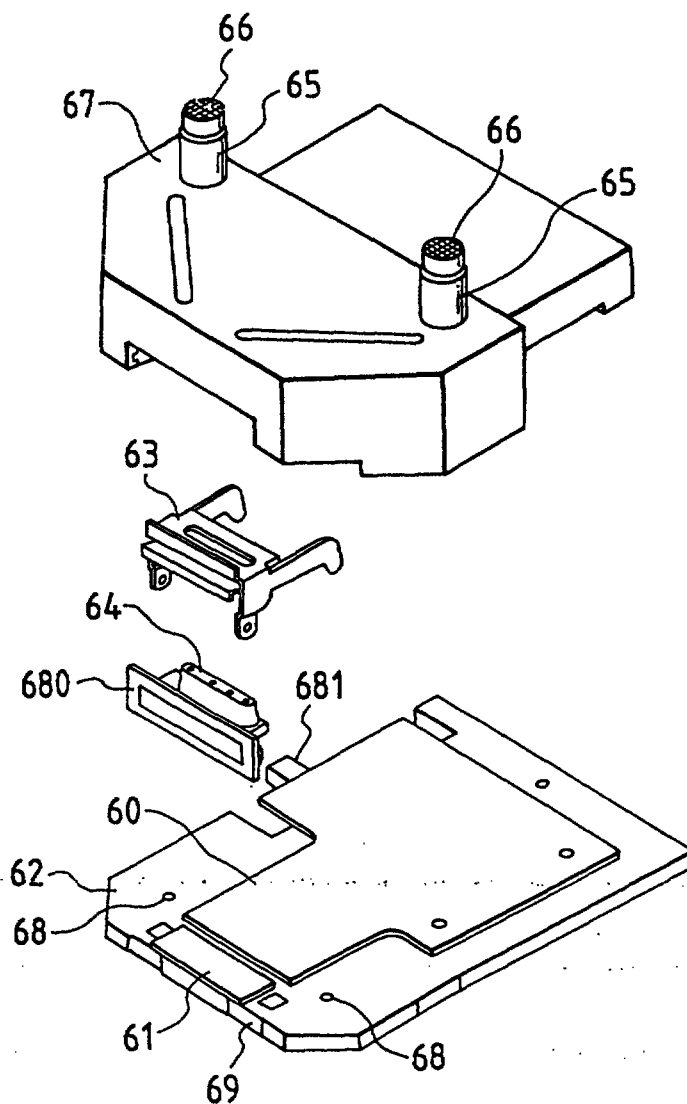


FIG. 7

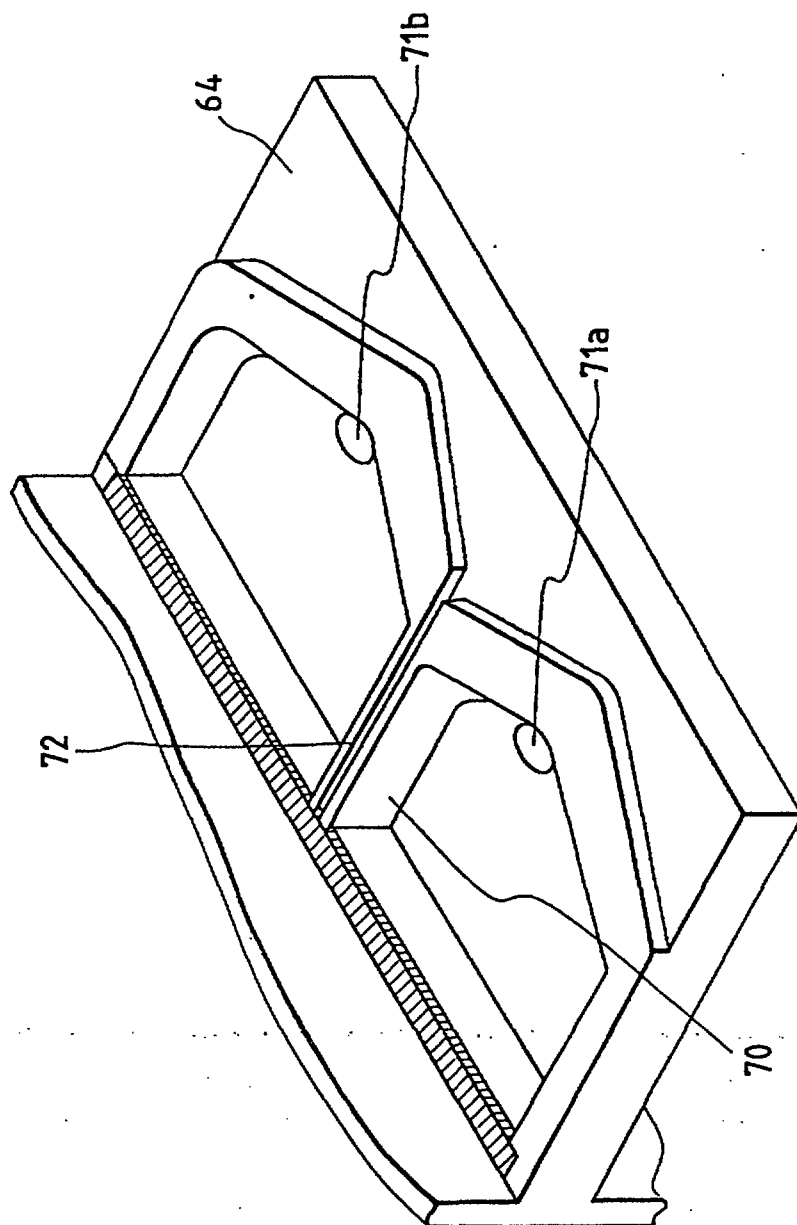


FIG. 8

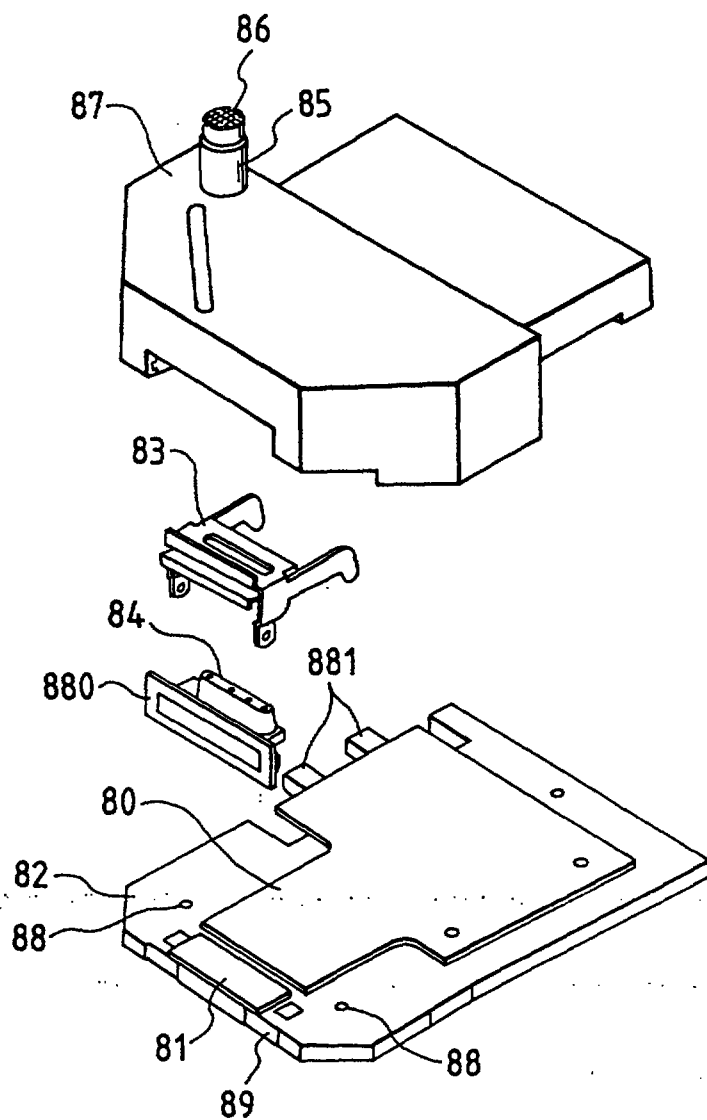


FIG. 9

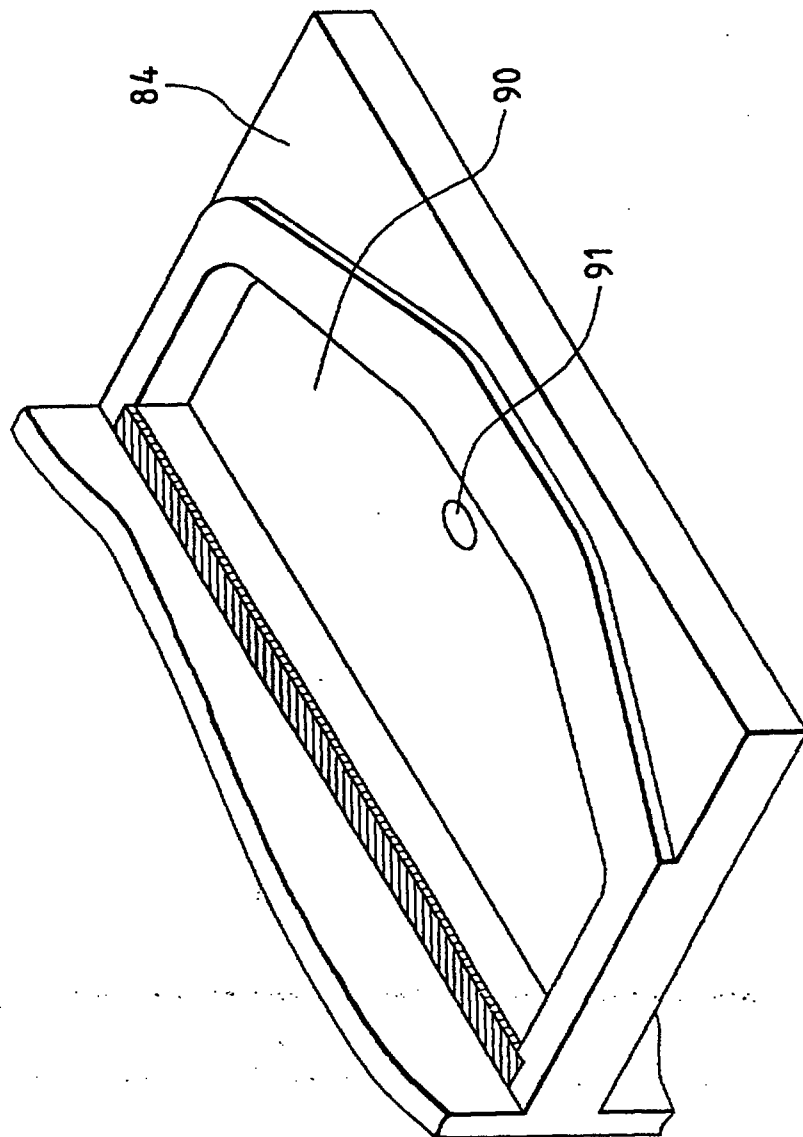


FIG. 10

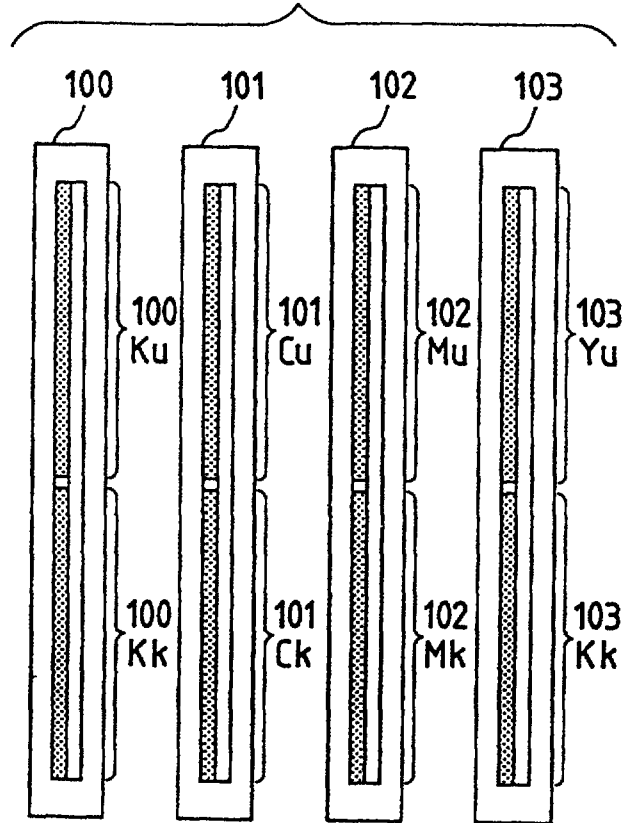
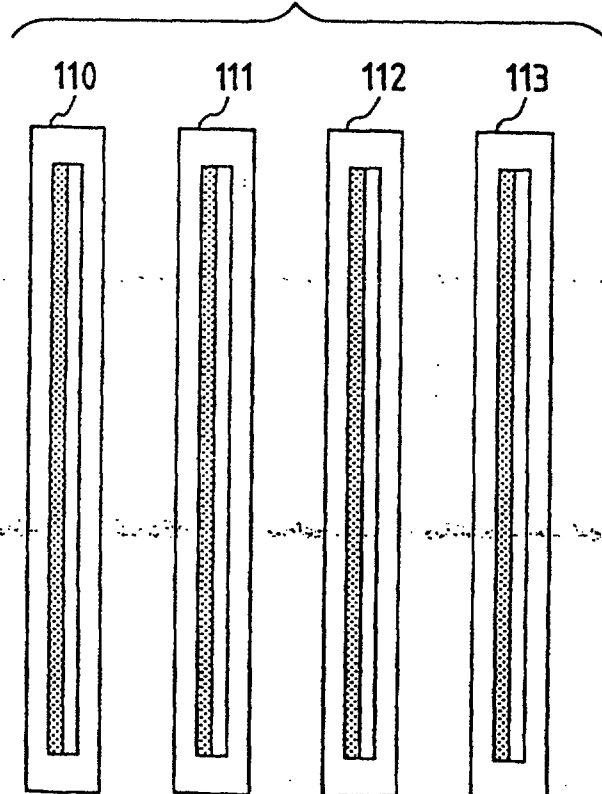


FIG. 11



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FIG. 12

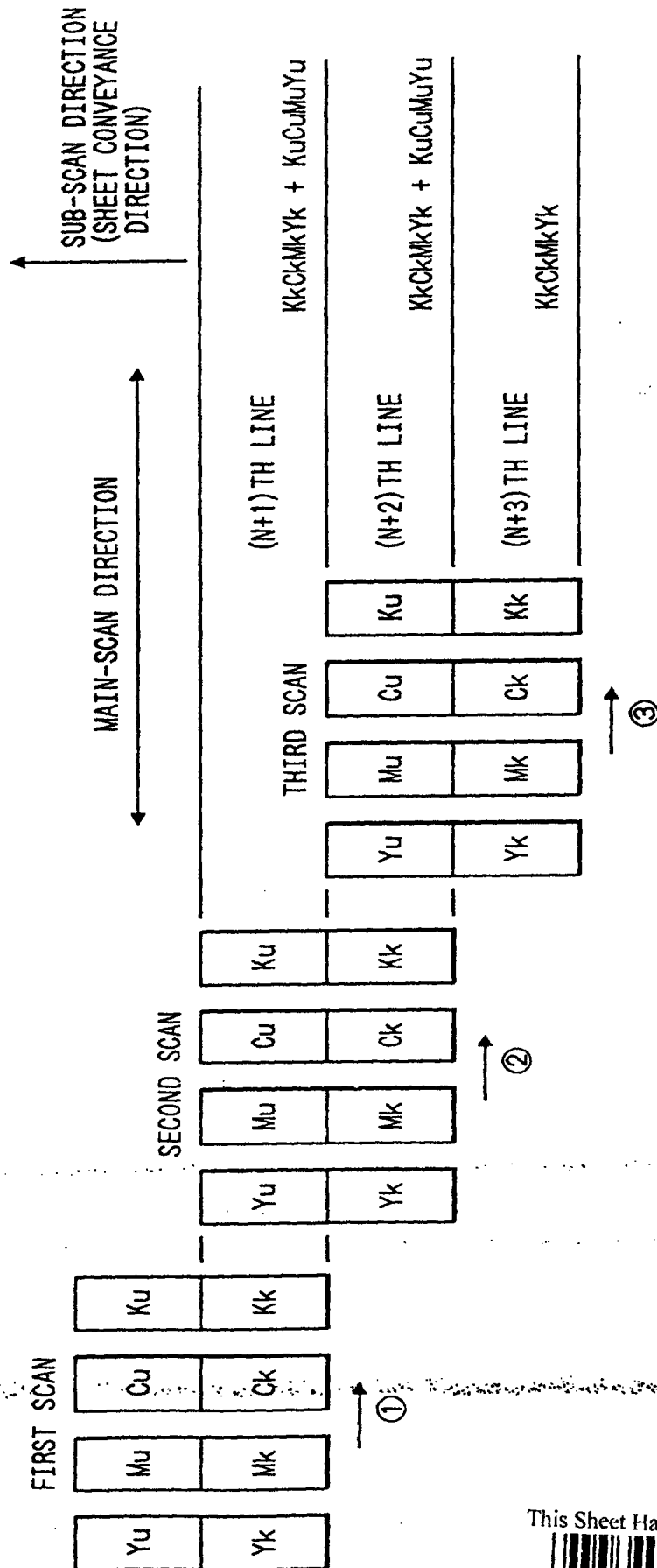


FIG. 13

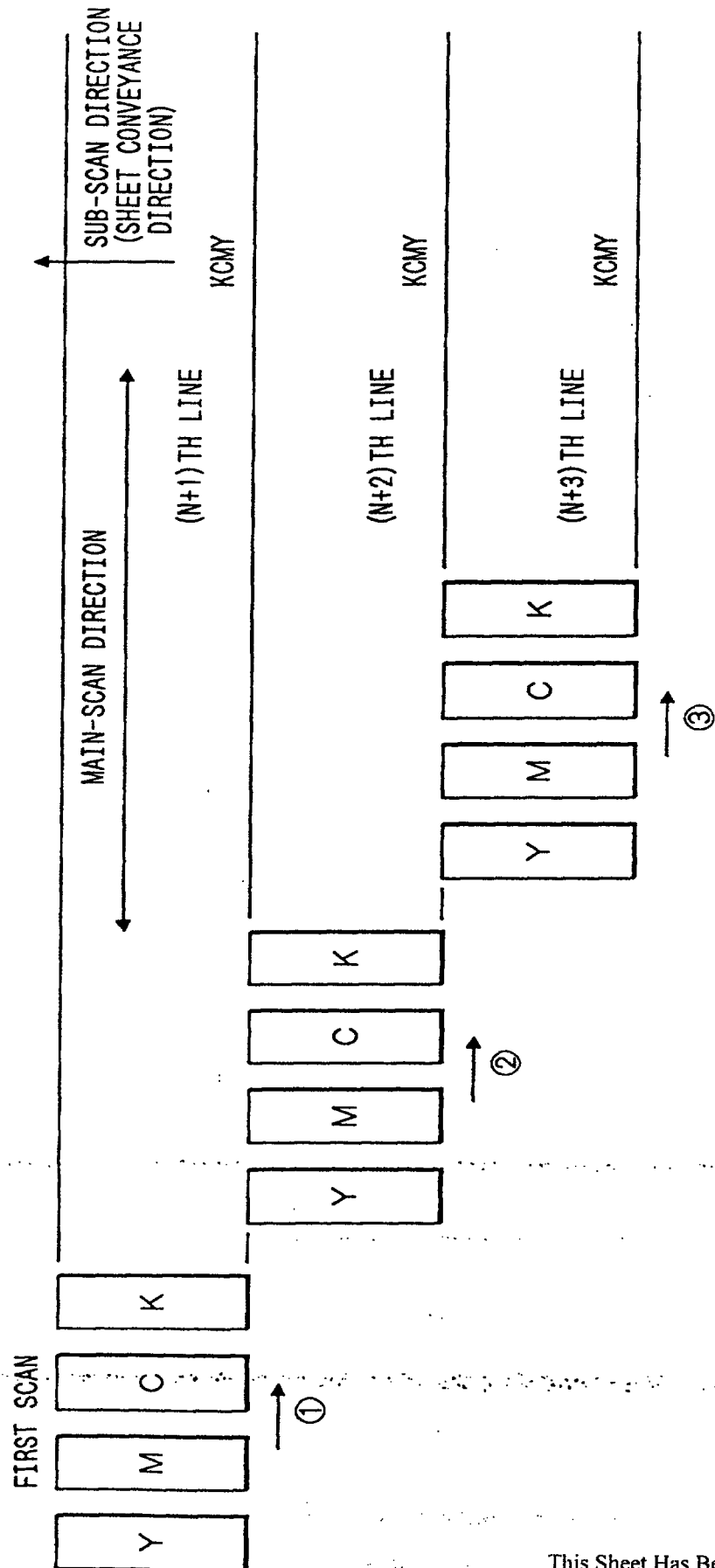


FIG. 14A

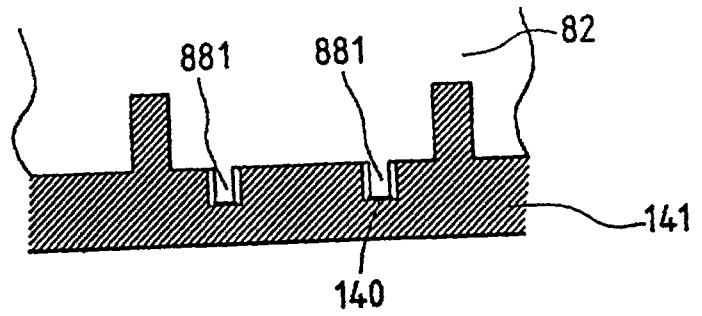


FIG. 14B

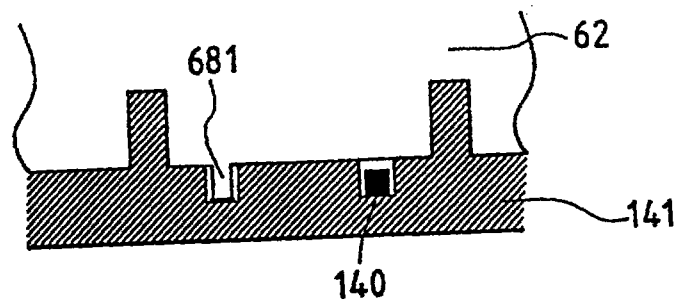


FIG. 16

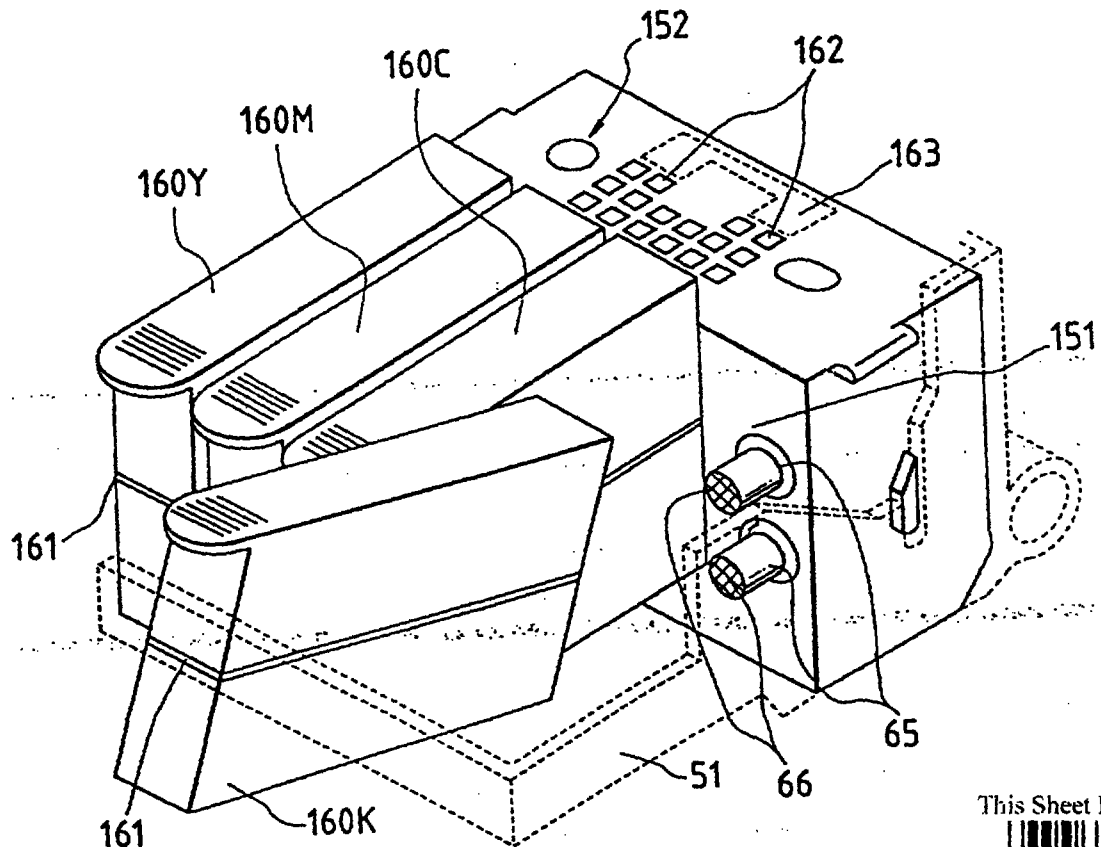


FIG. 15

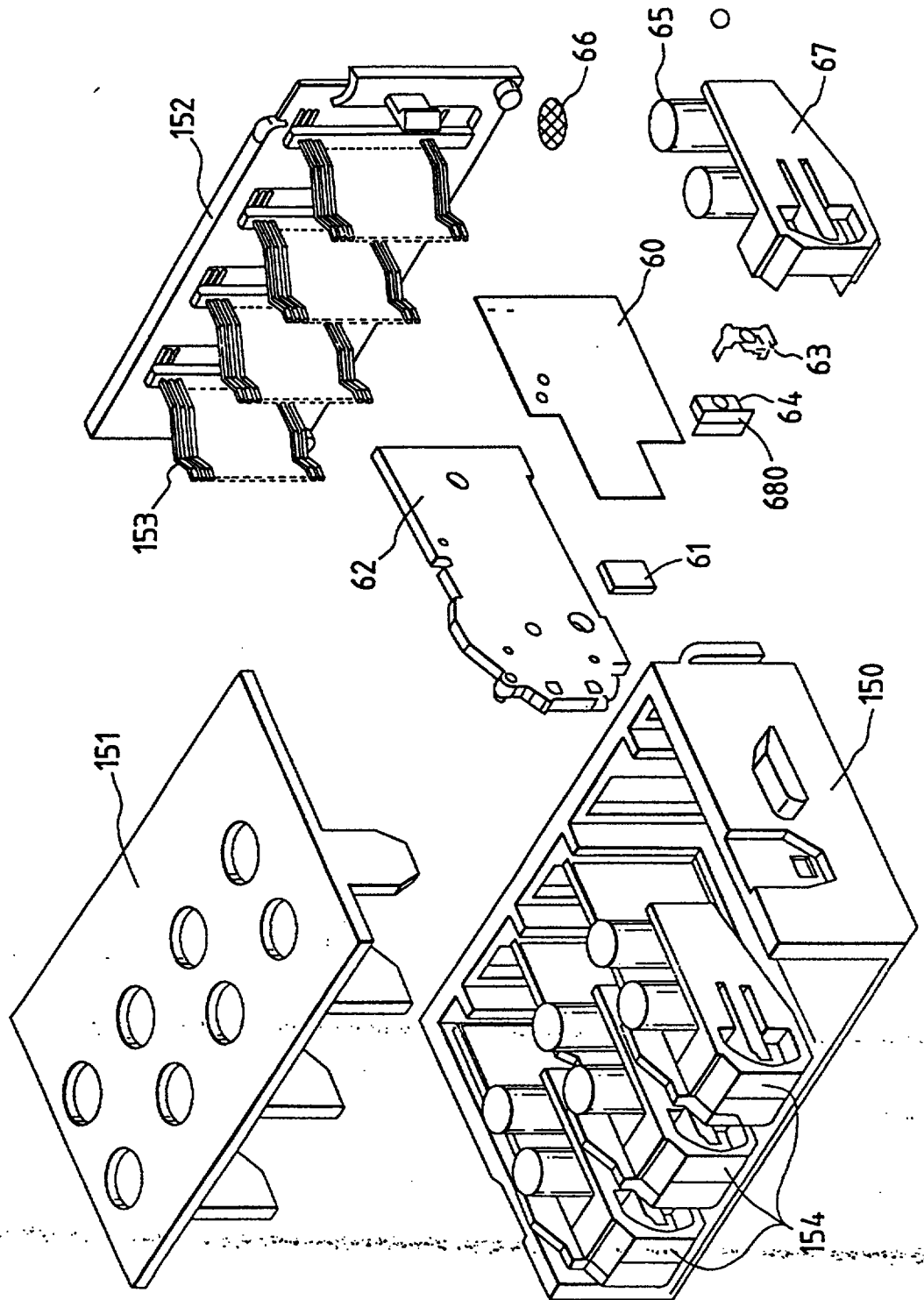


FIG. 17

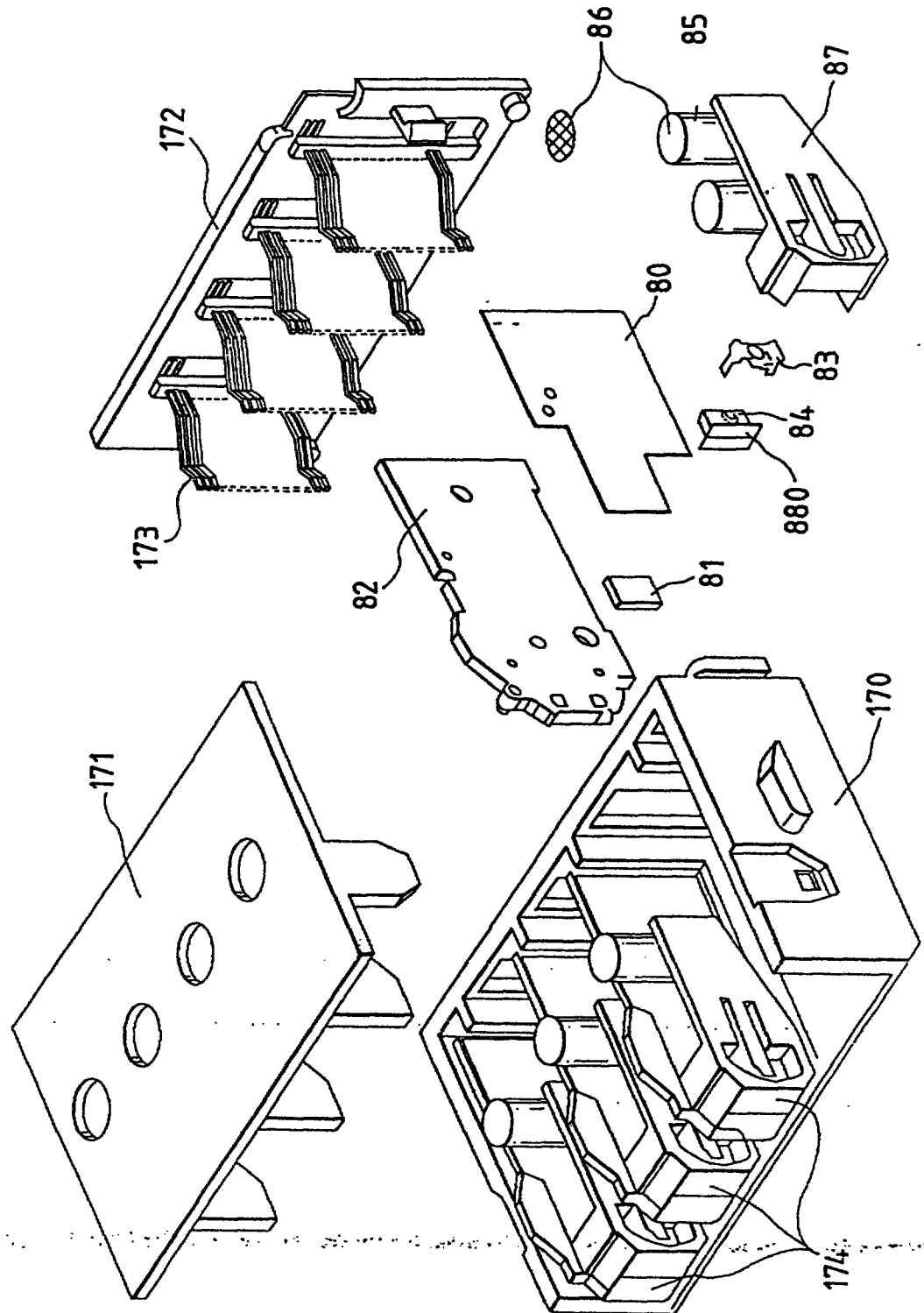


FIG. 18

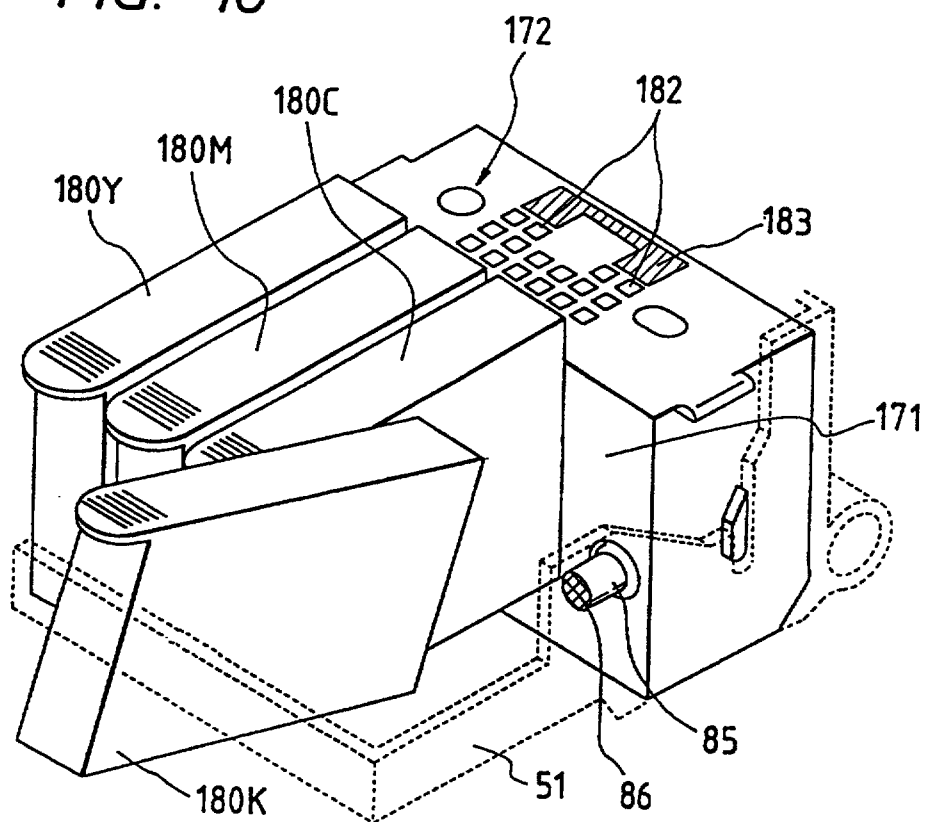


FIG. 19

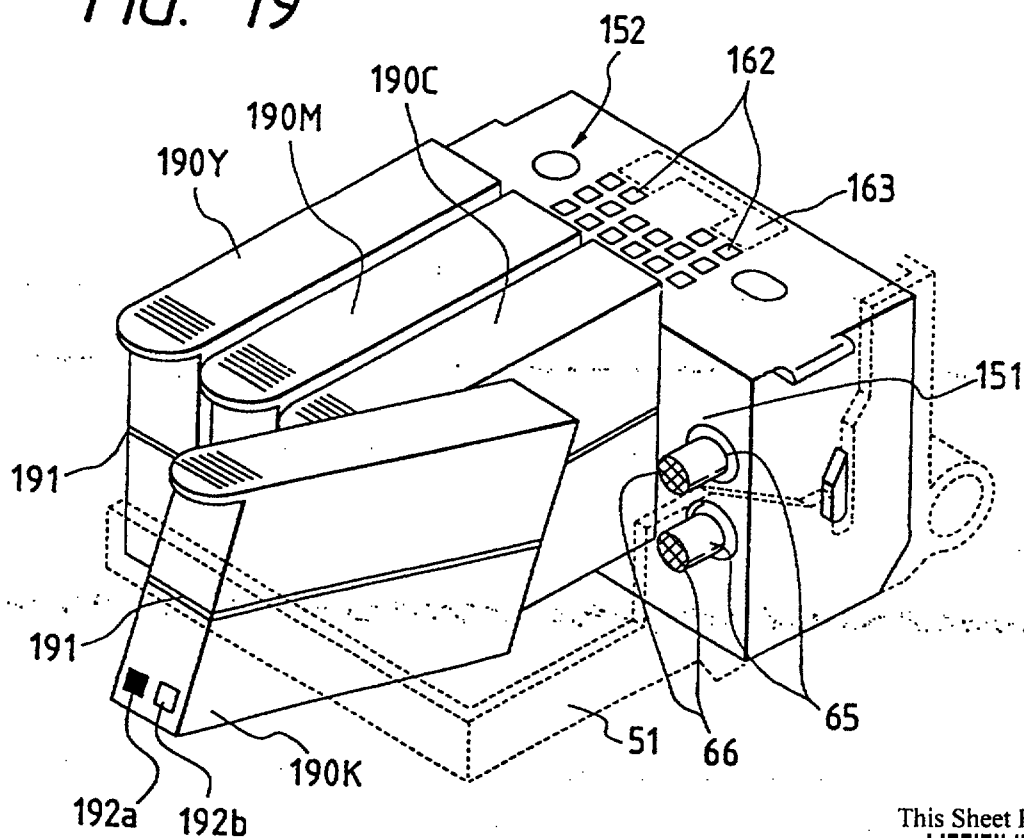


FIG. 20

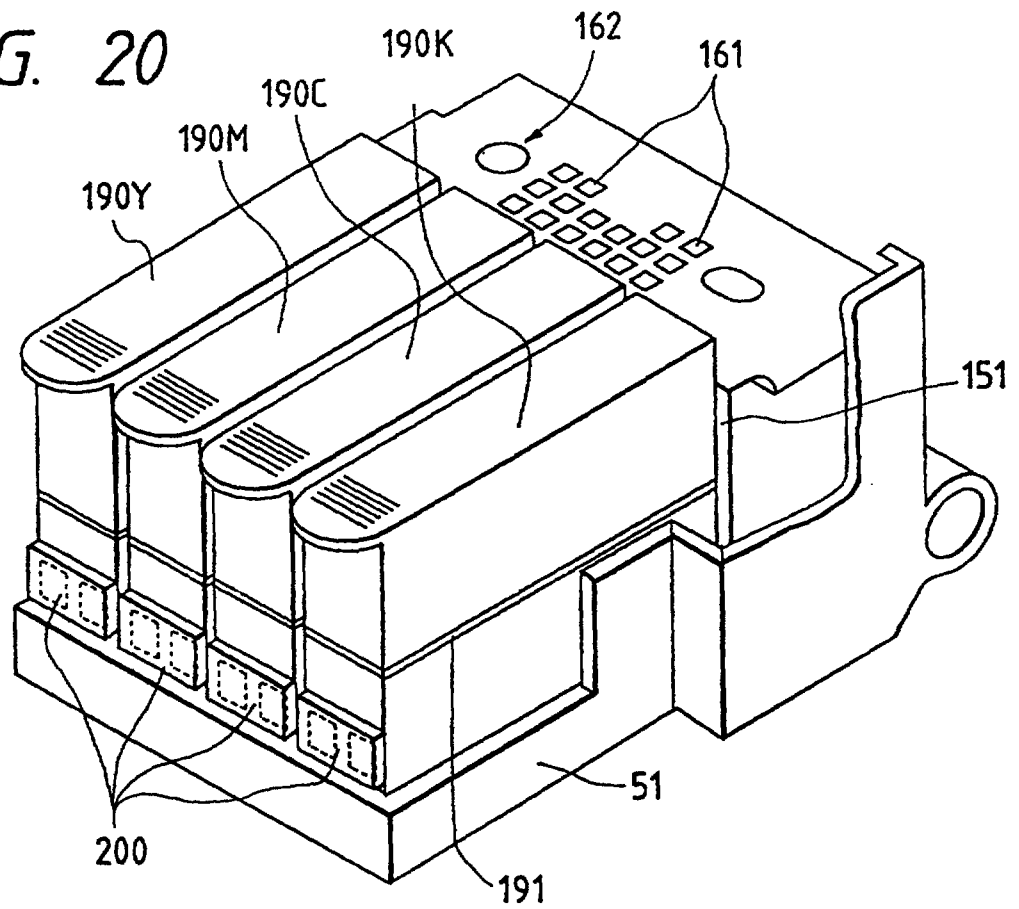


FIG. 21

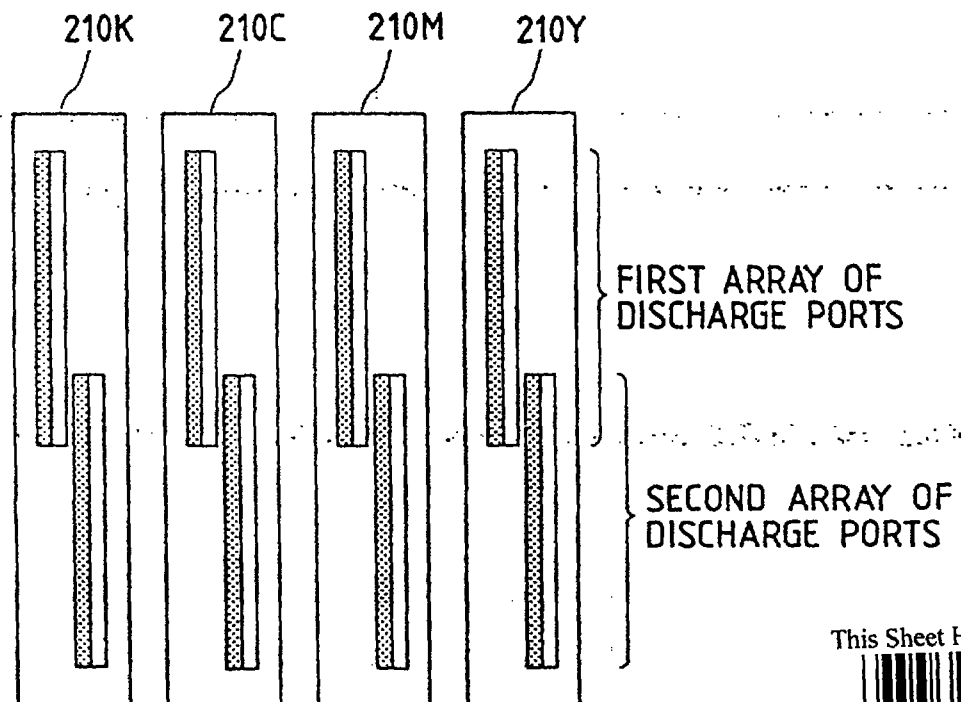
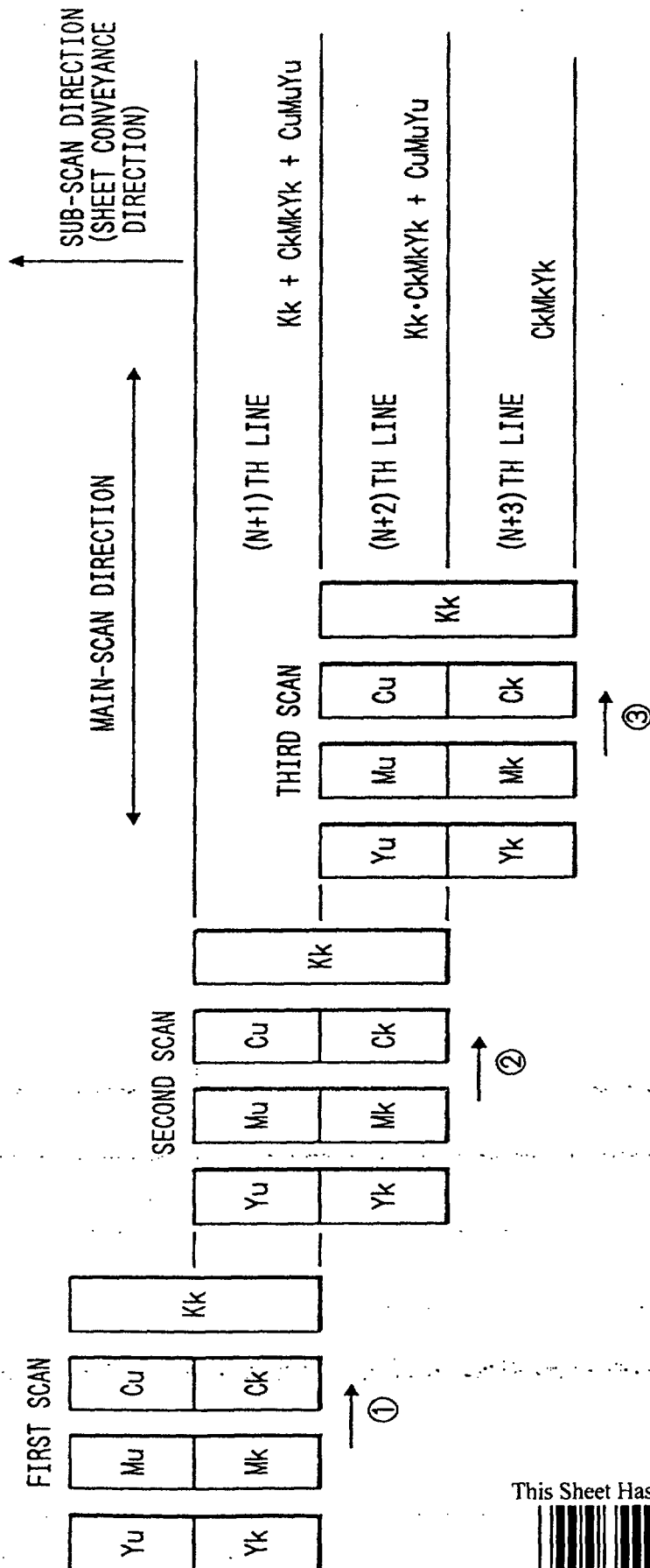


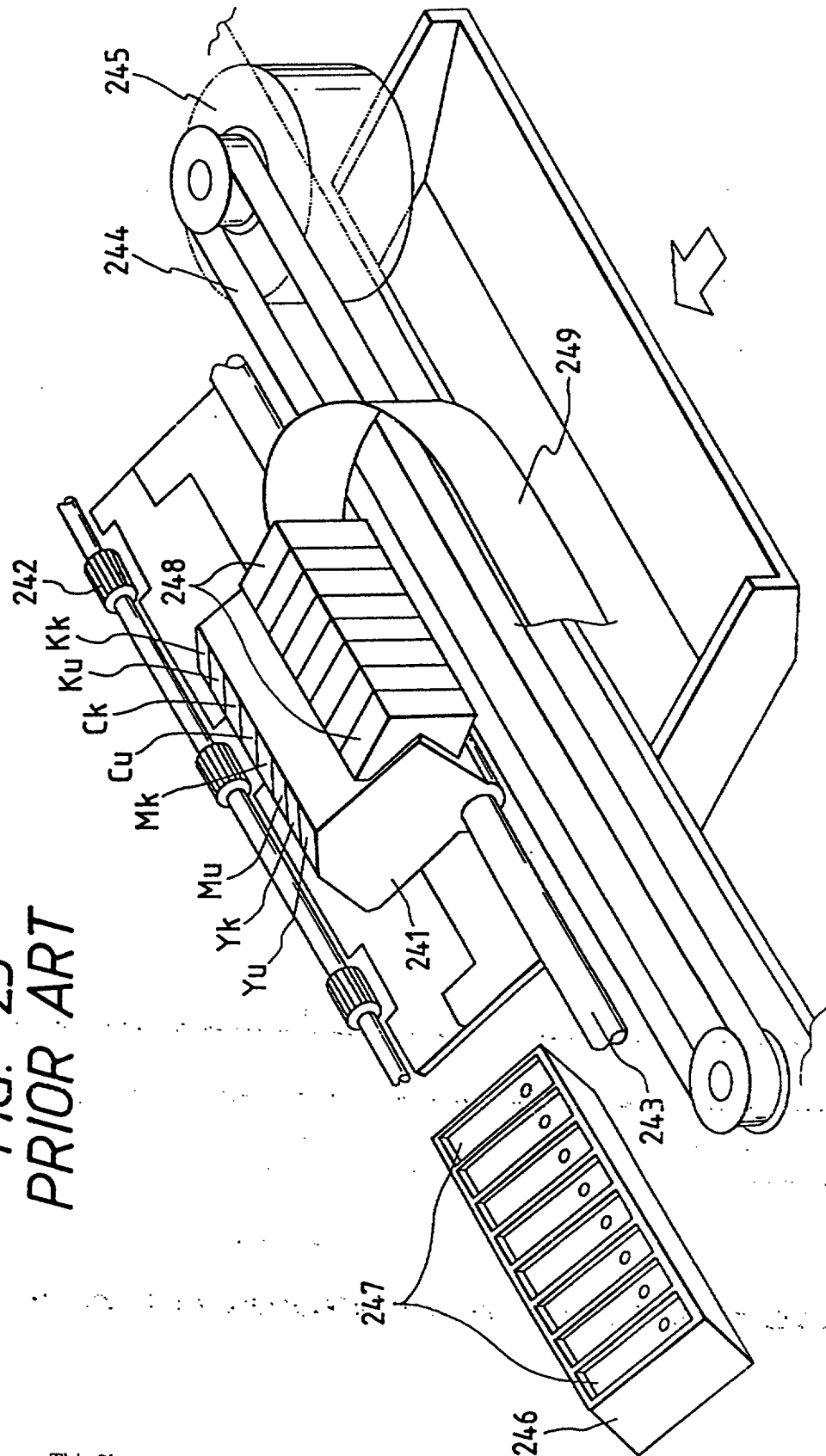
FIG. 22



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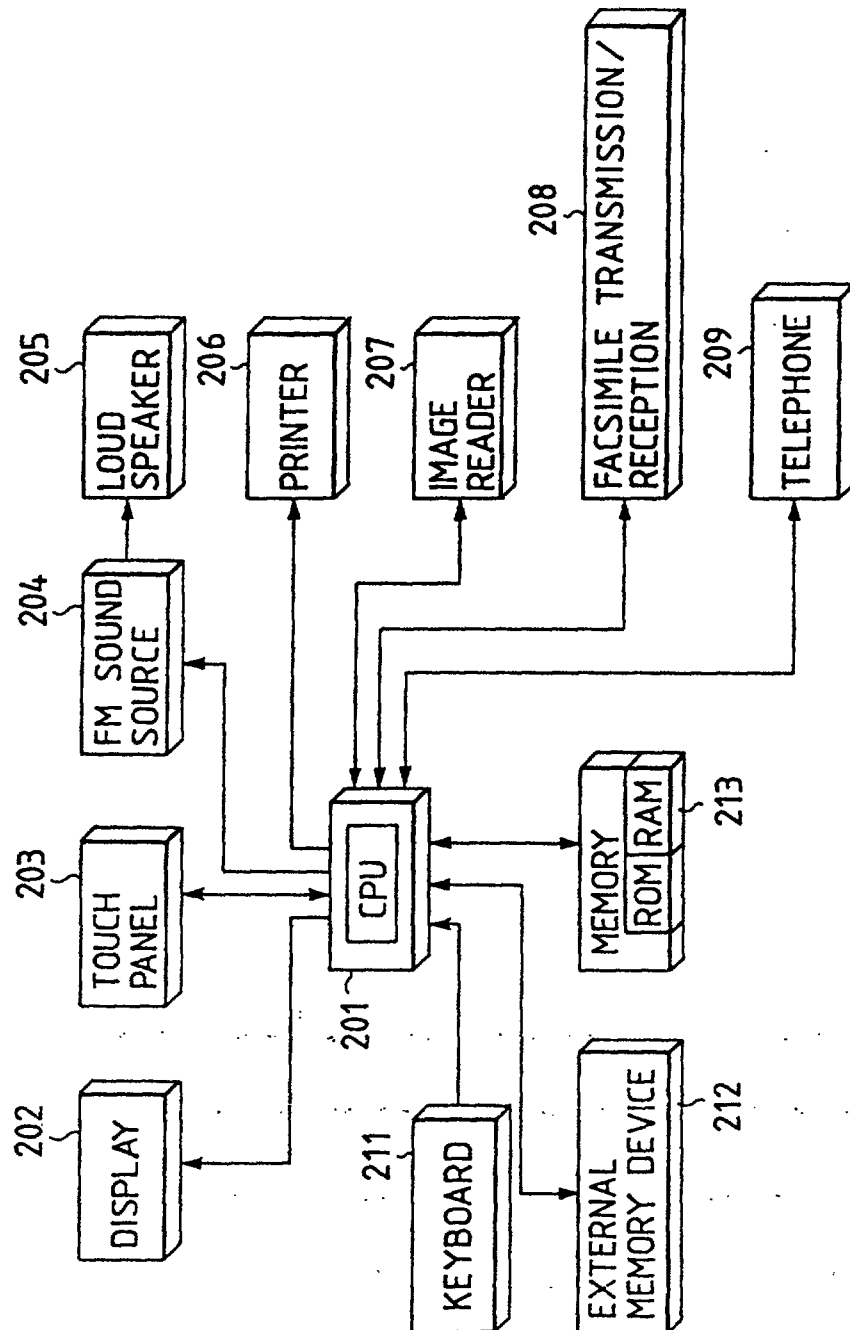
FIG. 23
PRIOR ART



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FIG. 24



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FIG. 25

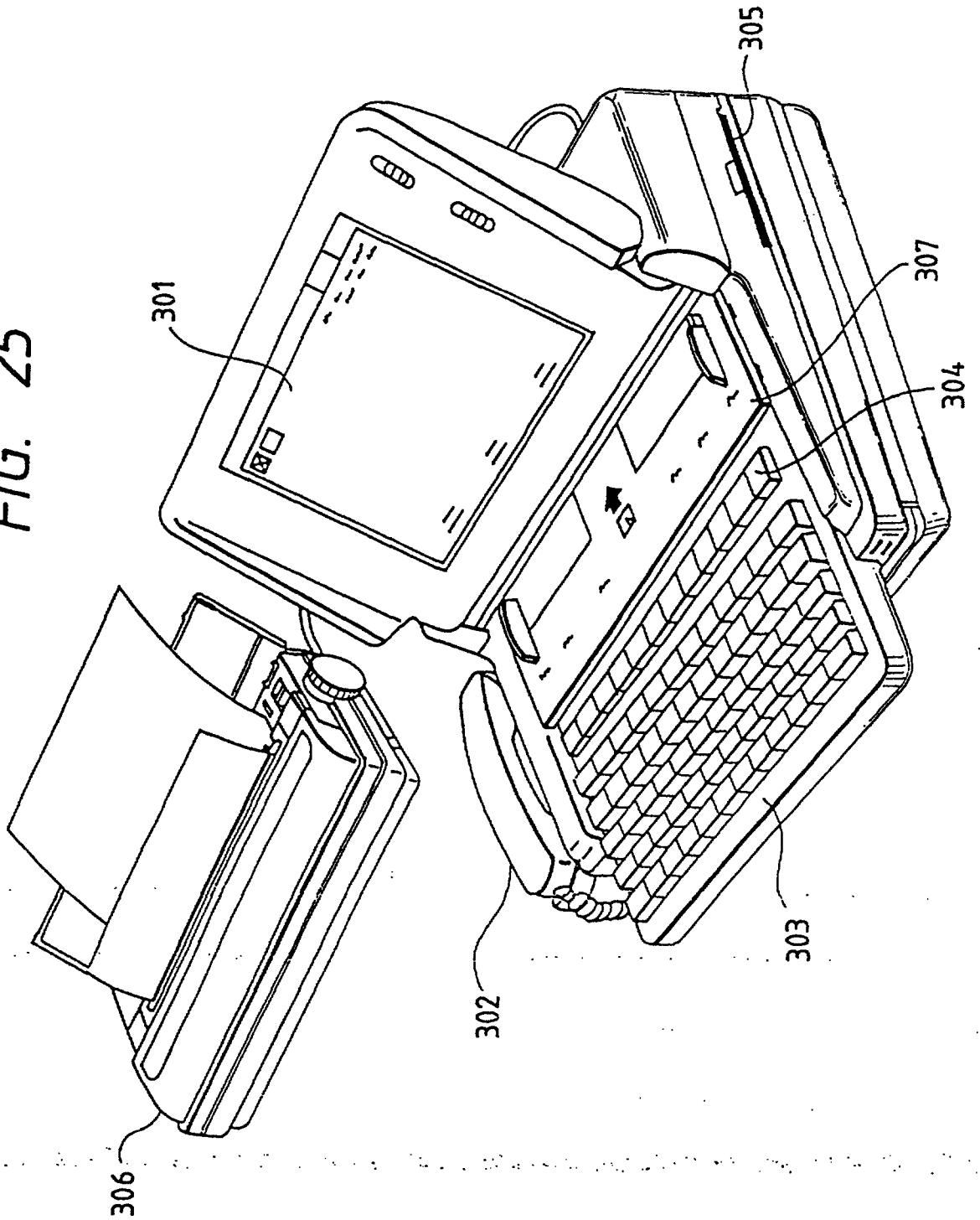
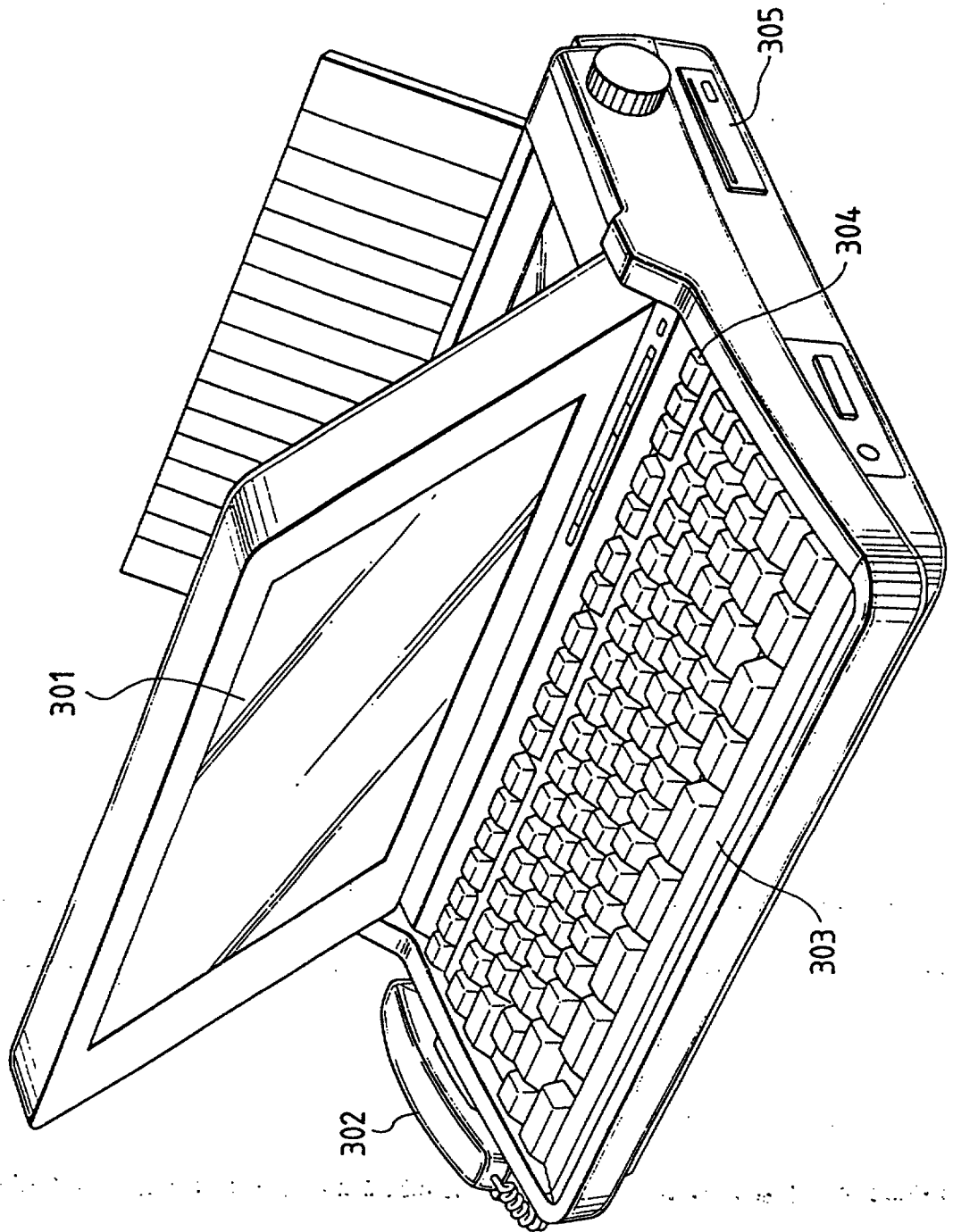


FIG. 26



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✓

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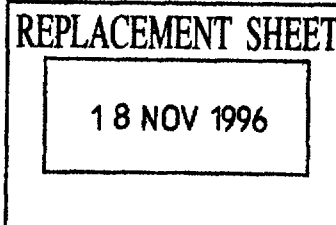
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METHOD AND APPARATUS FOR INK JET RECORDING



5 BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an ink jet recording apparatus and an ink jet recording method capable of recording the half-tone image in such a manner as to change the number of recording dots per unit area, as well as recorded matters.

Related Background Art

In the conventional ink jet recording methods, the recording is performed in such a manner as to discharge the ink through a plurality of discharge orifices formed in a recording head in accordance with data signal and attach ink droplets onto the recording medium such as a paper. This recording method has been utilized for printers, facsimile apparatuses, or copying machines, for example.

For the above apparatuses, there is a method involving the use of electricity-heat energy converters in which heat generating elements (electrothermal energy converters or electricity-heat energy converters) are provided in the neighborhood of discharge orifices to discharge the ink and apply

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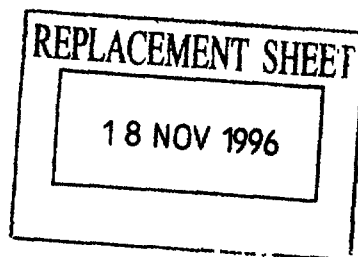
- 2 -

1 an electrical signal to those heat generating
elements to heat the ink locally, thus causing a
pressure change therein to discharge the ink through
discharge orifices, or the use of electromechanical
5 converters such as piezo-electrical elements.

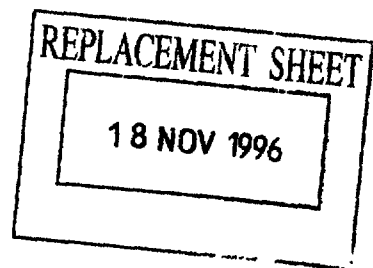
In this type of recording method, the half-
tone recording is controlled in accordance with a dot
density control method in which the half-tone is
represented by controlling the number of recording
10 dots per unit area with the recording dot of fixed
size, or a dot diameter control method in which the
half-tone is represented by controlling the size of
recording dots.

Herein, the latter dot diameter control
15 method has some restrictions because of its complex
control required to minutely change the size of
recording dot, and therefore the former dot density
control method is generally employed.

When the electricity-heat energy converters
20 are used as ink discharge means, they can be easily
manufactured and allows for the high density, and
thus the high resolution, but has the difficulty in
controlling the amount of pressure change, so that
the diameter of recording dot can not be readily
25 modulated. Hence, the dot density control method is
mainly employed for the half-tone recording with the
ink jet recording method.



1 Typical of the binarization method for the
half-tone representation for use with this dot
density control method is an organizational dither
method, but this method has a problem that the number
5 of gradations is limited by the matrix size. That
is, to increase the number of gradations requires to
increase the matrix size, but there is a problem that
if the matrix size is increased, one pixel of
recording image which is constituted of one matrix is
10 larger, thereby resulting in lower resolution. Also
another typical binarization method is a conditioned
decision type dither method such as an error
diffusion method. This is a method in which the
threshold is changed in consideration of peripheral
15 pixels around the input pixel, whereas the above-
mentioned organizational dither method is an
independent decision type dither method in which the
binarization is made using a threshold value
irrespective of the input pixel. The conditioned
20 decision type dither method represented by this error
diffusion method has the advantage that there is good
compatibility between gradation and resolution, and
that when the original image is a printed image,
there are quite less moire patterns produced in the
25 recorded image, whereas it has the drawback that the
graininess becomes conspicuous in the light part of
image, degrading the evaluation of image quality.

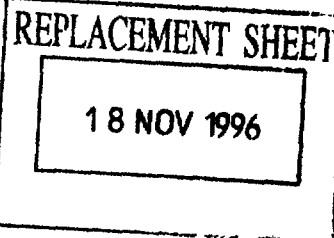


1 This problem was remarkable particularly in the
recording apparatus having low recording density.

To make the above graininess inconspicuous,
a recording method has been proposed in which two
5 recording heads for discharging the inks which are
thin and thick in the dye concentration respectively
are provided for the recording. With this method,
the portion from the light part of image to the half-
tone part has recording dots formed by the thin ink
10 in the dye concentration, while the portion from the
half-tone part to the dark part has recording dots
formed by the thick ink. The dots formed by the thin
ink in the dye concentration are light in the image
density, while the dots by the dark ink in the dye
15 concentration is dark in the image density.

Fig. 23 is a constitutional view showing the
essence of a conventional color ink jet recording
apparatus of the serial print type employing the
dark/light ink.

20 Kk is a recording head for discharging a
color ink of dark black, Ku is a recording head for
discharging a color ink of light black, Ck is a
recording head for discharging a color ink of dark
cyan, Cu is a recording head for discharging a color
25 ink of light cyan, Mk is a recording head for
discharging a color ink of dark magenta, Mu is a
recording head for discharging a color ink of light



1 magenta, Yk is a recording head for discharging a
color ink of dark yellow, and Yu is a recording head
for discharging a color ink of light yellow. Each of
the recording heads is installed a predetermined
5 distance apart on a carriage 241.

The ink is supplied to each recording head
from an ink cartridge 248 corresponding to respective
color. Also, the control signal to recording head is
provided via a flexible cable 249.

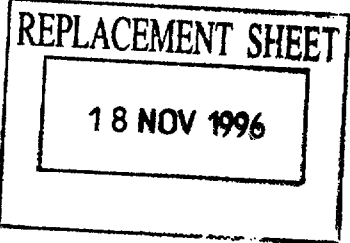
10 A recording medium composed of paper or
plastic thin plate is passed by a conveying roller
(not shown) and carried therewith by paper exhausting
rollers 242 to be fed in a direction of the arrow by
the driving of a conveying motor not shown.

15 Carriage 241 is guided and supported by means
of a guide shaft 243, and an encoder not shown.

Carriage 241 is caused to reciprocate along
the guide shaft 243 by the driving of a carriage
motor 245 via a drive belt 244.

20 The inside of an ink discharge orifice of the
recording head or a liquid channel through which the
ink flows is provided with a heat generating element
(electricity-heat energy converter) for generating
the heat energy for use in discharging the ink.

25 In accordance with the read timing of
encoder, the above-mentioned heat generating elements
are driven on the basis of a recording signal to



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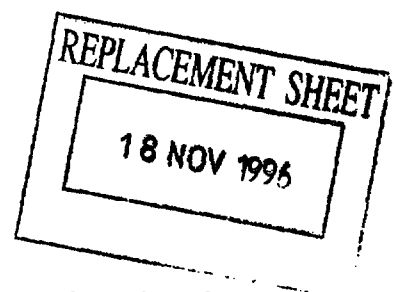
1 discharge ink droplets onto the recording medium in
the order of dark black, light black, dark cyan,
light cyan, dark magenta, light magenta, dark yellow,
and light yellow, thereby forming an image.

5 At a home position of carriage selected out
of the recording area, a recovery unit 246 having a
cap portion 247 is disposed to effect the recovery of
ink discharge performance and maintain the stability
of ink discharge.

10 In the case of a so-called pictorial image
in which the output image is represented in
gradation, the reproduction of image with reduced
graininess can be effected by making the effective
use of the dark/light ink.

15 On the other hand, it is often preferred to
perform the recording only by the use of dark ink,
in the case of an image not requiring any gradation
representation such as a document, graphics or
listing which is composed of characters and line
20 drawing, or an image already expanded in binary form
by the computer.

For the purposes of achieving the compactness
and the low price of the apparatus, and performing
the recording by using the dark/light ink, a method
25 is provided in which a recording head is used having
a plurality of discharge orifice arrays for
discharging different inks onto the same discharge

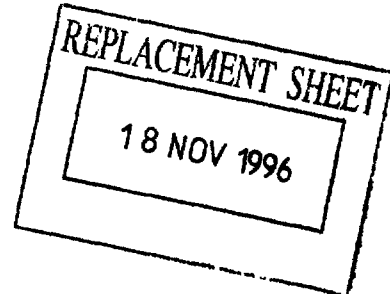


1 orifice formation face of the same recording head.
In this case, there is a problem that though the
apparatus is smaller, the array of discharge orifices
is divided corresponding to used ink color and the
5 number of discharge orifices for each ink color is
reduced, whereby the recording width per scan is
narrower and the recording speed is decreased.
Accordingly, the apparatus with its principal usage
found only on the recording by the use of such
10 dark/light ink is unsuitable for the output of
document, graphic and listing image.

SUMMARY OF THE INVENTION

An object of the present invention is to
15 resolve the aforementioned problems, and provide a
compact ink jet recording apparatus and an ink jet
recording method which is capable of producing an
image excellent in gradation and resolution with
reduced graininess, and producing the image for
20 document, graphic and listing at high speed and good
quality, as well as recorded products obtained by
carrying out said ink jet recording method.

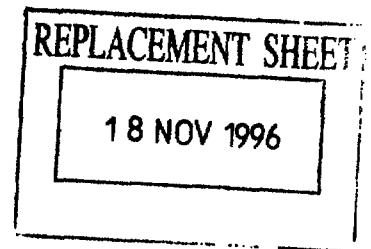
To accomplish the above object, the present
invention provides an ink jet recording apparatus
25 which can perform the recording by discharging the
ink onto the recording medium in accordance with the
recording data, characterized by comprising a



1 mounting portion for exchangeably mounting either
first recording means for discharging a single kind
of ink or second recording means capable of
discharging a plurality of kinds of inks,
5 discriminating means for discriminating whether
recording means to be mounted on said mounting
portion is said first recording means or said second
recording means, and recording control changing means
for changing the recording control in accordance with
10 said discriminating means.

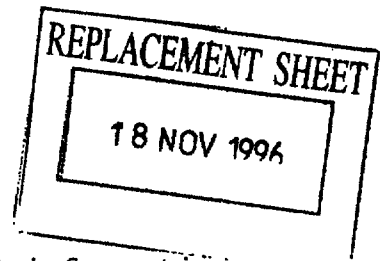
Also, the present invention provides an ink
jet recording apparatus which can perform the
recording by discharging the ink onto the recording
medium in accordance with the recording data,
15 characterized by comprising a mounting portion for
exchangeably mounting either first recording means
for discharging a single kind of ink or second
recording means capable of discharging a plurality of
kinds of inks, information generating means for
20 generating information as to whether recording means
to be mounted on said mounting portion is said first
recording means or said second recording means, and
recording control changing means for changing the
recording control in accordance with the information
25 of said information generating means.

Also, the present invention provides an ink
jet recording method which can perform the recording



1 by discharging the ink onto the recording medium in
accordance with the recording data, by using
recording means mounted on a mounting portion for
exchangeably mounting either first recording means
5 for discharging a single kind of ink or second
recording means capable of discharging a plurality of
kinds of inks, characterized by including a
discrimination step of discriminating whether
recording means to be mounted on said mounting
10 portion is said first recording means or said second
recording means, and a recording control changing
step of changing the recording control in accordance
with said discrimination step.

Also, the present invention provides an ink
15 jet recording method which can perform the recording
by discharging the ink onto the recording medium in
accordance with the recording data, by using
recording means mounted on a mounting portion for
exchangeably mounting either first recording means
20 for discharging a single kind of ink or second
recording means capable of discharging a plurality of
kinds of inks, characterized by including an
information generation step of generating information
as to whether recording means to be mounted on said
25 mounting portion is said first recording means or
said second recording means, and a recording control
changing step of changing the recording control in



1 accordance with the information of said information
generation step.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Fig. 1 is a block diagram showing the
configuration of a color ink jet recording apparatus
in accordance with an embodiment of the present
invention.

10 Fig. 2 is a diagram exemplifying an image
signal processing circuit in the color ink jet
recording apparatus in accordance with the embodiment
of the present invention.

Figs. 3A and 3B are explanation views of a
dark/light distribution table.

15 Fig. 4 is a flowchart for selecting the
dark/light distribution table.

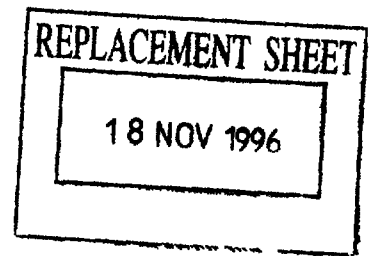
Fig. 5 is a perspective view showing the
essence of the color ink jet recording apparatus of
the present invention.

20 Fig. 6 is a constitutional view of an ink jet
unit capable of discharging the dark/light ink.

Fig. 7 is a constitutional view of a grooved
top for a head unit capable of discharging the
dark/light ink.

25 Fig. 8 is a constitutional view of an ink jet
unit for discharging the ink of single density.

Fig. 9 is a constitutional view of a grooved



1 top for a head unit for discharging the ink of single
density.

Fig. 10 is a view of the ink discharge
orifice array for the ink jet unit capable of
5 discharging the dark/light ink, as looked from the
side of the recording medium.

Fig. 11 is a view of the ink discharging
orifice array for the ink jet unit for discharging
the ink of single density, as looked from the side of
10 the recording medium.

Fig. 12 is a diagram showing an image
formation process where the ink jet unit capable of
discharging the dark/light ink is mounted.

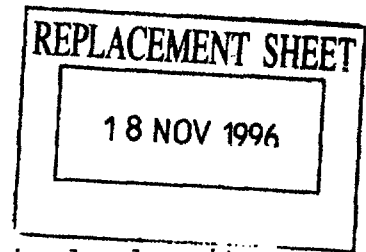
Fig. 13 is a diagram showing an image
15 formation process where the ink jet unit for
discharging the ink of single density is mounted.

Figs. 14A and 14B are explanation views of
means for passing designated information of ink jet
unit to the apparatus main.

20 Fig. 15 is a view showing the constitution of
an integral ink jet cartridge capable of discharging
the dark/light ink in accordance with another
embodiment of the present invention.

Fig. 16 is a view showing how the integral
25 ink jet cartridge as shown in Fig. 15 is mounted on
the carriage.

Fig. 17 is a view showing an integral ink jet



1 cartridge for discharging the ink of single density.

Fig. 18 is a view showing how the integral ink jet cartridge as shown in Fig. 17 is mounted on the carriage.

5 Fig. 19 is a view showing how an integral ink jet cartridge capable of discharging the inks of two densities in accordance with another embodiment of the present invention is mounted on the carriage.

10 Fig. 20 is a view showing the state of the integral ink jet cartridge as shown in Fig. 10 where all the ink cartridges are mounted on the carriage.

Fig. 21 is a view of the ink discharge orifice arrays in the integral ink jet cartridge as shown in Fig. 19, as looked from the side of
15 recording medium.

Fig. 22 is a view exemplifying an image formation process using the integral ink jet cartridge as shown in Fig. 19.

20 Fig. 23 is a perspective view showing the essence of a conventional color ink jet recording apparatus using the dark/light ink.

Fig. 24 is a block diagram showing a schematic configuration where a recording apparatus of the present invention is applied to an information
25 processing apparatus.

Figs. 25 and 26 are external views of the information processing apparatus.

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1 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of an ink jet recording apparatus of the present invention will be described below in detail with reference to the drawings.

[First embodiment]

(Configuration of recording apparatus)

Fig. 1 is a block diagram showing the configuration of a color ink jet recording apparatus in accordance with this embodiment.

In the figure, 1 is an image input unit for optically reading an original image by a CCD, or inputting an image luminance signal (RGB) from a host computer or a video equipment, and 2 is an operation unit having a variety of keys for setting various parameters and instructing the print start. 3 is a CPU for controlling the whole of this recording apparatus in accordance with various programs stored in a ROM, this CPU constituting discriminating means and image formation condition setting means in the present invention. 4 is a ROM for storing programs for operating this recording apparatus in accordance with a control program error processing program, and image formation conditions. In this ROM, 4a is an input/output gamma conversion table to be referred to in the processing of an input/output gamma conversion circuit, 4b is a masking coefficient to be referred

1 to in the processing of a color correction (masking)
circuit, 4c is a black formation and UCR table to be
referred to in the processing of a black formation
and UCR circuit, 4d is a dark/light distribution
5 table to be referred to in the processing of a
dark/light distribution circuit, 4e is a program
group in which various programs for performing the
above-described processings are stored. The
processing in each circuit will be described later in
10 detail. 5 is a RAM useful for the work area for
various programs in the ROM and the temporary save
area at the error handling. 6 is an image signal
processing unit as will be described later and 7 is a
printer unit for forming the dot image based on the
15 image signal processed by the image signal processing
unit at the recording. 8 is a bus line for
transmitting an address signal, data and a control
signal within the apparatus. 9 is designated
information generating means for any one of a host
20 computer connecting to the recording apparatus, a dip
switch provided on the recording apparatus, an
operation panel for the recording apparatus, memory
means provided on the recording apparatus, and ink
discharging means or an ink cartridge mounted on the
25 recording apparatus, and 10 is a detection unit for
detecting the type of ink jet unit. The designated
information from the designated information

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1 generating means 9 is designated command information
from the host computer, dip switch information from
the dip switch, panel information from the operation
panel, memory information from the memory means, or
5 a designated signal from the ink discharging means or
ink cartridge.

(Image signal processing unit)

An image signal processing unit will be now
described.

10 Fig. 2 shows an example of an image signal
processing circuit in a color ink jet recording
apparatus in this embodiment.

Red image luminance signal R, green image
luminance signal G, and blue image luminance signal B
15 are converted into a cyan image density signal 21C, a
magenta image density signal 21M and a yellow image
density signal 21Y in an input gamma correction
circuit 1.

Further, after the color processing in a
20 color correction (masking) circuit 12 and a black
formation and UCR (Under Color Removal) circuit 13,
they are converted into the new image density signals
23C, 23M, 23Y and 23K of cyan, magenta, yellow and
black. Then, they are converted into image density
25 signals 24C, 24M, 24Y and 24K of cyan, magenta,
yellow and black by undergoing gamma correction in an
output gamma correction circuit 14.

1 Figs. 3A and 3B are diagrams for exemplifying
a dark/light distribution table to be used in a
dark/light distribution circuit 15 in accordance with
a designated signal. A conversion table of Fig. 3A
5 is selected when the monochrome ink is only used,
while that of Fig. 3B is used when the inks of two
different densities are used for the conversion into
a dark/light signal in the dark/light distribution
circuit 15.

10 This table has set the image density signal
value and the optical reflection density value of
image recorded so as to exhibit the proportional
linear relation.

A table is selected by the dark/light
15 distribution circuit 15 in accordance with designated
information from the designated information
generating means 17 which is issued by a designated
signal. When the dark/light distribution table 15a
of Fig. 3A is selected by the dark/light distribution
20 circuit 15, the density signals of cyan, magenta,
yellow and black are directly output without
distribution into dark and light. When the
dark/light distribution table 15b of Fig. 3B is
selected, they are converted into the image density
25 signals 25Ck, 25Mk, 25Yk and 25Kk of dark cyan, dark
magenta, dark yellow and dark black which are at
higher dye density, and the image density signals

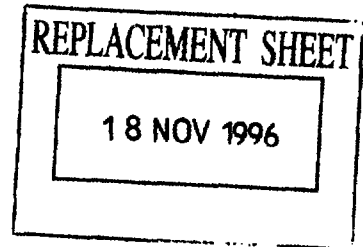
1 25Cu, 25Mu, 25Yu and 25Ku of light cyan, light
magenta, light yellow and light black which are at
lower dye density.

Each image density signal output from the
5 dark/light distribution circuit is binarized by a
binarization circuit 16, and a corresponding color
ink is discharged in accordance with a signal value
from each ink jet unit to effect the formation of
image. Binarization circuit 16 is a common circuit,
10 irrespective of whether the recording uses the inks
of two different densities or the ink of single
density.

Fig. 4 is a flowchart when the dark/light
distribution table is selected in this embodiment.

15 At step S41, the sort of ink jet unit is
detected by a detection unit, and at step S42,
designated information in accordance with a detected
result is generated. Next, if the dark/light ink is
determined to be dischargeable based on this
20 designated information at step S43, a distribution
table B, or a table of Fig. 3B is selected and set
in the dark/light distribution circuit 15 at step
S44, while if the dark/light ink is determined to be
undischargeable at step S43, a dark/light
25 distribution table A, or a table of Fig. 3A is
selected and set at step S45.

Because the dark/light distribution table is



1 set prior to recording the image, each processing of
input gamma correction, color correction (masking),
black formation and UCR, dark/light distribution, and
binarization is performed in accordance with the
5 dark/light distribution table set at step S44 or step
S45, to complete the recording.

(Printer unit)

Fig. 5 is a perspective view showing the
essence of a color ink jet recording apparatus in
10 this embodiment.

In Fig. 5, this apparatus is constituted to
effect the image recording using the dark/light ink.

An ink jet unit 50K has integrally a
discharge orifice array for discharging the dark
15 black ink and a discharge orifice array for
discharging the light black ink. Also, an ink jet
unit 50C has integrally a discharge orifice array for
discharging the dark cyan ink and a discharge orifice
array for discharging the light cyan ink. Also, 50M
20 is an ink jet unit for magenta ink having integrally
a discharge orifice array for discharging the dark
magenta ink and a discharge orifice array for
discharging the light magenta ink, and 50Y is an ink
jet unit for yellow ink having integrally a discharge
25 orifice array for discharging the dark yellow ink and
a discharge orifice array for discharging the light
yellow ink. Each of the ink jet units is installed

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1 a predetermined distance apart on the carriage 51.

A corresponding color ink is supplied from an ink cartridge 58 to a corresponding nozzle array for each ink jet unit 50. Each ink cartridge 58 is
5 divided internally into two sections by a partition, two sections containing the dark (thick) ink and the light (thin) ink, respectively.

The ink jet unit 50 and the ink jet cartridge 58 can be exchanged by an ink jet unit corresponding
10 to the ink of single density and an ink cartridge, as required.

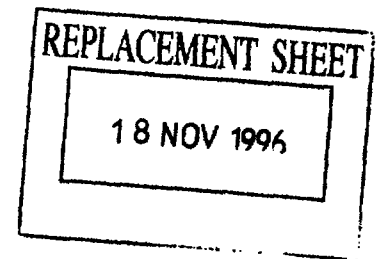
The control signal to the ink jet unit 50 is sent via a flexible cable 59.

The recording medium composed of a paper or
15 plastic thin plate is passed by a conveying roller (not shown) and carried by paper exhausting rollers 52 to be fed in a direction of the arrow by the driving of a conveying motor, not shown.

Carriage 51 is supported to be guided by
20 means of a guide shaft 53, and an encoder not shown.

The carriage 51 is caused to reciprocate along the guide shaft 53 by the driving of a carriage motor 55 via a drive belt 54.

The inside (liquid channel) of an ink
25 discharge orifice of each ink jet unit 50 is provided with a heat generating element (electricity-heat energy converter) for generating the heat energy for



4 use in discharging the ink.

In accordance with the read timing of encoder, the above-mentioned heat generating elements are driven on the basis of a recording signal to
5 discharge ink droplets onto the recording medium in the order of dark and light black, dark and light cyan, dark and light magenta, and dark and light yellow, thereby forming an image.

At a home position of carriage selected out
10 of the recording area, a recovery unit 56 having a cap portion 57 is disposed to maintain the stability of ink discharge.

Each of ink jet units and ink cartridges is exchangeable as required.

15 (Ink jet unit)

Fig. 6 is an explanation view for the constitution of an ink jet unit capable of discharging a plurality of inks of different densities for use in this embodiment, and Fig. 8 is
20 an explanation view for the constitution of an ink jet unit for discharging the ink of single density for use in this embodiment.

Both ink jet units have common parts and constitution, though partially different, and will be
25 described together.

One end of a wiring board 60, 80 is interconnected to the wiring part of a heater board

1 61, 81, and further at the other end of the wiring
board 60, 80 there are provided a plurality of pads
corresponding to electricity-heat energy converters
for accepting an electrical signal from the main
5 device. Thereby, an electrical signal from the main
device is supplied to respective electricity-heat
energy converter.

A metallic support 62, 82 for supporting the
back side of the wiring board 60, 80 in a plane
10 serves as a bottom plate of the ink jet unit. A
presser spring 63, 83 has a portion bent into a
substantial U-character shape in cross section to
apply a pressing force resiliently and linearly on
the area in the neighborhood of the ink discharge
15 orifices for a grooved top 64, 84, a hook claw
through the use of a relief hole provided on the base
plate, and a pair of back legs for receiving a force
applied on the spring in the base plate.

By virtue of this spring force, the wiring
20 board 60, 80 and the grooved top 64, 84 are placed
into close contact under pressure. Also, the
attachment of the wiring board 60, 80 to the support
can be bonded by an adhesive.

In the ink jet unit capable of discharging
25 the dark/light ink in this embodiment, two ink supply
tubes 65, 66 for supplying the ink are provided
corresponding to the dark ink and the light ink.

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1 On the other hand, in the case of an ink jet unit
corresponding to the ink of single density, only one
ink supply tube 85 is provided.

At the other end of the ink supply tube 65,
5 85, a filter 66, 86 is provided to prevent impurities
from entering the head.

An ink supply member 67, 87 is made by
molding and the grooved top has also formed with a
flow passageway for conducting the ink into each ink
10 supply opening. The fixture of the ink supply member
67, 87 to the support 62, 82 can be simply performed
by passing two pins (not shown) on the back side of
the ink supply member 67, 87 into and out of holes
68, 88 provided in the support 62, 82 and heat
15 welding them.

In this case, the interval between an orifice
plate portion 680, 880 and a chip tank 67, 87 is
formed evenly. A sealing agent is filled through a
sealing agent filler hole provided above the ink
20 supply member 127 to seal the wire bonding as well as
the gap between an orifice plate 680, 880 and a chip
tank 67, 87, further passing through a groove 69, 89
provided on the support 62, 82 to completely seal the
gap between the orifice plate portion 680, 880 and
25 the front end of support 62, 82.

Fig. 7 is a perspective view of a groove top
64 capable of discharging the dark/light ink for use

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1 in this embodiment, as looked from the side of heater
board 61. In this unit, two liquid chambers are
provided for the dark ink and the light ink, each
liquid chamber being divided by a partition 70. Each
5 liquid chamber is provided with supply openings 71a,
71b for supplying the ink.

A groove 72 is provided on the pressing
contact plane of the partition 70 for partitioning
this liquid chamber with the heater board 61. This
10 groove communicates to the outer peripheral portion
of the grooved top 64. After the grooved top 62 is
forced into close contact with the heater board, the
outer peripheral portion is sealed by a sealing
agent, as previously described. In doing so, the
15 sealing agent percolates into the groove to fill the
gap between the grooved top and the heater board. By
this technical process, the liquid chamber can be
completely separated. The structure of this groove
is different with the material of sealing agent, and
20 is necessary to have a corresponding shape.

In this way, by dividing the liquid chamber
into plural sections, the ink which is different for
each discharge orifice array can be supplied by one
ink jet unit.

25 Fig. 9 is a perspective view of a grooved top
84 of a head unit for discharging the ink of single
density for use in this embodiment, as looked from

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1 the side of heater board 81. The liquid chamber
provided in this unit is a liquid chamber 90
dedicated for the ink of single density. The liquid
chamber 90 is provided with a supply opening 91 for
5 supplying the ink.

After the grooved top 84 is forced into close
contact with the heater board, the outer peripheral
portion is sealed by the same sealing agent as
described in connection with Fig. 7.

10 Fig. 10 is a view of ink discharge orifice
arrays of an ink jet unit capable of discharging the
dark/light ink, as looked from the side of the
recording medium.

There are provided an ink jet unit 100 for
15 discharging the black ink, an ink unit 101 for
discharging the cyan color ink, an ink jet unit 102
for discharging the magenta color ink, and an ink jet
unit 103 for discharging the yellow color ink.

Also, 100Ku, 101Cu, 102Mu and 103Yu are
20 discharge orifice arrays for discharging the light
ink, and 100Kk, 101Ck, 102Mk and 103Yk are discharge
orifice arrays for discharging the dark ink.

Each discharge orifice array corresponding
to each dark/light ink has 64 discharge orifices at a
25 pitch of 360 dots per inch (360 dpi), wherein there
is a blank of 8 dots between each color array by
virtue of the partition of liquid chamber.

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1 Fig. 11 is a view of ink discharge orifice
arrays wherein an ink jet unit for discharging the
ink of single density is arranged for each color, as
looked from the side of the recording medium.

5 There are provided an ink jet unit 110 for
discharging the black ink, an ink jet unit 111 for
discharging the cyan color ink, an ink jet unit 112
for discharging the magenta color ink, and an ink jet
unit 113 for discharging the yellow color ink.

10 Each ink jet unit has discharge orifices
arranged at a pitch of 360 dots per inch (360 dpi),
with 128 discharge orifices provided for each one of
head units.

15 Fig. 12 is a view showing an image formation
process wherein an ink jet unit capable of
discharging the dark/light ink is mounted.

In the explanation of this figure, the image
formation process will be described, supposing that
no blank is provided between each color.

20 Noting the (N+1)th line, the recording in
dark black, dark cyan, dark magenta and dark yellow
and the conveying operation (line feed, hereinafter
abbreviated as LF) of the recording medium by a
predetermined amount is performed at the first scan
25 line, and the recording in light black, light cyan,
light magenta and light yellow and the LF is
performed at the second scan line, whereby such two

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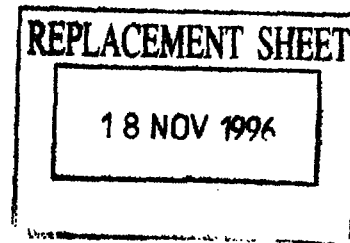
- 26 -

1 scan recordings can complete an image. The amount of
LF after each scan recording is 64 dots wide, and
the image 64 dots wide is recorded by the second scan
recording.

5 The recording in all colors which is not
completed by one time of the scan recording will
result in less degradation in image quality due to
blur and thus produces an excellent image. Further,
in the actual ink jet unit, owing to a blank provided
10 between each color, the connecting position of the
recording scan for each color is not coincide for
each color, as depicted in this figure, and located
at a different position, so that there is the effect
that the occurrence of connection streaks of the
15 recording scan is relieved.

Fig. 13 is a diagram showing an image
formation process wherein an ink jet unit for
discharging the ink of single density is mounted.

By the first scan and the LF, the recording
20 in black, cyan, magenta and yellow is performed to
complete the image at the $(N+1)$ th line. Then, by the
second scan recording and the LF, and the third scan
recording and the LF, the images at the $(N+1)$ th line
and at the $(N+1)$ th line are completed. The amount of
25 LF after each scan recording is 128 dots wide,
whereby the image 128 dots wide is recorded by one
time of the scan recording.

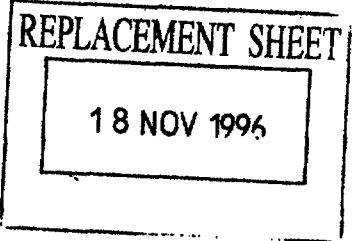


1- Figs. 14A and 14B are explanation views of means for transmitting designated information of an ink jet unit to the apparatus main, shown partially in cross section.

5 141 is a carriage, 140 is a switch provided on the carriage 141, and 62, 82 is a support for the ink jet unit. When the ink jet unit is mounted on the carriage, the number of switches which are turned on is determined by the number of signal pins
10 provided on the support 62, 82 of the ink jet unit.

Fig. 14A shows the state where an ink jet unit for discharging the ink of single density is mounted, with all the switches 140 turned on. In this case, the apparatus main is informed that the
15 ink jet unit for discharging the ink of single density is mounted, and a dark/light distribution table of Fig. 3A is selected, whereby the recording through the image formation process as described in Fig. 13 is performed.

20 Fig. 14B is a view wherein an ink jet unit capable of discharging a plurality of inks of different densities is mounted, with only one switch turned on. The apparatus main is informed that the ink jet unit capable of discharging the inks of
25 different densities is mounted, and a dark/light distribution table of Fig. 3B is selected, whereby the recording through the image formation process as

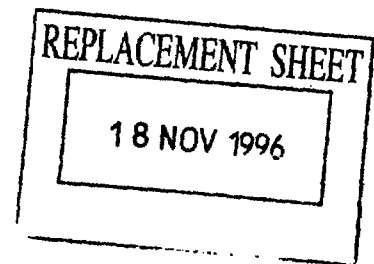


1 described in Fig. 12 is performed.

This embodiment as above described has been configured to provide the signal pin on the support of the ink jet unit as designated information
5 generating means for changing the recording control in accordance with the ink jet unit mounted therein, when the ink jet unit for discharging the ink of single density or the ink jet unit capable of discharging the inks of different densities is
10 mounted.

With this embodiment, information can be passed to the recording apparatus main by changing the number of signal pins provided on the ink jet unit in accordance with the designated content of the
15 recording control, whereby an appropriate dark/light distribution table can be selected and the recording control method can be set simply by mounting the ink jet unit on the carriage.

Note that the designated information
20 generating means is not limited to that as shown in this embodiment, but a host computer connecting to the recording apparatus, a dip switch for the host computer or the recording apparatus, an operation key on the operation panel, or memory means provided on
25 the recording apparatus may be used. Another configuration is also possible wherein memory means is provided on the ink jet unit, and the information



1 within memory is read by the apparatus main.

With this embodiment, the recorded matter of image which is excellent in gradation and resolution and has reduced graininess can be
5 obtained.

(Second embodiment)

The second embodiment of the present invention will be now described.

Fig. 15 shows the construction of an integral
10 ink jet cartridge wherein ink jet units 154 capable of discharging the dark/light ink for four colors of yellow, magenta, cyan and black are integrally assembled into a frame 150.

Fig. 17 shows the construction of an integral
15 ink jet cartridge wherein ink jet units 174 for discharging the ink of single density for four colors of yellow, magenta, cyan and black are integrally assembled into a frame 170.

The integral ink jet cartridges as shown in
20 Figs. 15 and 17 have common parts and constitution, though partially different, and will be described together.

The constitution of the ink jet unit 154, 174 has been described in detail in the previous
25 embodiment, and will be no longer described.

Four ink jet units 154, 174 as shown in Figs. 15 and 17 are mounted a predetermined interval apart

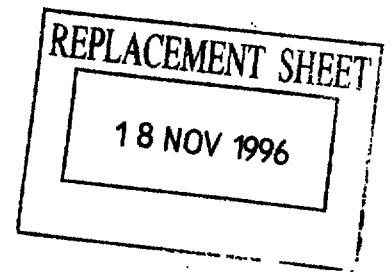
1 within the frame 150, 170, and fixed with the
registration in a direction of nozzle array adjusted.
151, 171 is a frame cover, and 152, 172 is a
connector for connecting pads provided on the wiring
5 board 60, 80 for the four ink jet units 154, 174 with
the apparatus main to provide an electrical signal.
The wiring board 60, 80 and the connector 152, 172
are connected through electrodes 153, 173,
respectively.

10 Fig. 16 shows how an integral ink jet
cartridge 152 capable of discharging the inks of
different densities is mounted on the carriage 51.

Fig. 18 shows how an integral ink jet
cartridge 172 for discharging the ink of single
15 density is mounted on the carriage 51.

An ink tank 160 for storing the inks of
different densities is partitioned into two upper and
lower chambers by a partition 161, an upper chamber
filled with the light ink and a lower chamber filled
20 with the dark ink.

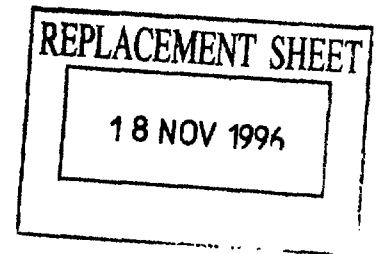
An ink tank 180 for storing the ink of single
density has no partition for serving to receive
different inks. And an ink jet cartridge 152, 172
and four ink tanks 160, 180 of yellow, magenta, cyan
25 and black are connected together on the carriage 51,
and the ink is supplied from the ink tank 160, 180 to
corresponding ink discharge orifice array.



1 As shown in Fig. 18, an electrically
conductive seal 183 is pasted on the integral ink jet
cartridge 172 for discharging the ink of single
density. On the other hand, no electrically
5 conductive seal is pasted on the integral ink jet
cartridge 152 capable of discharging the inks of
different densities, as indicated by 163 in Fig. 16.

The recording apparatus main body in this
embodiment has two electrode contacts at the
10 positions corresponding to the electrically
conductive seal by mounting the integral ink jet
cartridge thereto.

When any electrically conductive seal exists
on a portion indicated by 183 as shown in Fig. 18,
15 two electrode contacts provided on the main body as
above described are placed in conduction, the
apparatus main is informed that the integral ink jet
cartridge for discharging the ink of single density
is mounted, and a dark/light distribution table of
20 Fig. 3A is selected, whereby the recording through
the image formation process as depicted in Fig. 13 is
performed. Also, when no electrically conductive
seal exists on a portion indicated by 163 as shown in
Fig. 16, two corresponding electrodes provided on the
25 main body are not in conduction, the apparatus main
is informed that the integral ink jet cartridge
capable of discharging the dark/light ink is mounted,



1 and a dark/light distribution table of Fig. 3B is
selected, whereby the recording through the image
formation process as depicted in Fig. 12 is
performed.

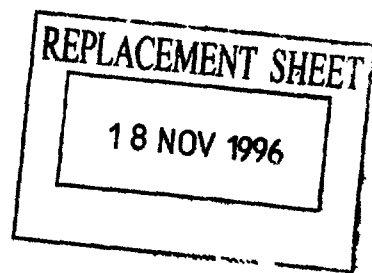
5 With this embodiment, by placing the
corresponding contacts on the side of the recording
apparatus main body in conduction or non-conduction
depending on whether or not any electrically
conductive seal of the integral ink jet cartridge
10 exists, information can be transferred to the
recording apparatus main body, an appropriate
dark/light distribution table can be selected, and
the recording control method can be set simply by
mounting the recording head on the carriage.

15 With this embodiment, the recorded matter of
image which is excellent in gradation and resolution
and has reduced graininess can be obtained.
(Third embodiment)

A third embodiment of the present invention
20 will be now described.

Fig. 19 shows how an integral ink jet
cartridge 152 is mounted on a carriage 51, wherein
ink jet units capable of discharging two different
inks through corresponding arrays of discharge
25 orifices with a liquid chamber divided into two
sections are integrated.

This ink jet units and the integral ink jet



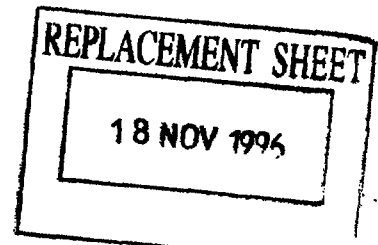
1 cartridge 152 are identical to the ink jet units
capable of discharging the inks of different
densities and the integral ink jet cartridge thereof
as described in the previous embodiment,
5 respectively.

Fig. 21 is a view of ink discharge orifice
arrays for an integral ink jet cartridge capable of
discharging two different inks used in this
embodiment through corresponding arrays of discharge
10 orifices, as looked from the side of recording
medium.

There are provided an ink jet unit 210Y for
discharging the yellow color ink, an ink jet unit
210M for discharging the magenta color ink, an ink
15 jet unit 210C for discharging the cyan color ink, and
an ink jet unit 210K for discharging the black color
ink.

Each ink jet unit 210 has a first discharge
orifice array and a second discharge orifice array,
20 each array capable of discharging a different ink.

Each discharge orifice array has arranged
discharge orifices at a density of 360 dots per inch
(360dpi). The first discharge orifice array and the
second discharge orifice array are 64 discharge
25 orifices usable for the recording, respectively, with
no blank in a direction of discharge orifice array
provided between discharge orifice arrays usable for



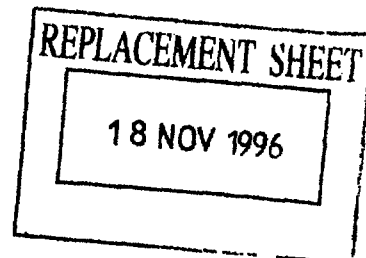
1 the recording, as previously described. That is, an
ink jet unit for discharging the ink of single
density having 128 discharge orifices may be
constructed in such a way that discharge timing
5 correction is made by the amount of deviation in a
main scan direction between the first discharge
orifice array and the second discharge orifice array,
and the same ink is supplied and discharged to and
from the first discharge orifice array and the second
10 discharge orifice array.

In Fig. 19, an ink tank 190 is partitioned
into two upper and lower chambers by a partition 191,
wherein the upper and lower chambers can contain
different inks.

15 And an ink jet cartridge 152 and four ink
tanks 190 of yellow, magenta, cyan and black are
connected together on a carriage 51, the ink being
supplied from the ink tank 190 to a corresponding ink
discharge orifice array.

20 192a, 192b is a marking indicating the
information of ink tank.

In this embodiment, when a marking 192a is
black and 192b is white, an dark/light ink
corresponding ink tank is indicated containing the
25 light ink in the upper chamber and the dark ink in
the lower chamber with the partition within the ink
tank, as shown in Fig. 19. On the other hand, when



1- the markings 192a, 192b are both black, a single density ink corresponding ink tank is indicated containing the thick ink within the upper and lower chambers.

5 Fig. 20 is a view showing the state wherein all the ink tanks are mounted on the carriage.

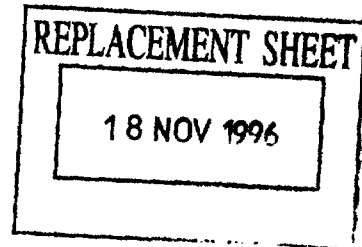
Markings 192a, 192b for the ink tank 190 are detected by means of an optical sensor 200 provided on the carriage 51.

10 Herein, an image formation process will be described below with reference to Fig. 22, wherein the black ink tank corresponds to the single density ink in which the optical sensor 200 discriminates both the markings 192a, 192b as black, while the
15 other color ink tank corresponds to the dark/light ink in which the optical sensor 200 discriminates the marking 192a as black and the marking 192b as white.

Fig. 22 is a view showing the image formation process.

20 For the black dark/light distribution table, Fig. 3A is selected and set, according to designated information of the ink tank by the optical sensor, and for the dark/light distribution table of yellow, magenta and cyan, Fig. 3B is selected and set.

25 In Fig. 22, noting the (N+2)th line, the recording in dark black, dark cyan, dark magenta and dark yellow and the LF are performed at the second



1- scan, and the recording in light cyan, light magenta, and light yellow and the LF are performed at the third scan, whereby an image is completed by two scan recordings.

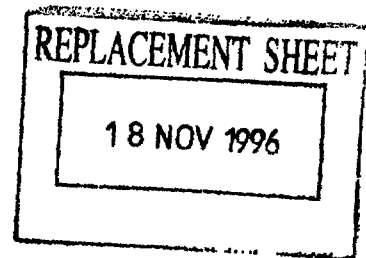
5 The amount of LF after each scan recording is 64 dots wide, and the image 64 dots wide is recorded by two scan recordings.

 The recording in dark black occurs only at the second scan in the figure, and thus at every
10 other scan, in which the recording 128 dots wide which is double that of yellow, magenta and cyan is performed once.

 With such a constitution, the recording speed can be increased by varying the amount of LF to the
15 width of 128 dots when printing black characters or in monochrome.

 With this embodiment, the marking state is changed according to designated information preset in the ink tank, and detected by the optical sensor upon
20 mounting the ink tank, whereby an appropriate dark/light distribution table can be selected and the recording control method set.

 Further, it is preferable to provide an automatic suction recovery mode of fully exchanging
25 the ink in a liquid chamber and discharge orifices within an ink jet unit in such a way as to allow the recovery unit to perform the suction recovery



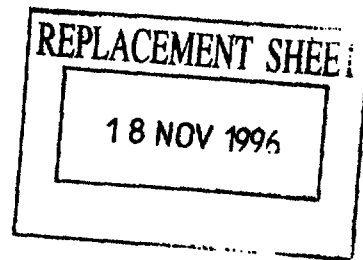
1 operation upon discriminating the replacement to the
different ink tank by detecting the marking state of
the ink tank to be changed.

Note that designated information generating
5 means for generating designated information by
detecting the marking is not limited to that shown
in this embodiment, but may be a host computer
connecting to the recording apparatus.

As above described in the embodiment, the
10 recording control can be altered upon detecting the
marking provided, simply by exchanging the ink jet
unit, the ink jet cartridge or the ink tank, when
outputting the image having significance on the
graininess and gradation reproducibility such as a
15 so-called pictorial image composed of gradation
representation or when attaching great importance on
the recording speed such as when printing characters,
graphics and listing, whereby the image can be output
with a desired image quality and at the recording
20 speed.

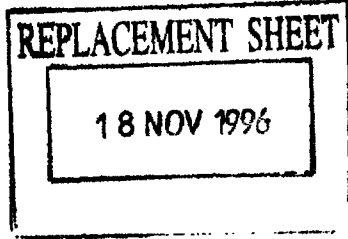
With this embodiment, the image excellent in
gradation and resolution and with reduced graininess
can be obtained.

The present invention brings about excellent
25 effects particularly in a recording head or a
recording device of the ink jet system for performing
the recording by forming flying fine ink droplets by



1- the use of heat energy among the various ink jet recording systems.

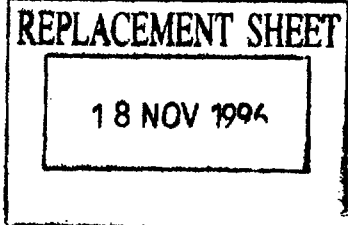
As to its representative constitution and principle, for example, one practiced by use of the basic principle disclosed in, for example, U.S. Patents 4,723,129 and 4,740,796 is preferred. This system is applicable to either of the so-called on-demand type and the continuous type. Particularly, the case of the on-demand type is effective because, by applying at least one driving signal which gives rapid temperature elevation exceeding nucleus boiling corresponding to the recording information on electricity-heat converters arranged corresponding to the sheets or liquid channels holding a liquid (ink), heat energy is generated at the electricity-heat converters to effect film boiling at the heat acting surface of the recording head, and consequently the bubbles within the liquid (ink) can be formed corresponding one by one to the driving signals. By discharging the liquid (ink) through an opening for discharging by growth and shrinkage of the bubble, at least one droplet is formed. By making the driving signals into the pulse shapes, growth and shrinkage of the bubbles can be effected instantly and adequately to accomplish more preferably discharging of the liquid (ink) particularly excellent in response characteristic.



1 As the driving signals of such pulse shape,
those as disclosed in U.S. Patents 4,463,359 and
4,345,262 are suitable. Further excellent recording
can be performed by employment of the conditions
5 described in U.S. Patent 4,313,124 of the invention
concerning the temperature elevation rate of the
above-mentioned heat acting surface.

 As the constitution of the recording head, in
addition to the combination of the discharging
10 orifice, liquid channel, and electricity-heat
converter (linear liquid channel or right-angled
liquid channel) as disclosed in the above-mentioned
respective specifications, the constitution by use of
U.S. Patent 4,558,333 or 4,459,600 disclosing the
15 constitution having the heat acting portion arranged
in the flexed region is also included in the present
invention.

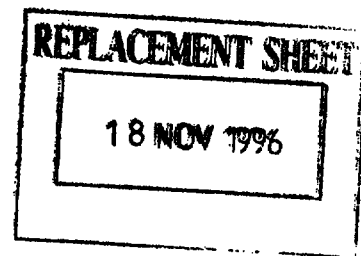
 In addition, the present invention can be
also effectively made the constitution as disclosed
20 in Japanese Laid-Open Patent Application No. 59-
123670 which discloses the constitution using a slit
common to a plurality of electricity-heat converters
as the discharging portion of the electricity-heat
converter or Japanese Laid-Open Patent Application
25 No. 59-138461 which discloses the constitution having
the opening for absorbing pressure wave of heat
energy correspondent to the discharging portion.



1 Further, the recording head of the full line
type having a length corresponding to the maximum
width of a recording medium which can be recorded by
the recording device may be either the constitution
5 which satisfies its length by a combination of a
plurality of recording heads as disclosed in the
above-cited specifications or the constitution as one
recording head integrally formed.

Also, addition of a restoration means for the
10 recording head, a preliminary auxiliary means, etc.,
provided as the constitution of the recording device
of the present invention is preferable, because the
effect of the present invention can be further
stabilized. Specific examples of these may include,
15 for the recording head, capping means, cleaning
means, pressurization or suction means, electricity-
heat converters or another type of heating elements,
or preliminary heating means according to a
combination of these, and it is also effective for
20 performing stable recording to perform preliminary
mode which performs discharging separate from
recording.

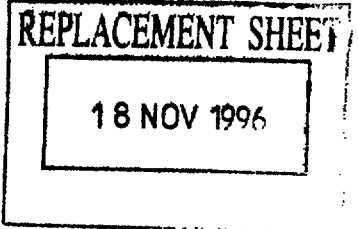
Though the ink is considered as the liquid
in the embodiments as above described, another ink
25 may be also usable which is solid below room
temperature and will soften or liquefy at or above
room temperature, or liquefy when a recording signal



1 is issued as it is common with the ink jet device to
control the viscosity of ink to be maintained within
a certain range of the stable discharge by adjusting
the temperature of ink in a range from 30 °C to 70 °C.

5 In addition, in order to avoid the
temperature elevation due to heat energy by
positively utilizing the heat energy as the energy
for the change of state from solid to liquid, or to
prevent the evaporation of ink by using the ink which
10 will solidify in the shelf state, the use of the ink
having a property of liquefying only with the
application of heat energy, such as liquefying with
the application of heat energy in accordance with a
recording signal so that liquid ink is discharged,
15 or is already solidifying upon reaching the recording
medium, is also applicable in the present invention.
In such a case, the ink may be held as liquid or
solid in recesses or through holes of a porous sheet,
which is placed opposed to electricity-heat
20 converters, as described in Japanese Laid-Open Patent
Application No. 54-56847 or No. 60-71260. The most
effective method for the ink as above described in
the present invention is based on the film boiling.

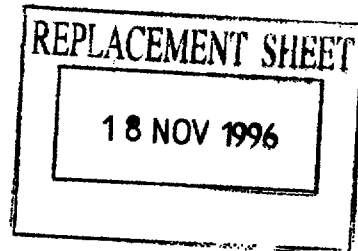
25 Further, a recording apparatus according to
the present invention may be provided integrally or
separately as the image output terminal of
information processing equipment such as a computer



1- or word processor, or the copying machine in
combination with a reader, or the facsimile apparatus
having the transmission and reception feature.

Fig. 24 is a block diagram showing a
5 schematic configuration in which a recording
apparatus of the present invention is applied to an
information processing apparatus having the features
of word processor, personal computer; facsimile
apparatus, copying machine and electronic typewriter.
10 In the figure, 201 is a control unit for controlling
the whole apparatus, comprised of a CPU such as a
microprocessor or various I/O ports, this control
unit controlling each unit by outputting or inputting
control signal or data to or from it. 202 is a
15 display unit for displaying various menus, document
information, and image data read by an image reader
207 on its display screen. 203 is a transparent,
pressure sensitive touch panel provided on the
display unit 202, which enables the entry of items or
20 coordinate values on the display unit 202 by
depressing its surface with a finger or the like.

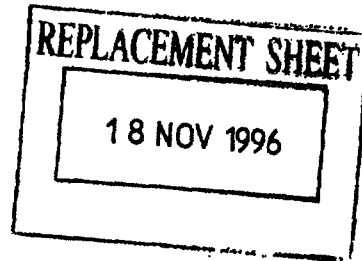
204 is a FM (Frequency Modulation) sound
source unit, which makes the FM modulation for the
music information created with a music editor, this
25 information being stored in a memory 210 or an
external storage device 212 as the digital data and
read therefrom for the FM modulation. An electrical



1 signal from the FM sound source unit 204 is converted
into an audible sound by a speaker unit 205. A
printer unit 206 consists of a recording apparatus
according to the present invention as the output
5 terminal for a word processor, a personal computer,
a facsimile apparatus, a copying machine or an
electronic typewriter.

207 is an image reader unit for
photoelectrically reading original data for the
10 input, which is provided midway on original conveying
passage to read facsimile or copying original, and
other various kinds of originals. 208 is a FAX
transmission or reception unit for FAX transmitting
original data read by the image reader unit 207 or
15 receiving and decoding the facsimile signal
transmitted thereto, this unit having an interface
facility with the outside. 209 is a telephone unit,
comprising various telephone functions, such as an
ordinary telephone function or an automatic answering
20 telephone function. 210 is a memory unit comprised
of a ROM for storing a system program, manager
programs and other application programs, character
fonts, and dictionaries, application programs or
document information loaded from the external storage
25 device 212, and a video RAM.

211 is a keyboard unit useful for inputting
document information or various kinds of command.



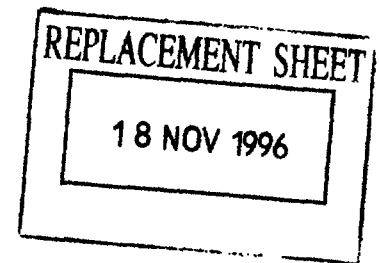
1 212 is an external storage device, which is a storage
medium consisting of a floppy disk or a hard disk,
for the storage of document information, music or
audio data, and user's application programs.

5 Fig. 25 is an appearance view of the
information processing apparatus as shown in Fig. 24.
In the figure, 301 is a flat panel display utilizing
liquid crystal or the like for displaying various
menus, graphic data or documents. On this display
10 301 is installed a touch panel, which enables the
entry of coordinates or item specifications by
depressing the surface of the touch panel with a
finger or the like. 302 is a handset for use when
the apparatus functions as a telephone.

15 A keyboard 303 is detachably connected via
a cord to the main body, and is used to input various
documents or data. Also, the keyboard 303 is
provided with various function keys 304. 305 is an
opening for insertion of the floppy disk.

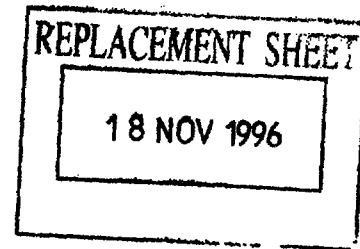
20 307 is a sheet setting board for placing
thereon a paper to be read by the image reader unit
207, the read paper being exhausted out of the rear
side of device. In the facsimile reception, received
data is recorded by the printer.

25 It should be noted that the display unit 301
as above described may be a CRT, but is preferably a
flat panel of the liquid crystal display using a



1 ferroelectric liquid crystal, because it can be
lighter as well as more compact and thinner. When
the above-noted information processing device
functions as a personal computer or a word processor,
5 various kinds of document information input from the
keyboard 211 are processed according to a
predetermined program by the control unit 201 as
shown in Fig. 24, and output as the image to the
printer unit 206. When such information processing
10 device functions as a receiver for the facsimile
apparatus, facsimile information input from the FAX
transmission/reception unit 208 via the communication
line are received according to a predetermined
program by the control unit 201, and output to the
15 printer unit 206 as the received image.'

And when it functions as a copying machine,
the original is read by the image reader unit 207,
and read original data is output via the control
unit 201 to the printer unit 206 as the copied image.
20 Note that it functions as a transmitter for the
facsimile apparatus, original data read by the image
reader unit 207 is processed for transmission
according to a predetermined program by the control
unit 201, and transmitted via the FAX
25 transmission/reception unit 208 to the communication
line. It should be noted that the above-noted
information processing device can be an integral



1 type incorporating a printer within the main body,
as shown in Fig. 26, in which its portability can
be enhanced. In the same figure, corresponding
reference numerals are affixed to the parts having
5 the same functions as those in Fig. 25.

If a recording apparatus of the present
invention is applied to the multifunctional type
information processing device as above described,
higher quality recording image can be obtained so
10 that the functions of the information processing
device can be further enhanced.

As above described, with the present
invention, the image excellent in gradation and
resolution and with reduced graininess can be
15 obtained, and a compact, inexpensive ink jet
recording apparatus can be provided.

Further, this recording apparatus can perform
the recording without any decrease in the speed when
recording the document, graphic and listing image.



1- WHAT IS CLAIMED IS:

1. An ink jet recording apparatus which performs the recording by discharging the ink onto the recording medium in accordance with the recording data, characterized by comprising:

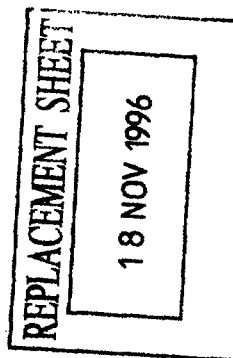
a mounting portion for exchangeably mounting either a first recording means for discharging a single kind of ink or a second recording means capable of discharging a plurality of kinds of inks;

10 discriminating means for discriminating whether recording means to be mounted on said mounting portion is said first recording means or said second recording means; and

recording control changing means for changing
15 the recording control in accordance with said discriminating means.

2. An ink jet recording apparatus according to claim 1, wherein said second recording means is
20 capable of discharging a plurality of inks of the same type color and having different dye densities.

3. An ink jet recording apparatus according to claim 1, wherein said first recording means and
25 said second recording means have the discharge orifice arrays each composed of a plurality of discharge orifices.





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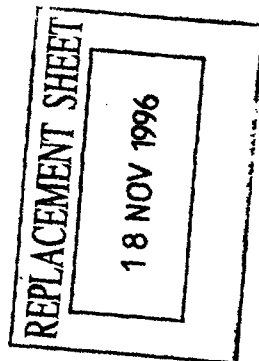
1 4. An ink jet recording apparatus according
to claim 3, wherein said second recording means has
said discharge orifice arrays separately in plural
sections, corresponding to said plurality of kinds of
5 inks.

 5. An ink jet recording apparatus according
to claim 1, wherein said first recording means and
said second recording means have discriminated means,
10 said discriminating means making a discrimination
with said discriminated means.

 6. An ink jet recording apparatus according
to claim 5, wherein said discriminated means is a
15 plurality of pin members provided at contact points
when said first recording means and said second
recording means are mounted on said mounting portion.

 7. An ink jet recording apparatus according
20 to claim 5, wherein said discriminated means is an
electrically conductive or non-electrically
conductive member, and said discriminating means
discriminates the type of said recording means by
detecting the conductivity of said discriminated
25 means.

 8. An ink jet recording apparatus according





1 to claim 1, further comprising:

ink supply means to be exchangeably mounted
on said mounting portion in accordance with the type
of recording means mounted on said mounting portion;

5 wherein said discriminating means makes a
discrimination whether recording means to be mounted
on said mounting portion is said first recording
means or said second recording means by detecting
the type of said ink supply means.

10

9. An ink jet recording apparatus according
to claim 8, wherein said ink supply means has
discriminated means in accordance with the type of
corresponding recording means, said discriminating
15 means making a discrimination for recording means by
detecting said discriminated means.

10. An ink jet recording apparatus according
to claim 9, wherein said discriminated means is a
20 marking in accordance with corresponding recording
means.

11. An ink jet recording apparatus according
to claim 1, further comprising a plurality of image
25 processing means corresponding to said first
recording means and said second recording means,
respectively, wherein said recording control changing

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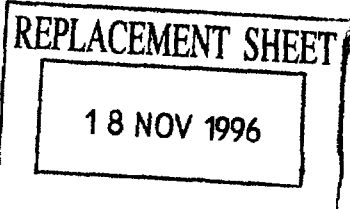


1 means changes said image processing means in
accordance with said discriminating means.

12. An ink jet recording apparatus according
5 to claim 11, wherein said second recording means is
capable of discharging a plurality of inks of the
same type color and having different dye densities.

13. An ink jet recording apparatus according
10 to claim 12, wherein said plurality of image
processing means consists of a first table
corresponding to said first recording means for
determining the discharging of the ink in accordance
with the density of the image to be recorded, and a
15 second table corresponding to said second recording
means for determining the discharging of said
plurality of inks having different dye densities in
accordance with the density of the image to be
recorded, and said recording control changing means
20 changes said first table and said second table in
accordance with said discriminating means.

14. An ink jet recording apparatus according
to claim 1, wherein said recording means has heat
25 energy generating means for giving heat energy to the
ink, and discharges the ink by the use of said heat
energy.





1 15. An ink jet recording apparatus according
to claim 14, wherein said recording means causes a
state change in the ink by the use of the heat energy
generated by said heat energy generating means, and
5 discharges the ink owing to a pressure based on said
state change.

16. An ink jet recording apparatus according
to claim 1, further comprising reading means for
10 reading the original image.

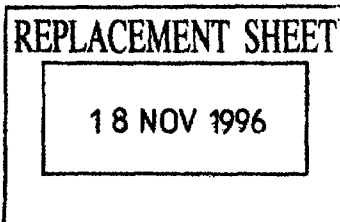
17. An ink jet recording apparatus according
to claim 1, further comprising transmission and/or
reception means of image information.

15

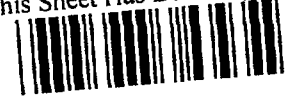
18. An ink jet recording apparatus according
to claim 17, further comprising reading means for
reading the original image.

20 19. An ink jet recording apparatus according
to claim 1, further comprising input means for
inputting record data.

20. An ink jet recording apparatus according
25 to claim 19, wherein said input means is a keyboard.



21. An ink jet recording apparatus which



1 performs the recording by discharging the ink onto
the recording medium in accordance with the recording
data, characterized by comprising:

a mounting portion for exchangeably mounting
5 either first recording means for discharging a single
kind of ink or second recording means capable of
discharging a plurality of kinds of inks;

information generating means for generating
information as to whether recording means to be
10 mounted on said mounting portion is said first
recording means or said second recording means; and

recording control changing means for changing
the recording control in accordance with the
information of said information generating means.

15

22. An ink jet recording apparatus according
to claim 21, wherein said second recording means is
capable of discharging a plurality of inks of the
same type color and having different dye densities.

20

23. An ink jet recording apparatus according
to claim 21, wherein said first recording means and
said second recording means have the discharge
orifice arrays each composed of a plurality of
25 discharge orifices.

24. An ink jet recording apparatus according

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1 to claim 23, wherein said second recording means has
said discharge orifice arrays separately in plural
sections, corresponding to said plurality of kinds
of inks.

5

25. An ink jet recording apparatus according
to claim 21, further comprising a plurality of image
processing means corresponding to said first
recording means and said second recording means,
10 respectively, wherein said recording control changing
means changes said image processing means in
accordance with information generated by said
information generating means.

15

26. An ink jet recording apparatus according
to claim 25, wherein said second recording means is
capable of discharging a plurality of inks of the
same type color and having different dye densities.

20

27. An ink jet recording apparatus according
to claim 26, wherein said plurality of image
processing means consists of a first table
corresponding to said first recording means for
determining the discharging of the ink in accordance
25 with the density of the image to be recorded, and a
second table corresponding to said second recording
means for determining the discharging of said

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1 plurality of inks having different dye densities in
2 accordance with the density of the image to be
3 recorded, and said recording control changing means
4 changes said first table and said second table in
5 accordance with said information.

28. An ink jet recording apparatus according
to claim 21, wherein said information generating
means is a dip switch provided on the ink jet
10 recording apparatus.

29. An ink jet recording apparatus according
to claim 21, wherein said information generating
means is an operation panel provided on the ink jet
15 recording apparatus.

30. An ink jet recording apparatus according
to claim 21, wherein said information generating
means generates said information based on an
20 instruction from host means connected to the ink
jet recording apparatus.

31. An ink jet recording apparatus according
to claim 21, wherein said recording means has heat
25 energy generating means for supplying heat energy
to the ink, and discharges the ink by the use of said
heat energy.

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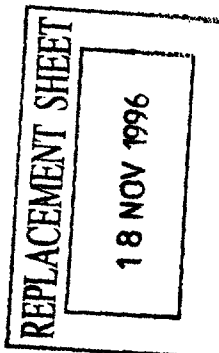
1 32. An ink jet recording apparatus according
to claim 31, wherein said recording means causes a
state change in the ink by the use of the heat energy
generated by said heat energy generating means, and
5 discharges the ink owing to a pressure based on said
state change.

 33. An ink jet recording method which
performs the recording by discharging the ink onto
10 the recording medium in accordance with the recording
data by recording means mounted on a mounting portion
for exchangeably mounting either first recording
means for discharging a single kind of ink or second
recording means capable of discharging a plurality
15 of kinds of inks, characterized by including:

 a discrimination step of discriminating
whether recording means to be mounted on said
mounting portion is said first recording means or
said second recording means; and

20 a recording control changing step of changing
the recording control in accordance with said
discrimination step.

 34. An ink jet recording method according
25 to claim 33, wherein said second recording means is
capable of discharging a plurality of inks of the
same type color and having different dye densities.





1 35. An ink jet recording method according
to claim 34, further including image processing steps
for performing an image processing corresponding to
recording means to be mounted in accordance with the
5 image to be recorded, wherein said plurality of image
processing steps determine the discharging of the
ink for the recording means, based on a first table
corresponding to said first recording means for
determining the discharging of the ink in accordance
10 with the density of the image to be recorded, and a
second table corresponding to said second recording
means for determining the discharging of said
plurality of inks having different dye densities
in accordance with the density of the image to be
15 recorded, and wherein said recording control changing
means changes said first table and said second table
in accordance with said discrimination step.

20 36. An ink jet recording method according
to claim 33, wherein said first recording means and
said second recording means have discriminated means,
said discrimination step making a discrimination by
said discriminated means.

25 37. An ink jet recording method according
to claim 33, wherein ink supply means is exchangeably
mounted on said mounting portion in accordance with



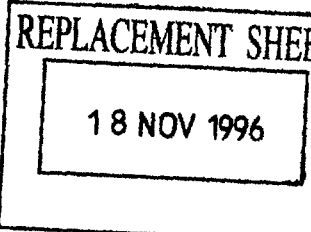
1 the type of recording means to be mounted on said
mounting portion, and said discrimination step makes
a discrimination as to whether recording means to
be mounted on said mounting portion is said first
5 recording means or said second recording means by
detecting the type of said ink supply means.

38. An ink jet recording method according
to claim 37, wherein said ink supply means has a
10 marking in accordance with the type of corresponding
recording means, and said discrimination step makes
a discrimination by detecting said marking.

39. An ink jet recording method according
15 to claim 33, wherein said recording means has heat
energy generating means for supplying heat energy
to the ink, and discharges the ink by the use of
said heat energy.

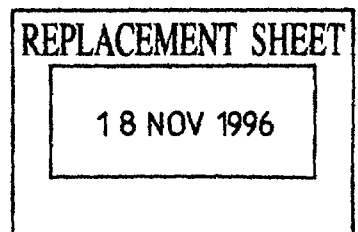
20 40. An ink jet recording method according
to claim 39, wherein said recording means causes a
state change in the ink by the use of the heat energy
generated by said heat energy generating means, and
discharges the ink owing to a pressure based on said
25 state change.

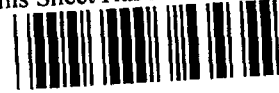
41. An ink jet recording method which





1 performs the recording by discharging the ink onto
the recording medium in accordance with the recording
data by using recording means mounted on a mounting
portion for exchangeably mounting either first
5 recording means for discharging a single kind of
ink or second recording means capable of discharging
a plurality of kinds of inks, characterized by
including:
an information generation step of generating
10 information as to whether recording means to be
mounted on said mounting portion is said first
recording means or said second recording means; and
a recording control changing step of changing
the recording control in accordance with the
15 information of said information generation step.





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42. An ink jet head for a recording apparatus which performs the recording by discharging the ink onto the recording medium in accordance with recording data, including a carriage mounting portion for exchangeably mounting said head, discriminating means for discriminating whether recording means to be mounted on said mounting portion is of a type for discharging a single kind of ink or of a type for discharging a plurality of kinds of inks; and recording control changing means for changing the recording control in accordance with said discriminating means, said head having discriminated means readable by said discriminating means and being of a kind capable of discharging a single first kind of ink or alternatively of a second kind capable of discharging a plurality of inks of the same type color and having different dye densities.

43. An ink jet head as claimed in claim 42, characterised in that said discriminated means is a plurality of members provided at contact points for engagement with cooperating members on said mounting portion.

44. An ink jet head as claimed in claim 42 or 43, characterised in that said discriminated means is an electrically conductive or non-electrically conductive

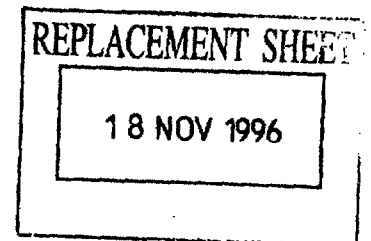


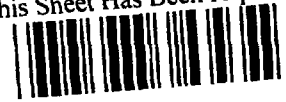
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member, whereby said discriminating means discriminates the type of said recording means by detecting the conductivity of said discriminated means.

- 5 45. An ink jet head as claimed in claim 42, 43 or 44, characterised in that heat energy generating means are provided for giving heat energy to the ink, whereby the ink is discharged by the use of said heat energy.





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METHOD AND APPARATUS FOR INK JET RECORDING1 ABSTRACT OF THE DISCLOSURE

The present invention aims to provide an ink jet recording apparatus and an ink jet recording method which can produce an image excellent in gradation and resolution and allows the image for text, graphics and listing to be obtained at high speed and good quality. The present invention allows a desired recorded image to be obtained by exchangeably comprising an ink jet unit for producing the image excellent in gradation, and an ink jet unit having higher character quality and capable of recording at high speed, and effecting recording control in accordance with the ink jet unit.

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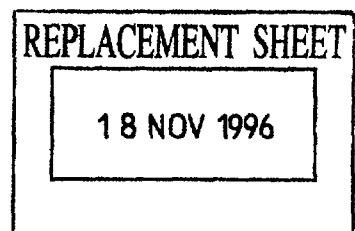
FIGURE 1

FIG. 1

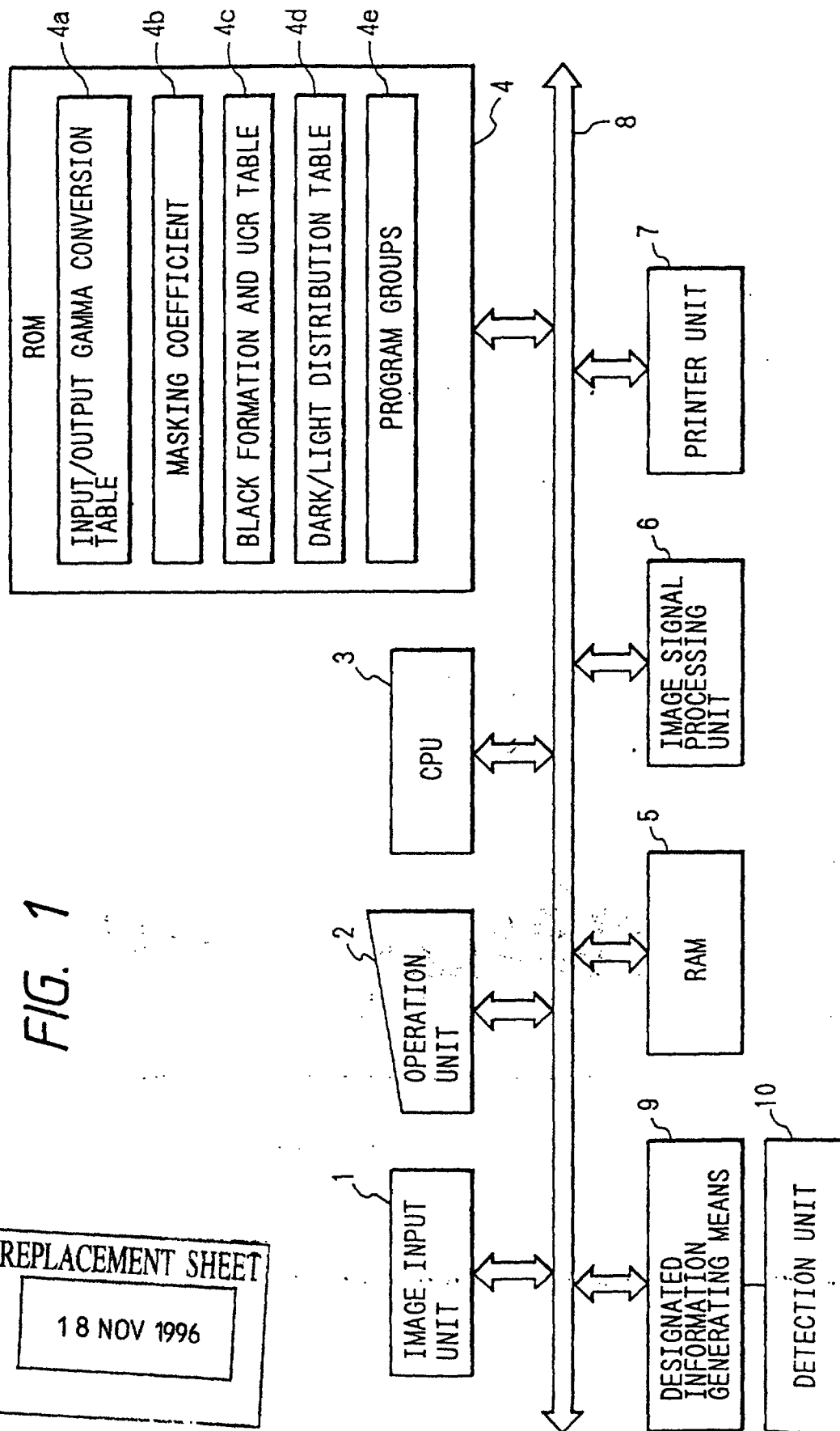


FIG. 2

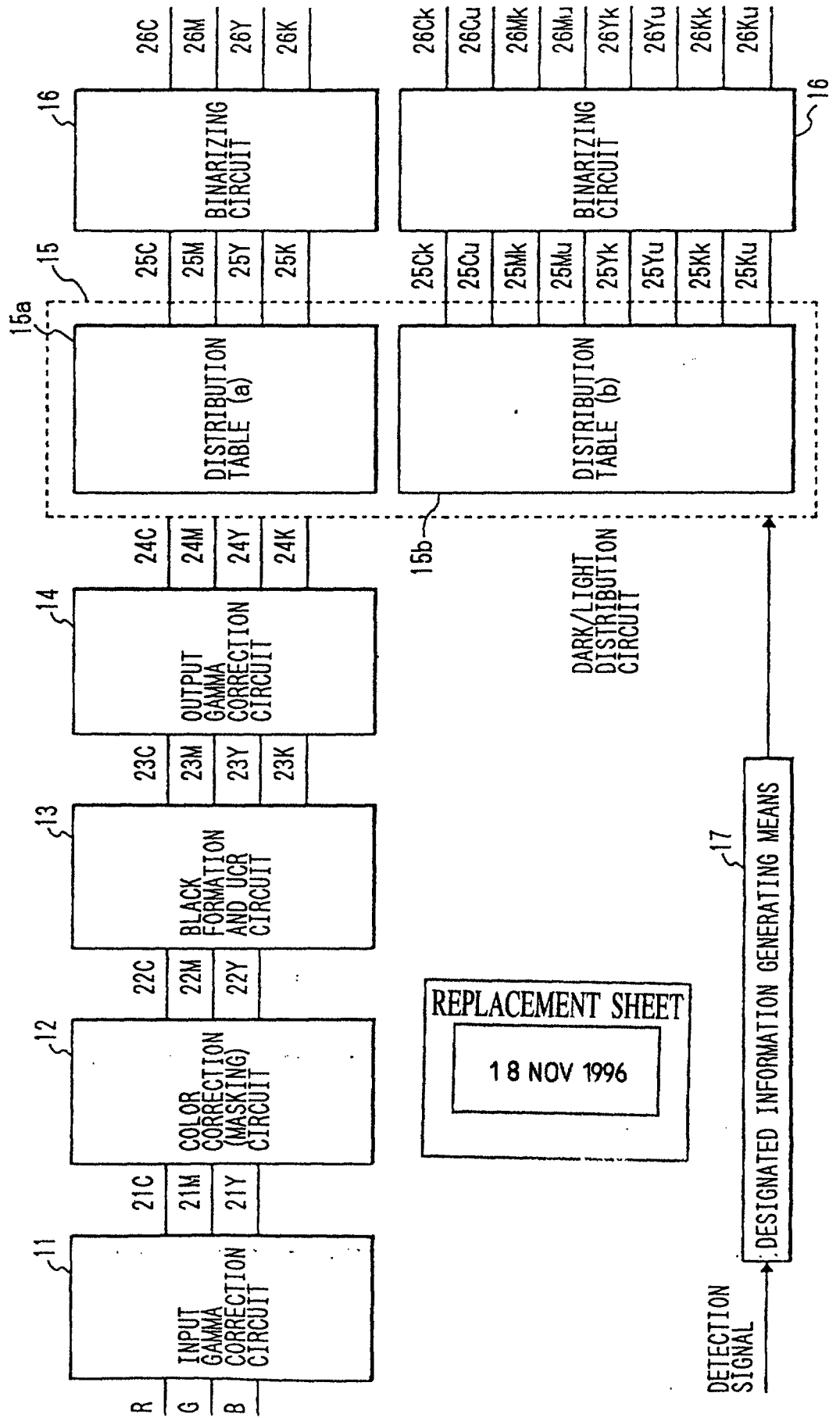


FIG. 3A

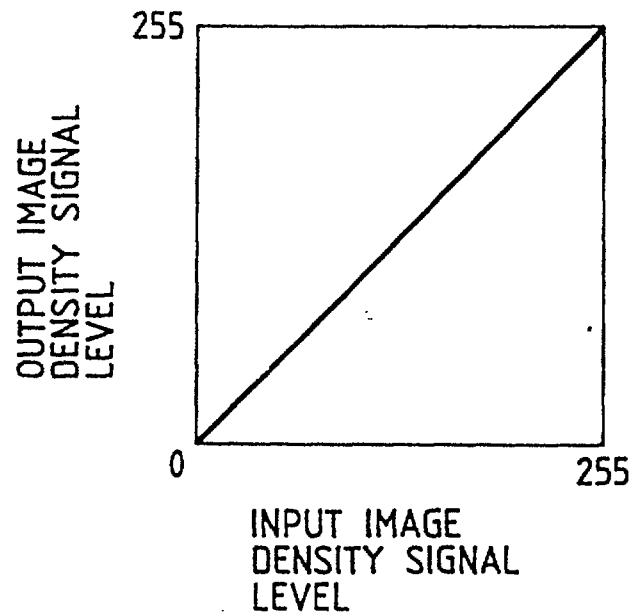
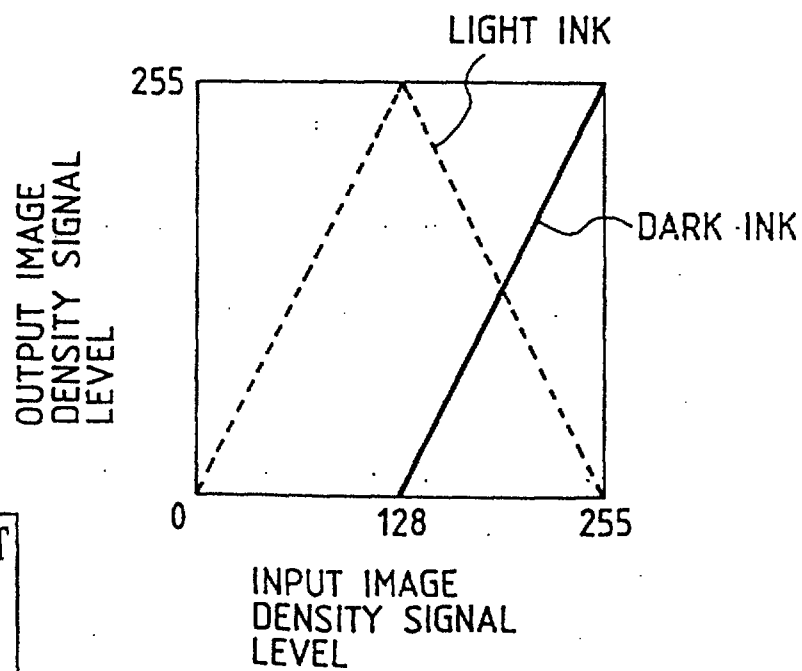


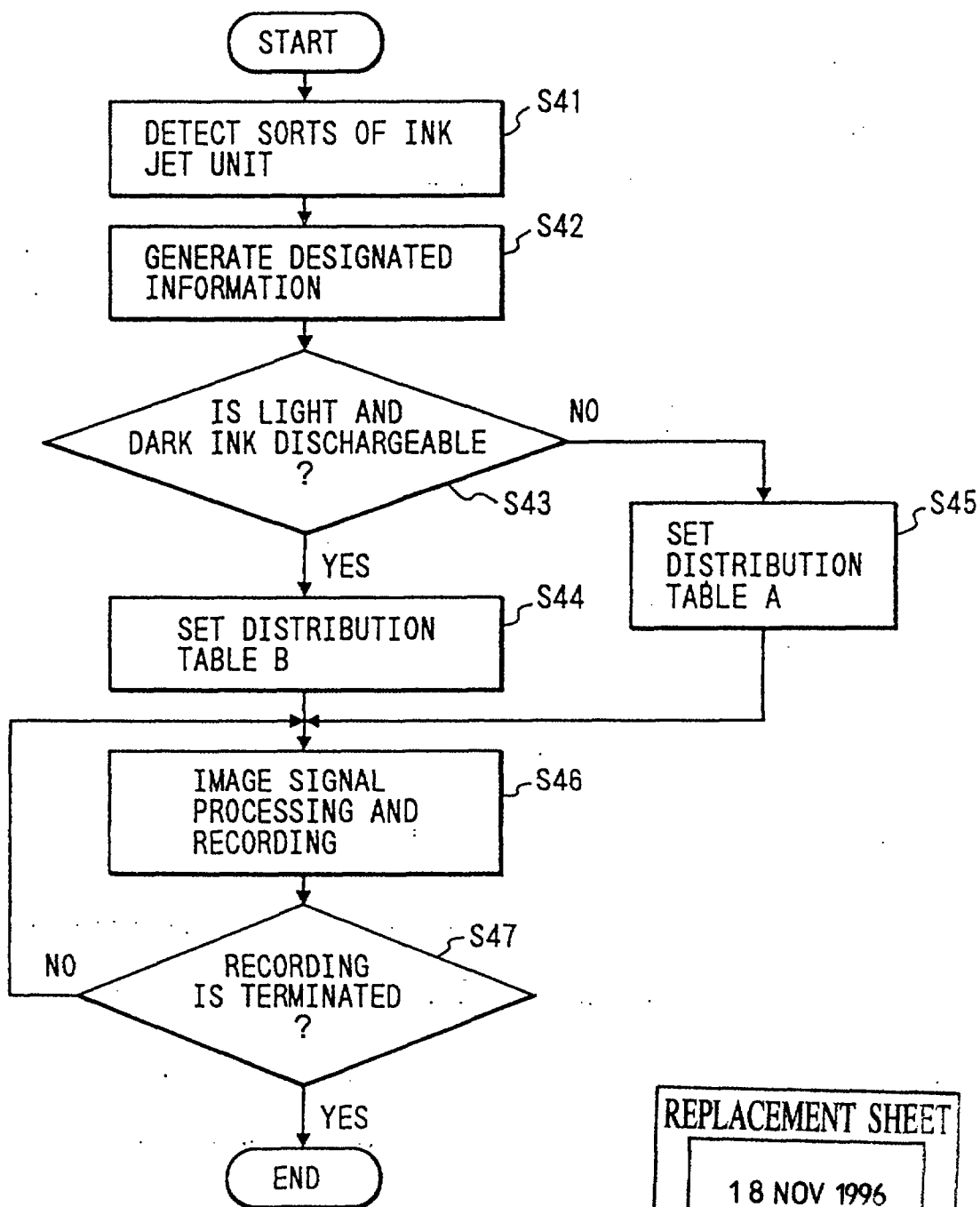
FIG. 3B



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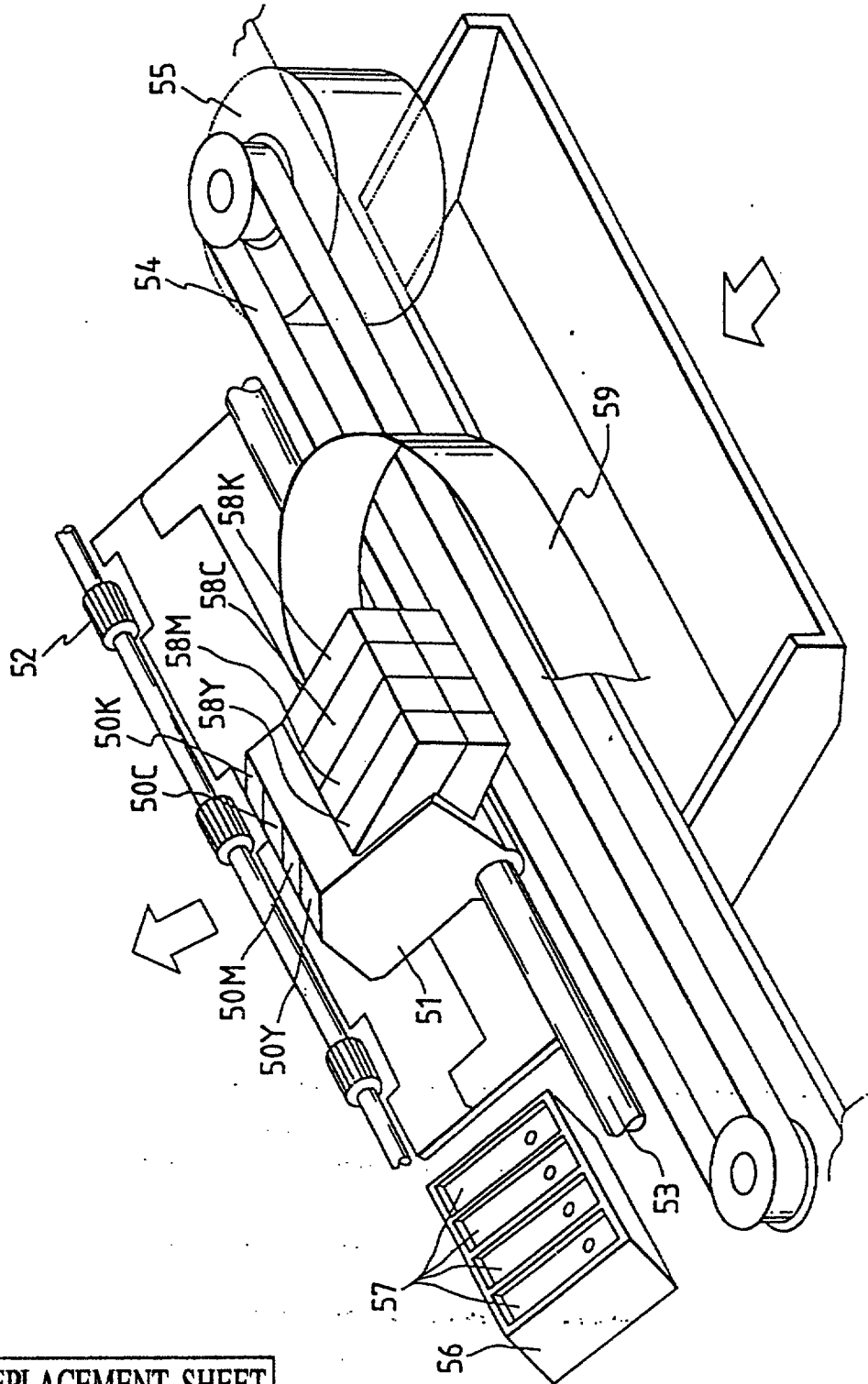
FIG. 4



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FIG. 5



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FIG. 6

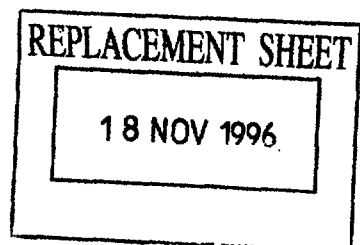
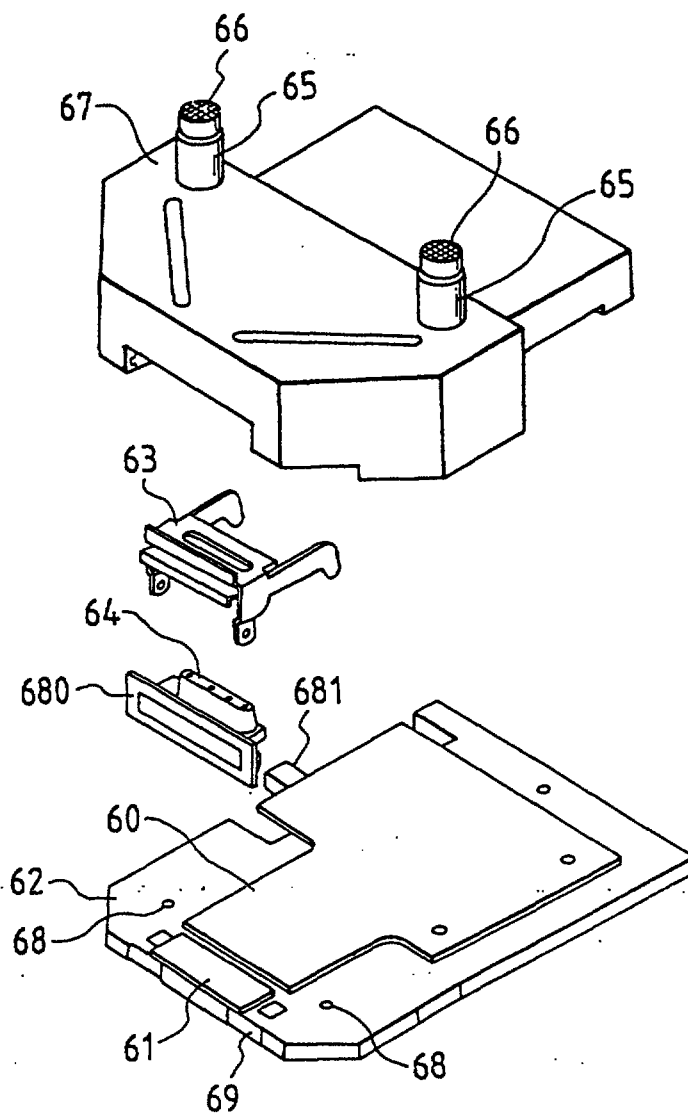


FIG. 7

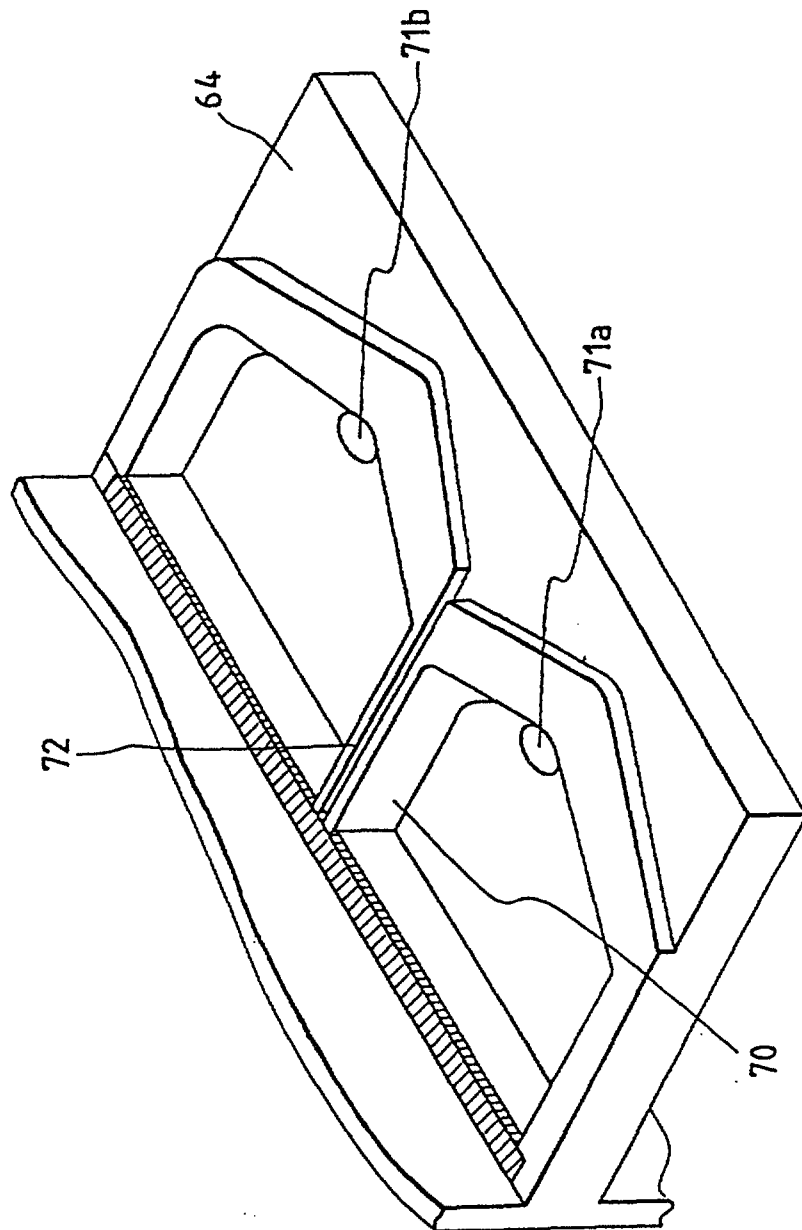
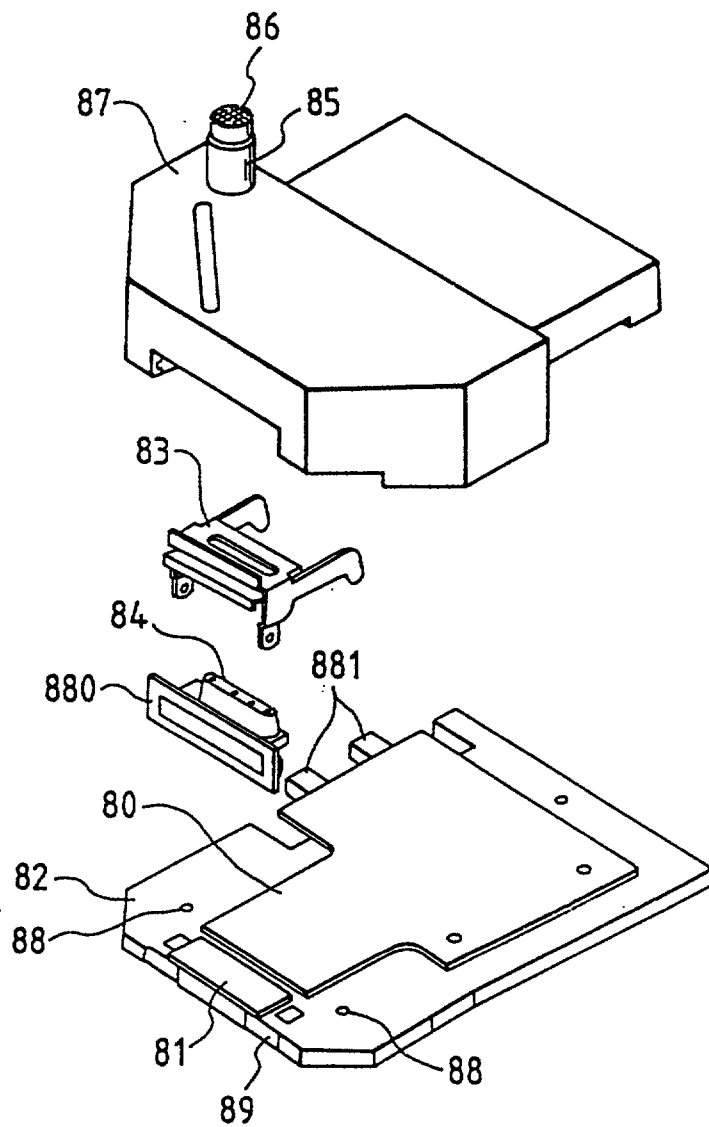


FIG. 8



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FIG. 9

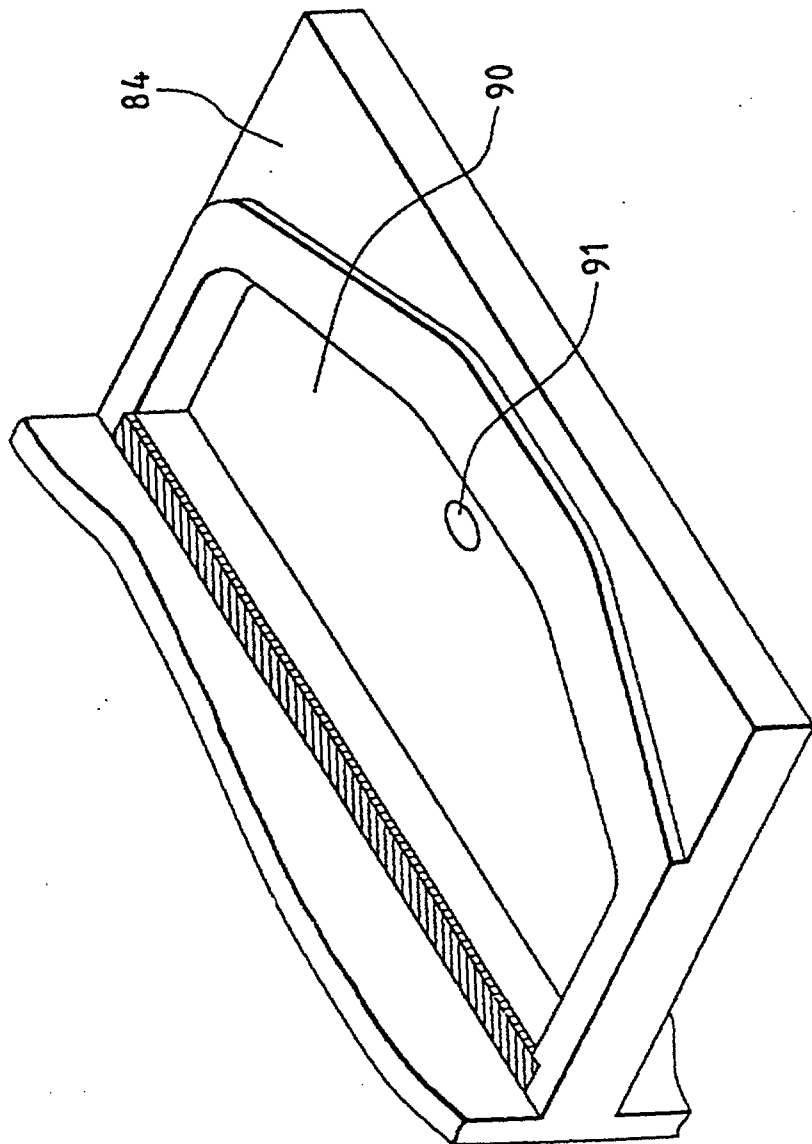


FIG. 10

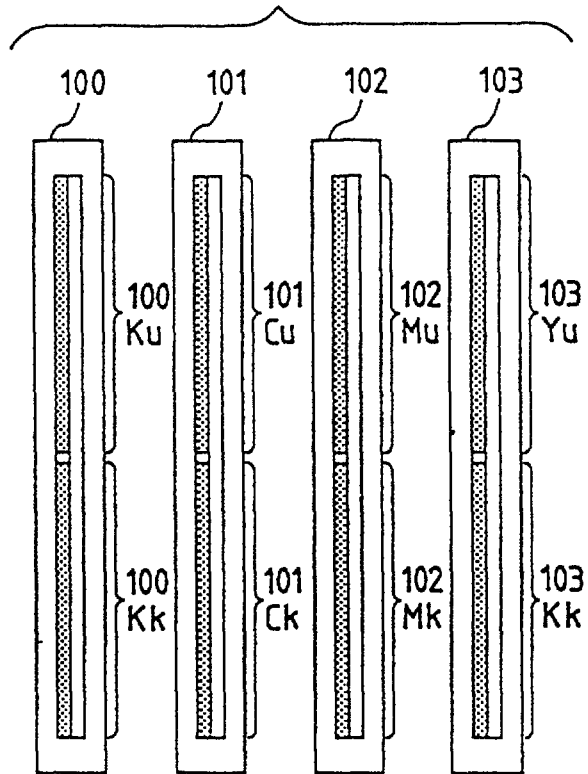
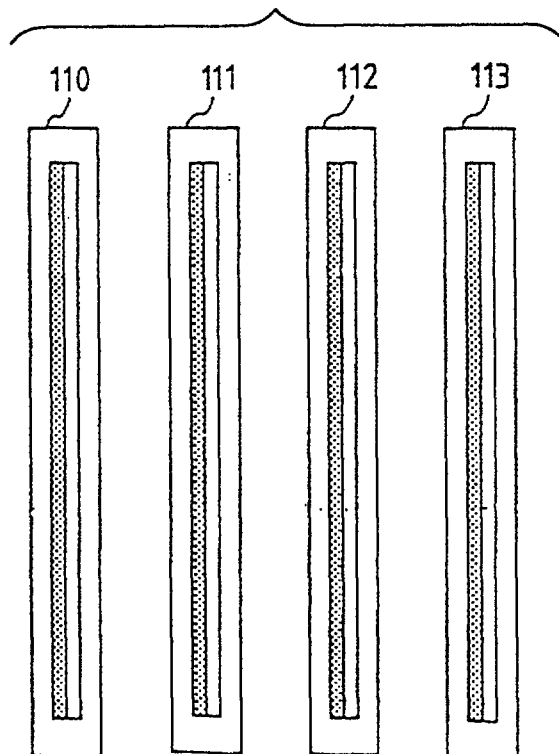
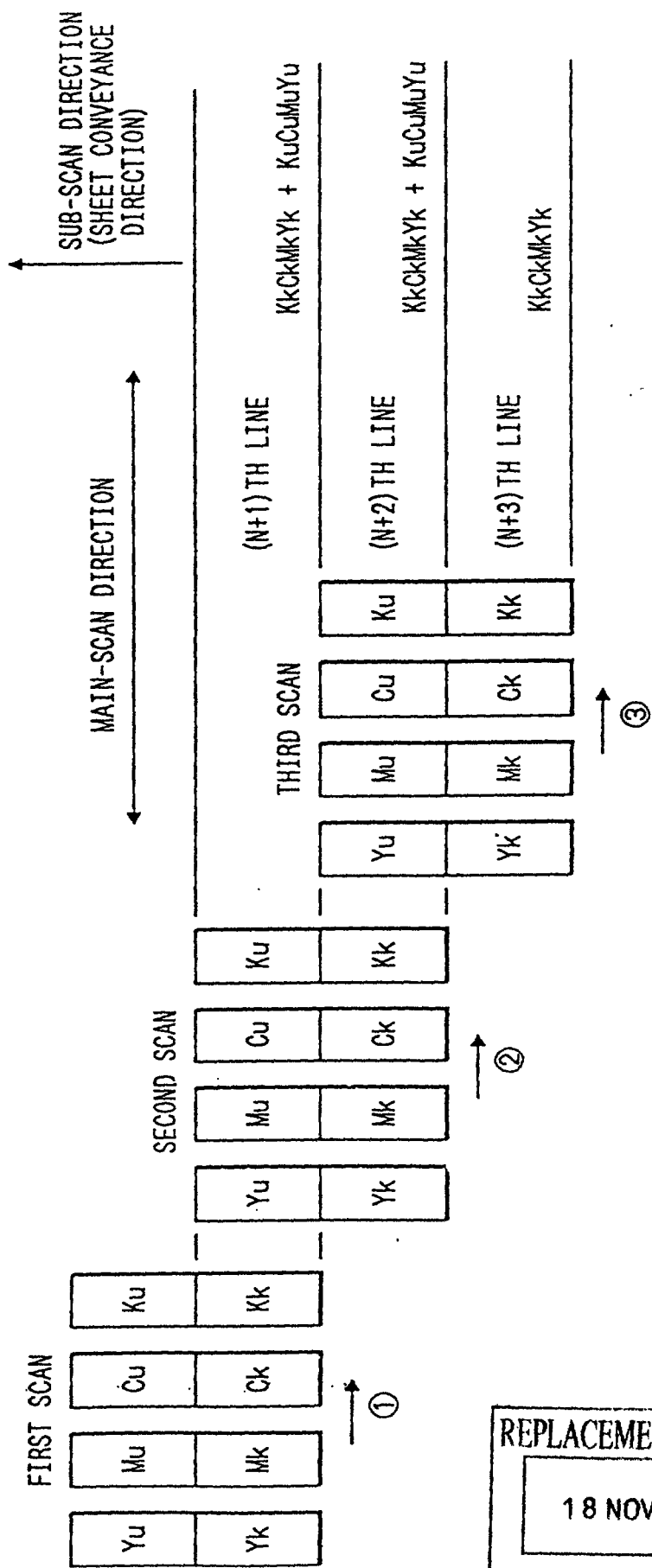


FIG. 11



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FIG. 12



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FIG. 13

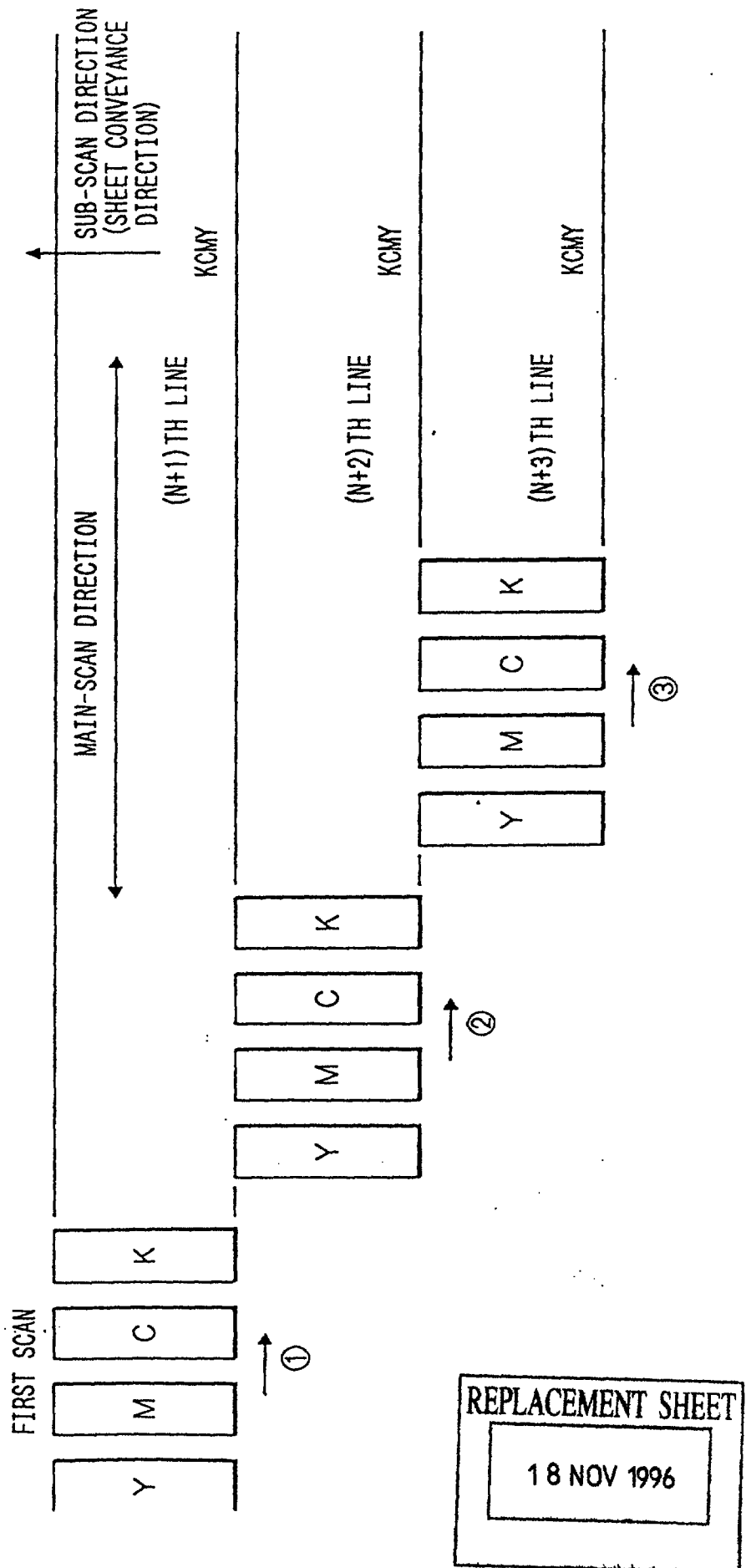


FIG. 14A

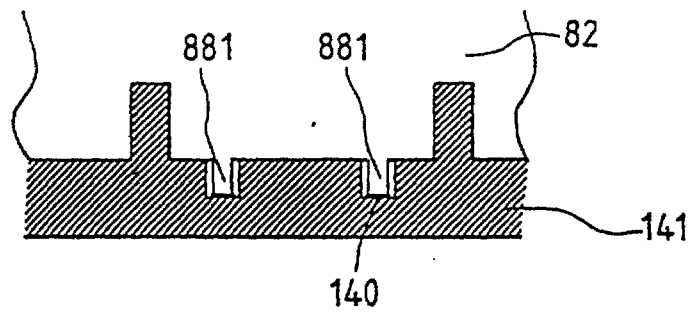


FIG. 14B

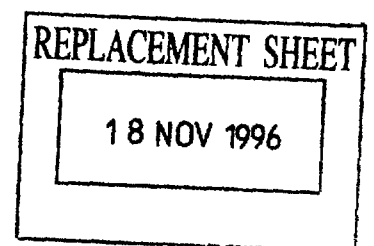
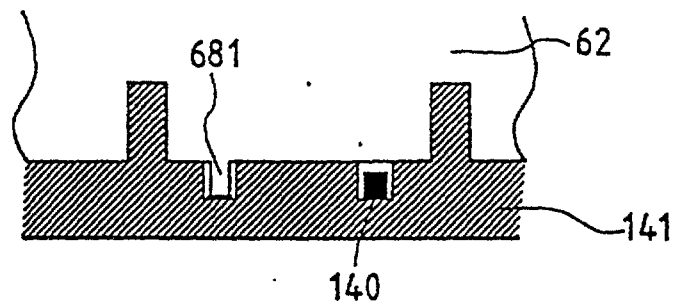


FIG. 15

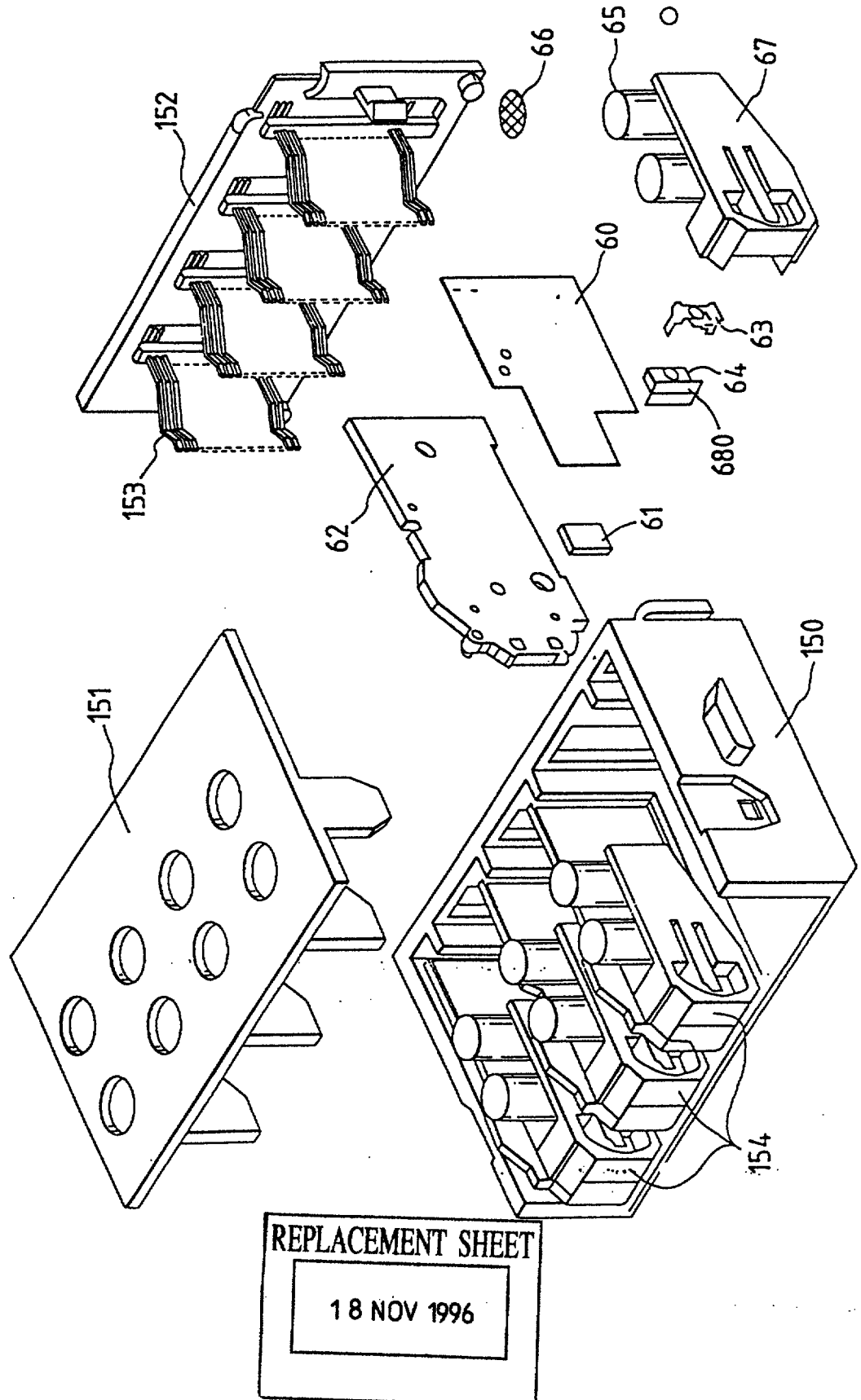


FIG. 16

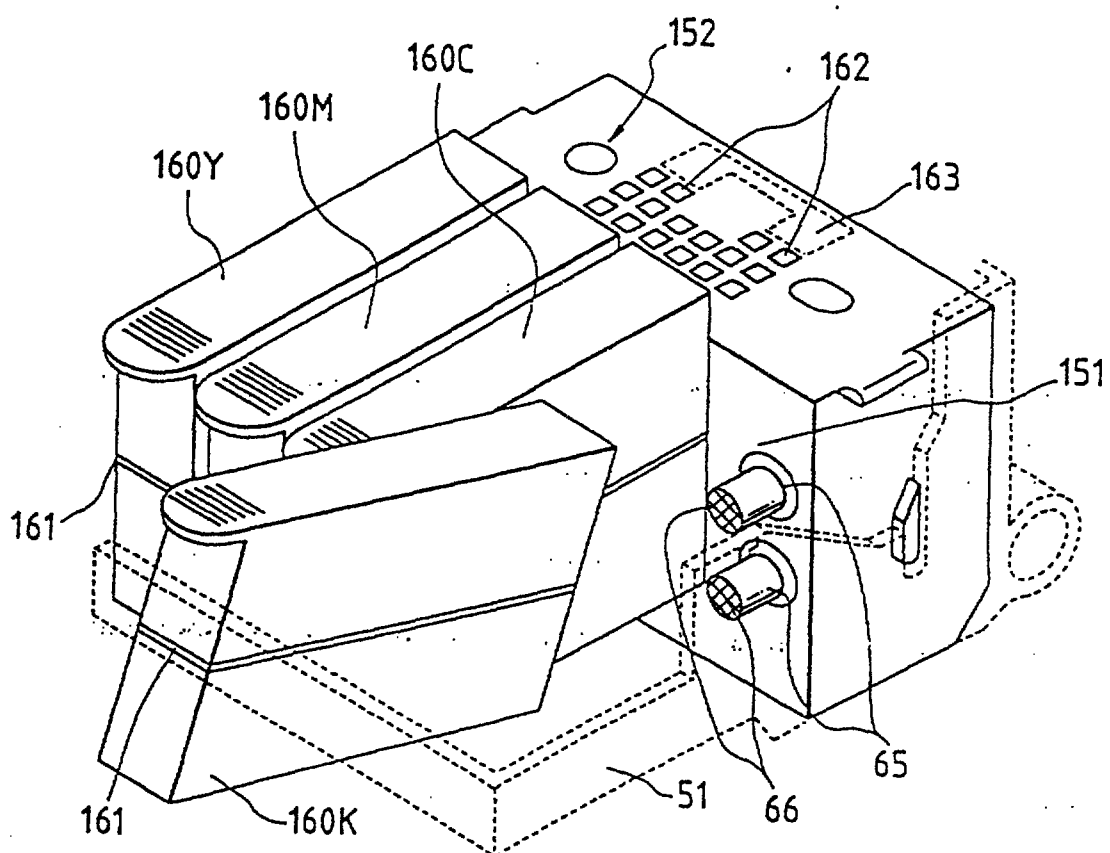
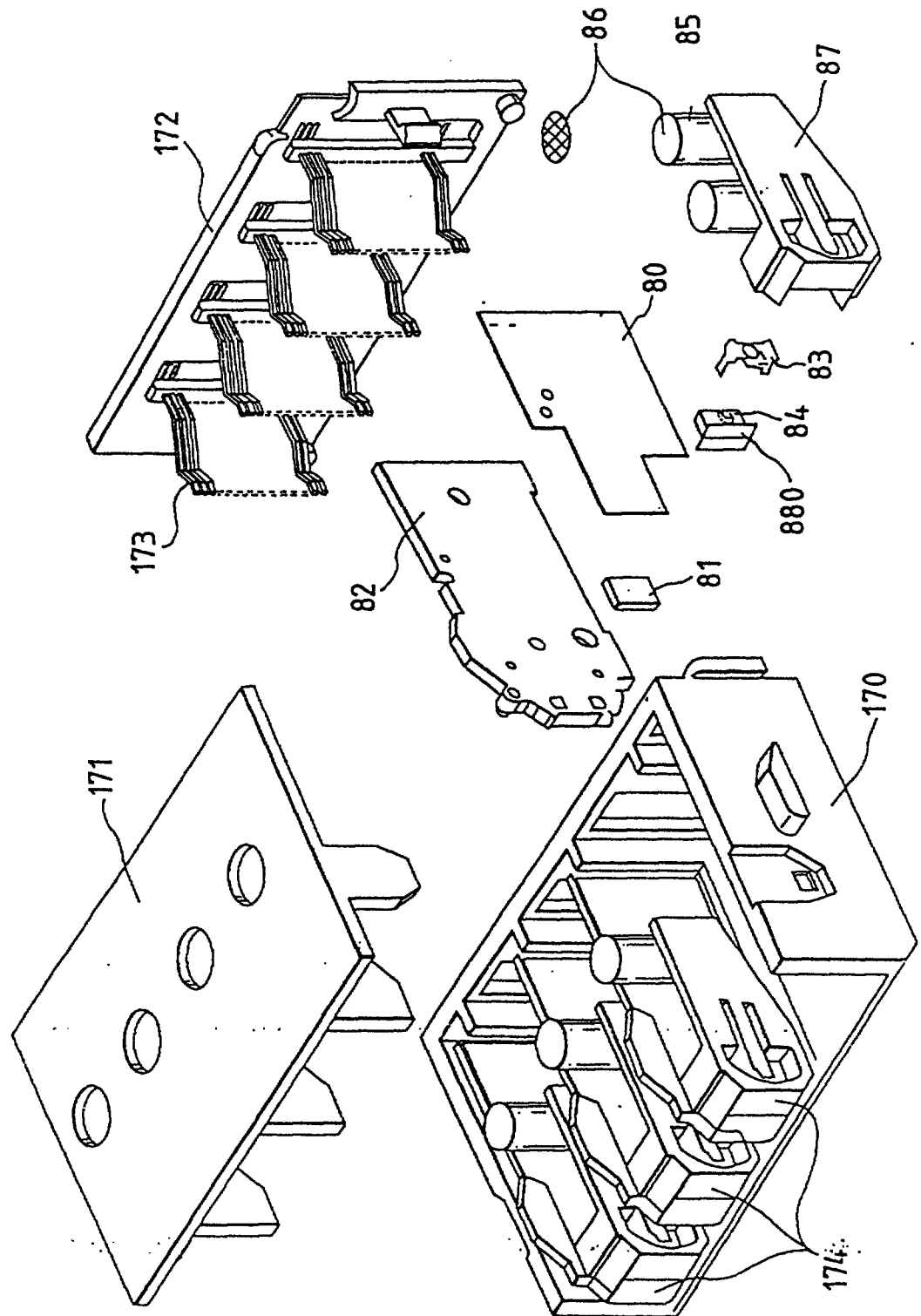


FIG. 17



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FIG. 18

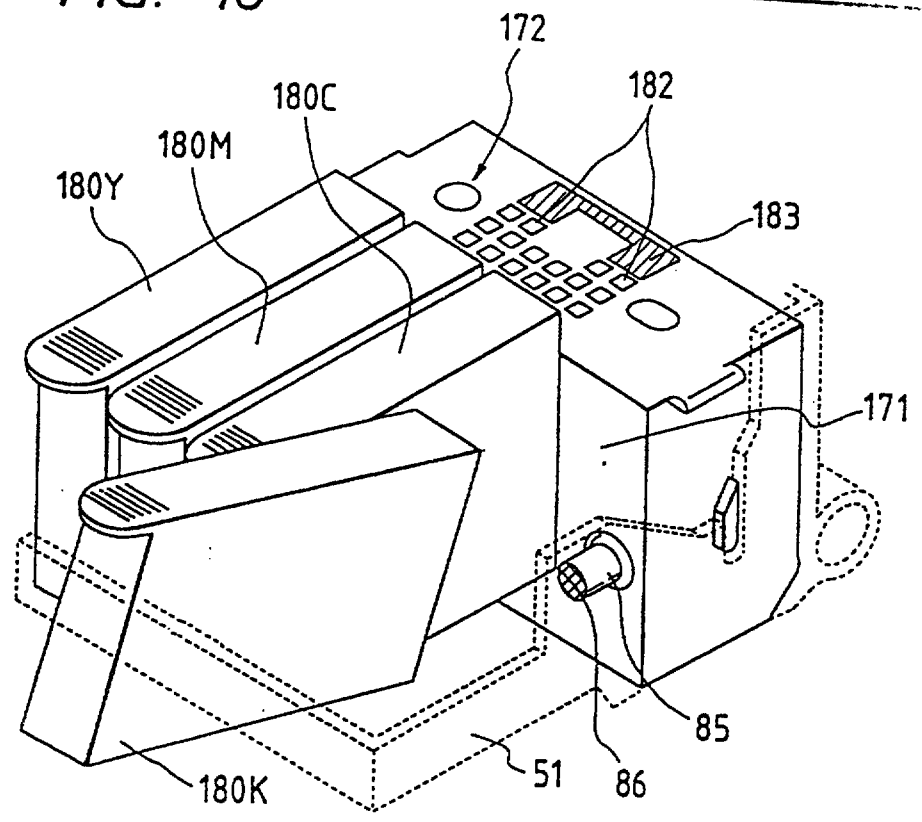


FIG. 19

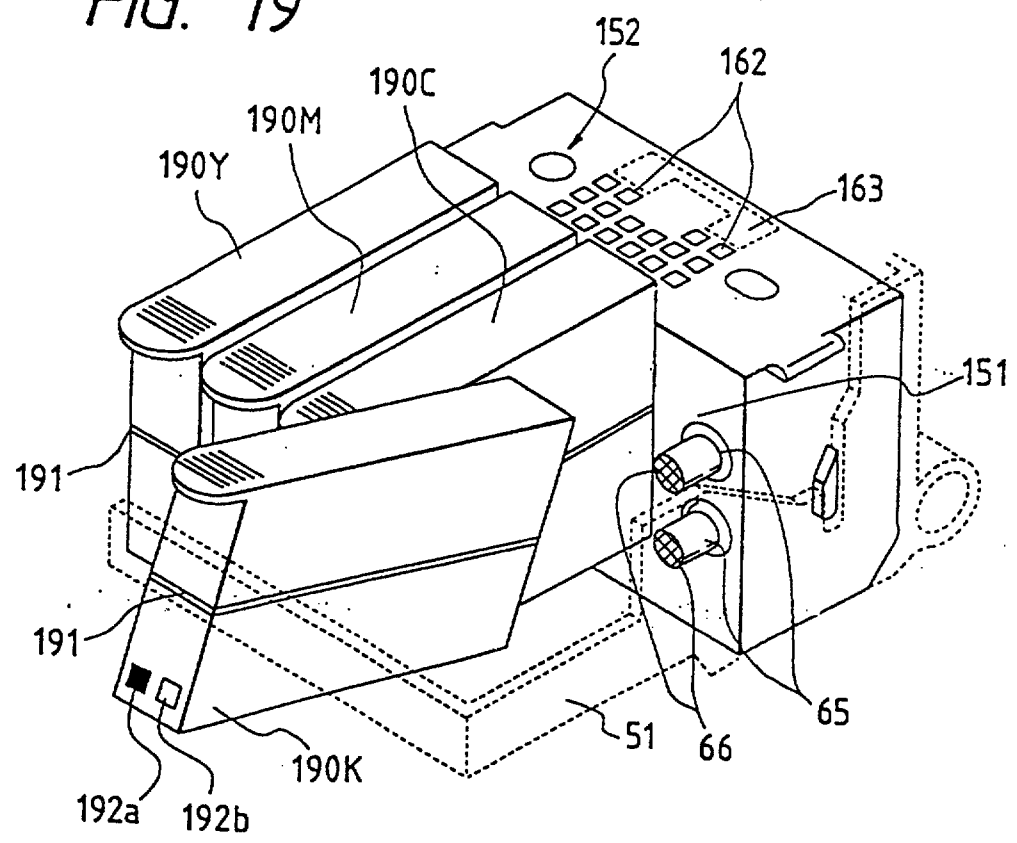


FIG. 20

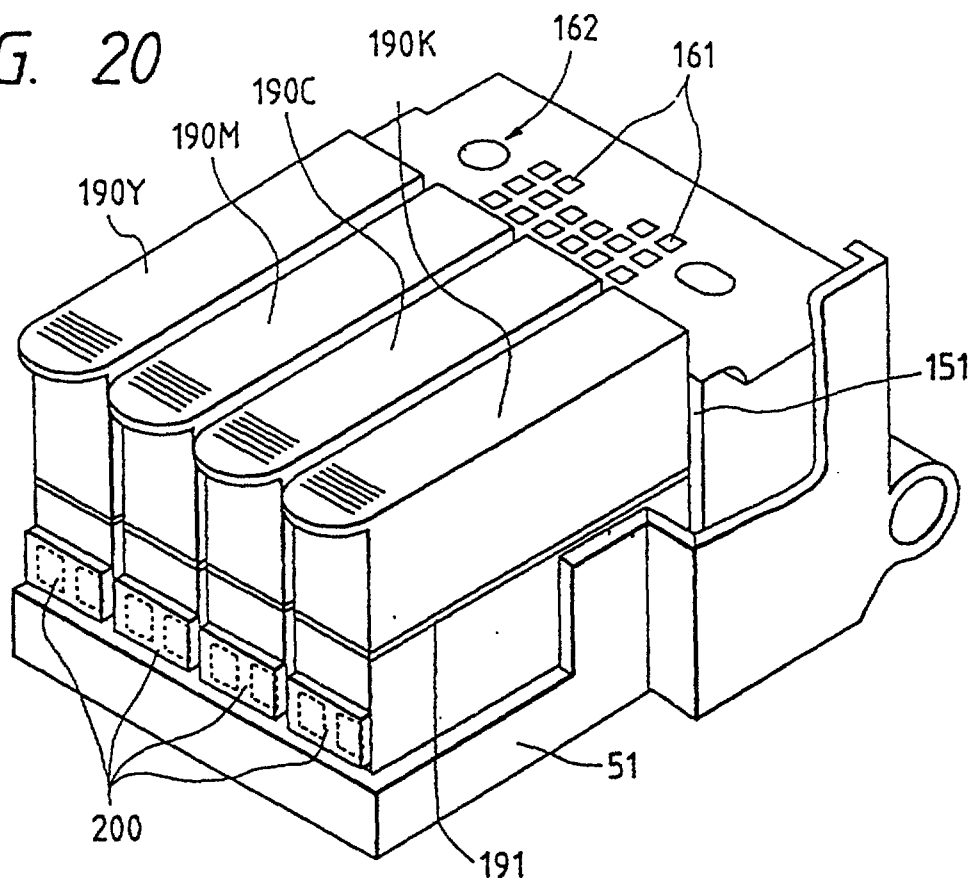


FIG. 21

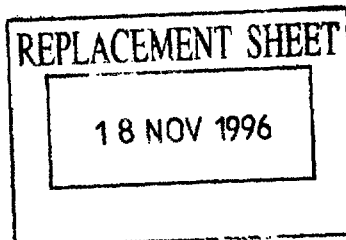
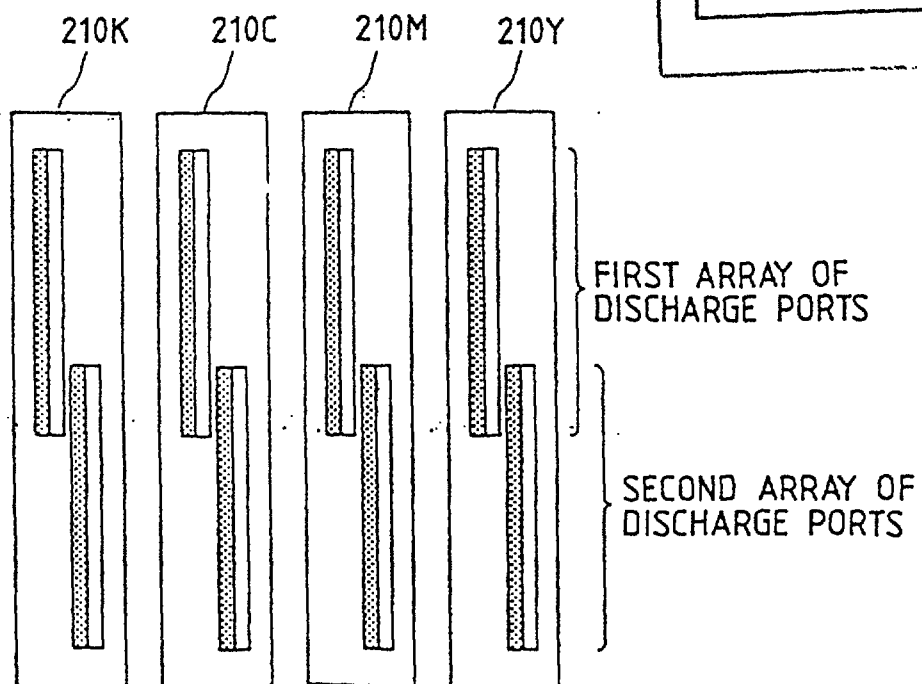


FIG. 22

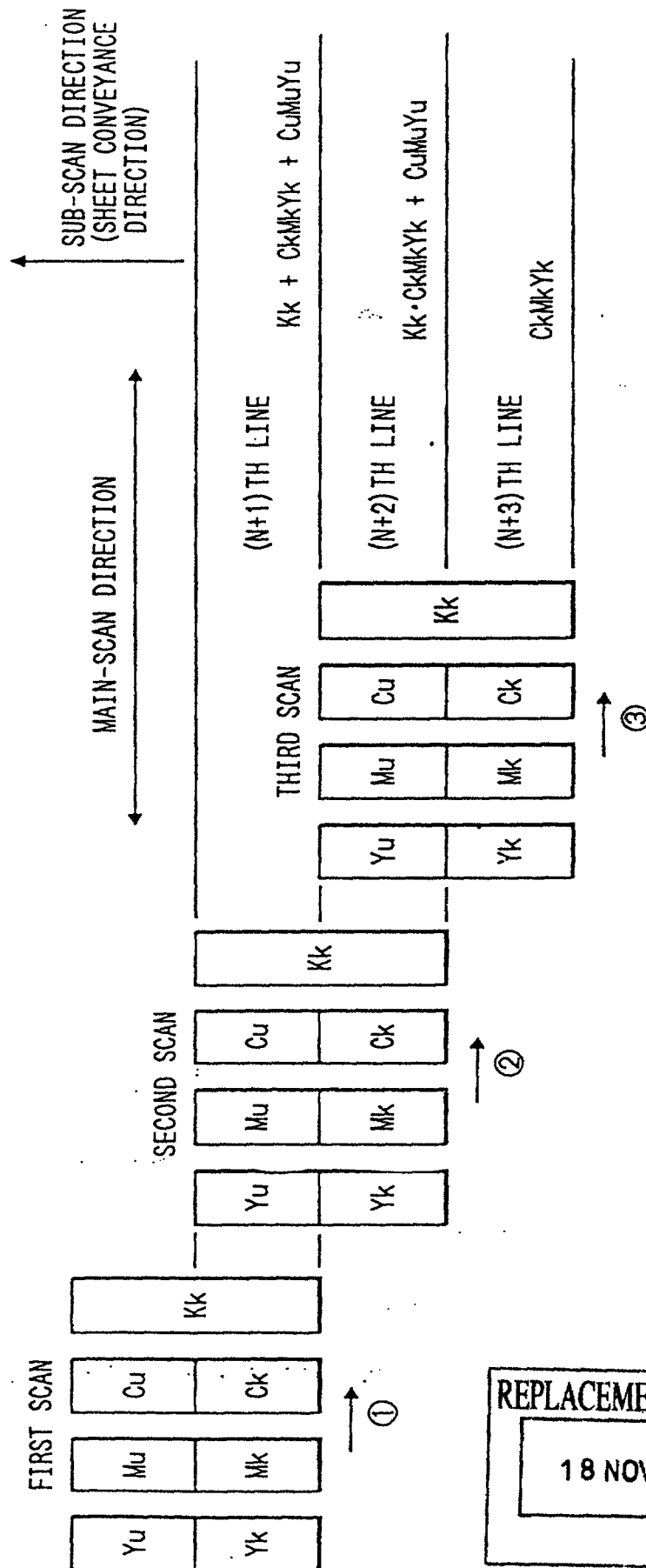


FIG. 23
PRIOR ART

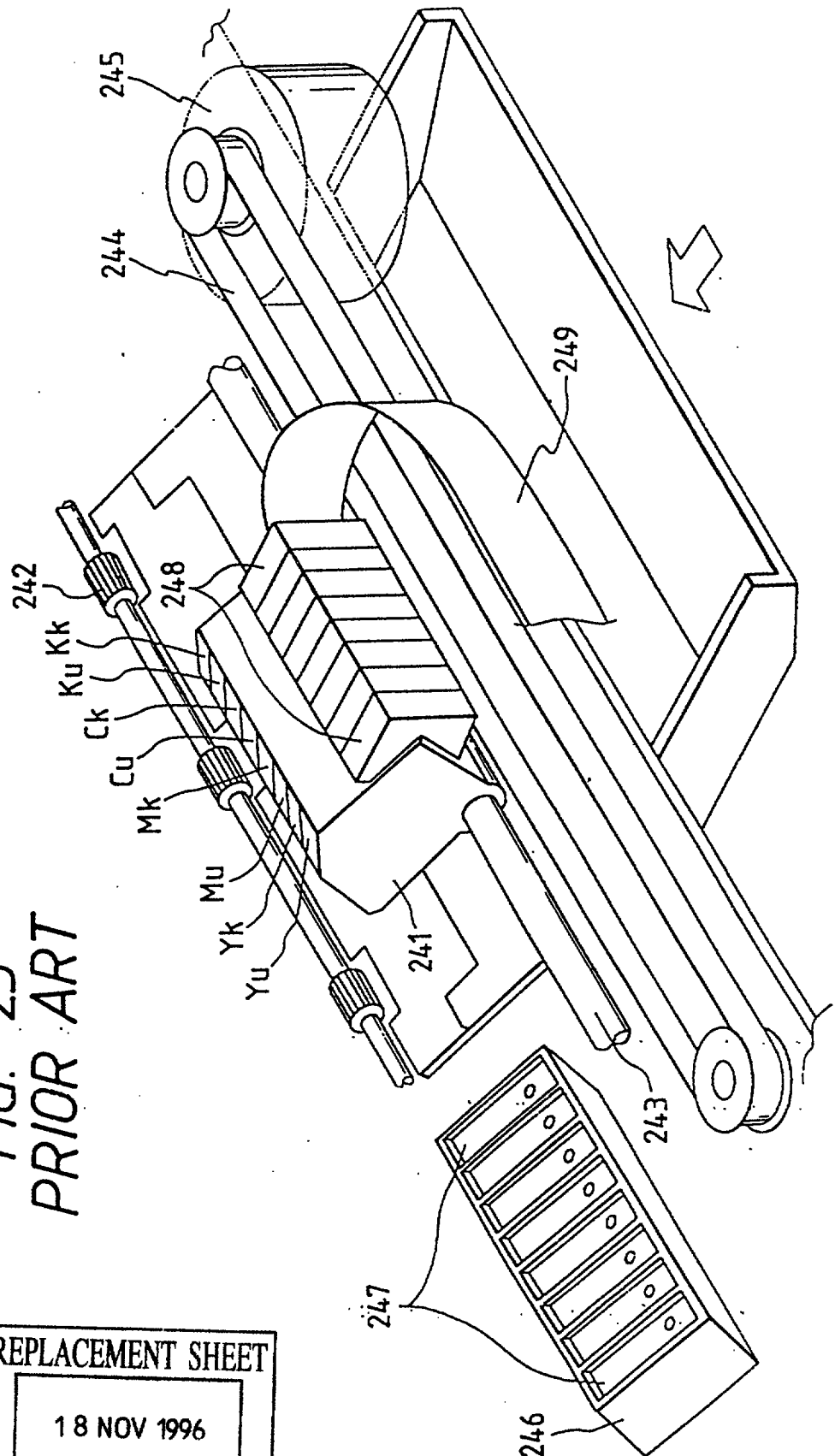
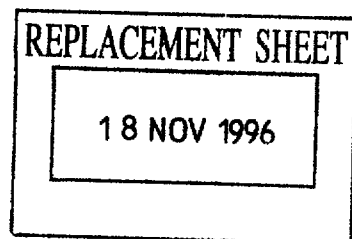


FIG. 24

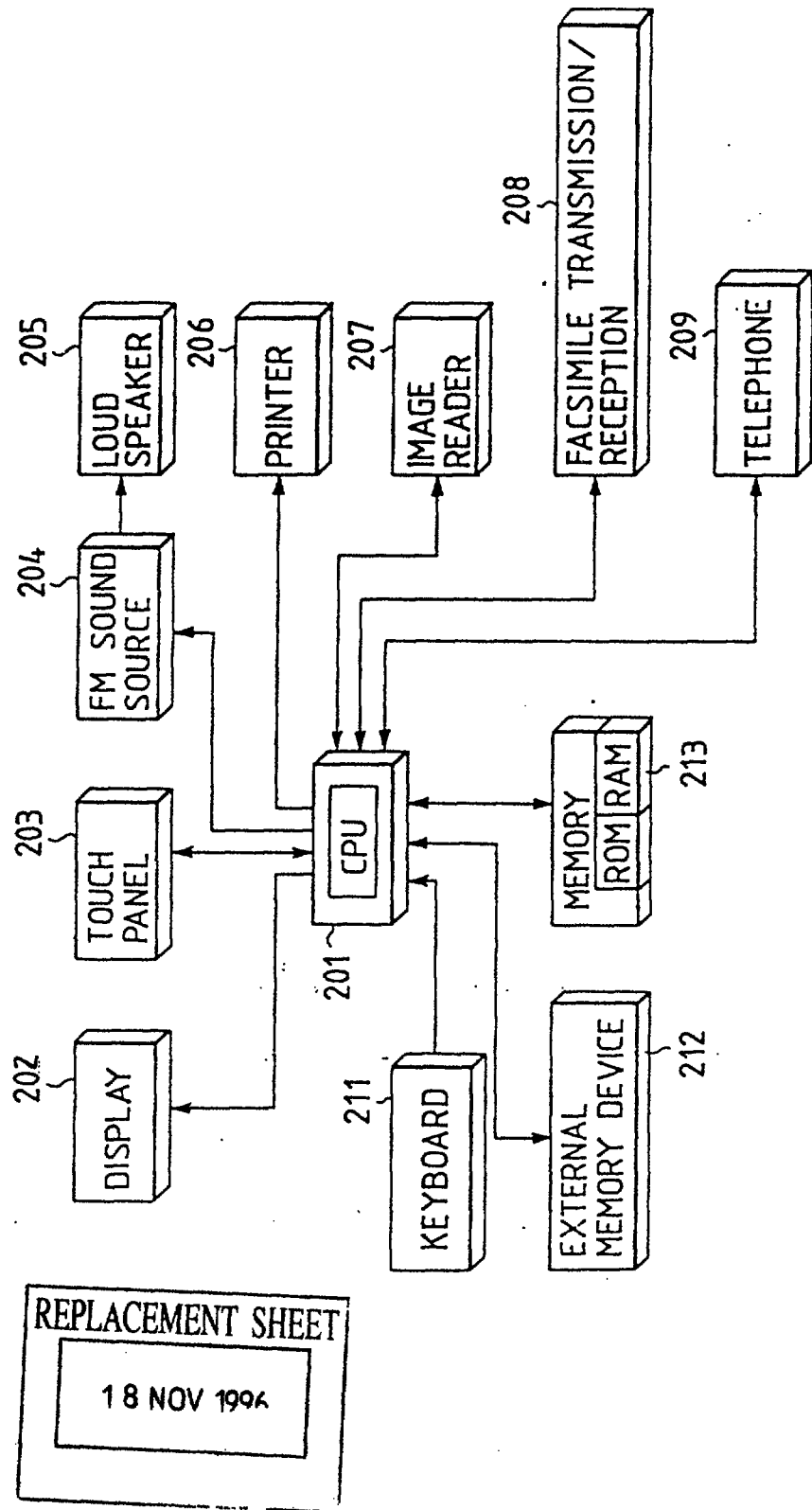
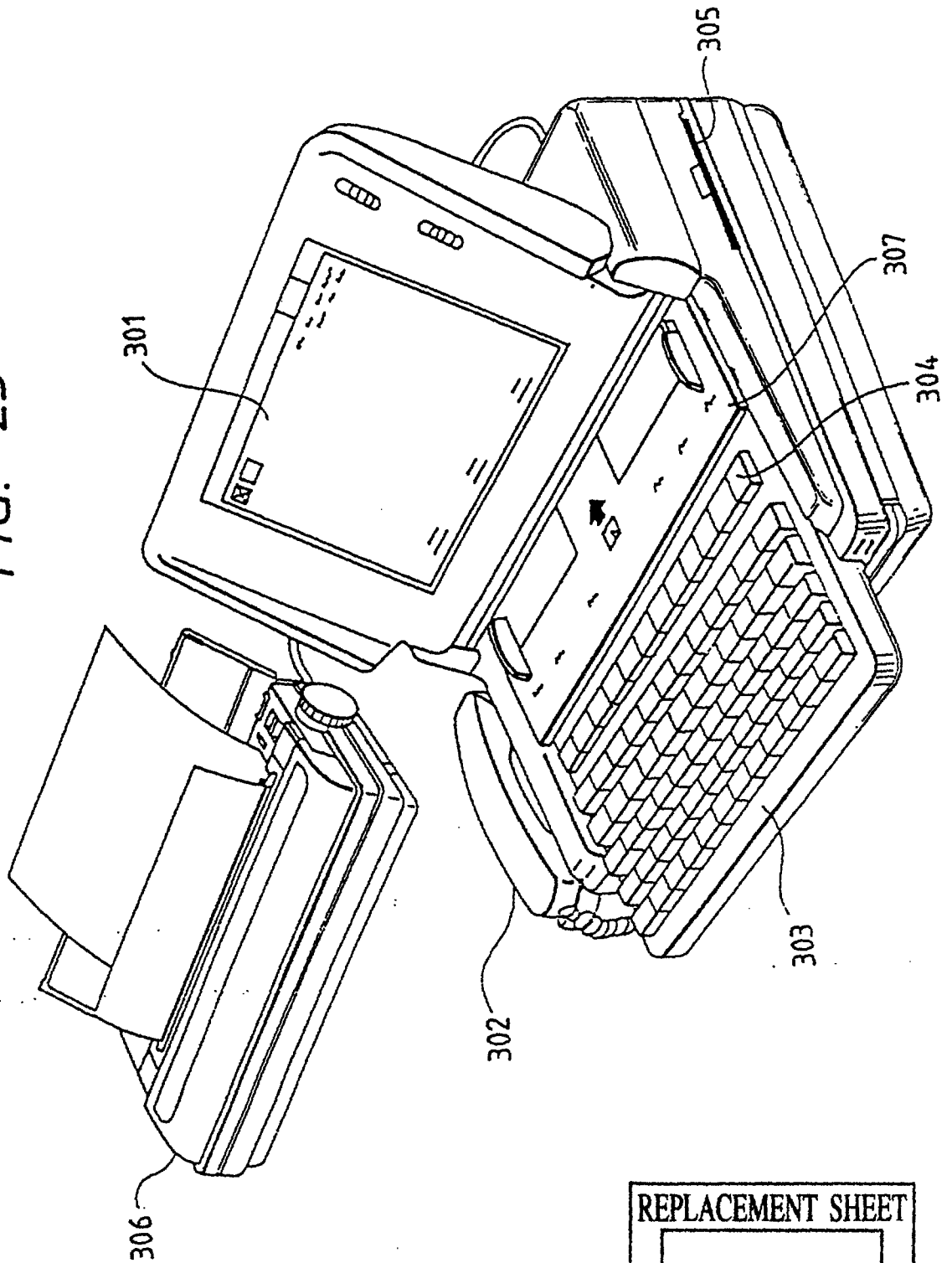


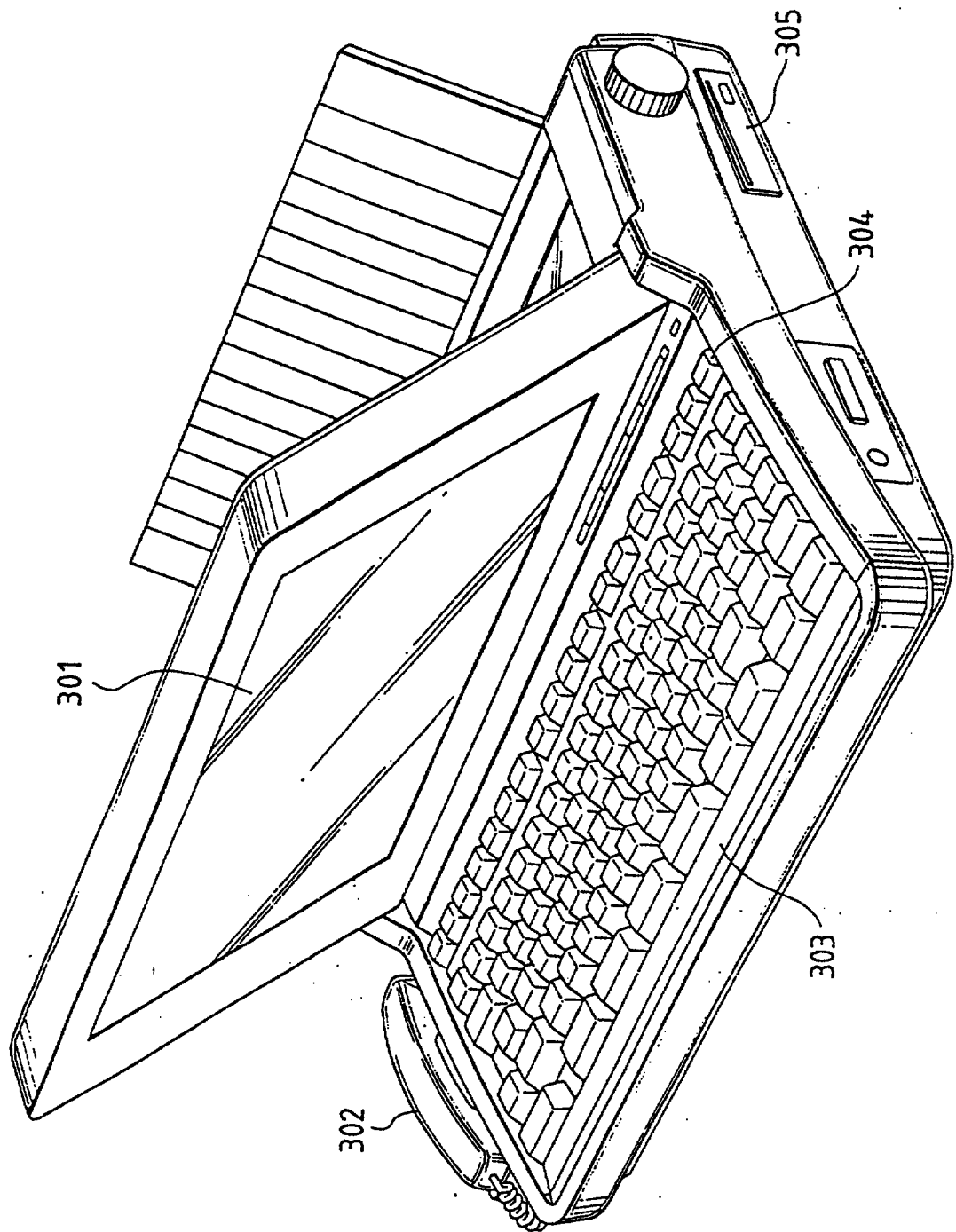
FIG. 25



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FIG. 26



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AMENDED CLAIMS



1. An ink jet recording apparatus which records by discharging an ink onto a recording medium in accordance with a recording data, characterized by comprising:

a mounting portion for exchangeably mounting either of a first recording means for discharging an ink of a predetermined color and having a single density and a second recording means for discharging an ink of the predetermined color and having a plurality of densities;

a plurality of image processing means for processing images corresponding to said first recording means and said second recording means, respectively, said plurality of image processing means consisting of a first table corresponding to said first recording means for determining the discharging of the ink in accordance with a density of the image to be recorded, and a second table corresponding to said second recording means for determining the discharging of said plurality of inks having different densities in accordance with the density of the image to be recorded;

recording control changing means for changing a said image processing means in accordance with said designated information; and

means for receiving designated information for instructing said image processing means.

2. An ink jet recording apparatus which records by discharging an ink onto a recording medium in accordance with a recording data and a system comprising a host device connected to said ink jet recording apparatus, sai apparatus comprising:

information generating means for generating an information signifying whether a particular recording means to be mounted on said mounting portion is said first recording means or said second recording means, said information generating means being provided in said host device;

a mounting portion for exchangeably mounting either of a first recording means for discharging an ink of a predetermined color and having a single density and a second recording means for discharging an ink of the predetermined color and having a plurality of densities;

a plurality of image processing means for processing images, corresponding to said first recording means and said second recording means, respectively, wherein said recording control changing means changes said image processing means in accordance information generated by said information generating means, said plurality of image processing means

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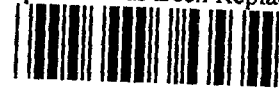
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consisting of a first table corresponding to said first recording means for determining the discharging of the ink in accordance with a density of the image to be recorded, and a second table corresponding to said second recording means for determining the discharging of said plurality of inks having different densities in accordance with the density of the image to be recorded; and

recording control changing for changing said image processing means in accordance with information generated by said host device.

3 An ink jet recording method for recording by discharging an ink onto a recording medium in accordance with a recording data using a particular recording means for recording mounted on a mounting portion for exchangeably mounting either a first recording means for discharging an ink of a predetermined color and having a single density or a second recording means for discharging an ink of the predetermined color and having a plurality of densities, characterized by including:

a step for receiving designated information for instructing recording control; and

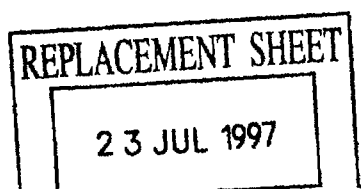
a recording control changing step of changing a recording control of the recording in accordance with said designated information; and

a plurality of image processing steps for processing an image corresponding to said particular recording means to be mounted in accordance with the image to be recorded, wherein said image processing steps determine a discharging of the ink for the recording means, based on a first table corresponding to said first recording means for determining the discharging of the ink in accordance with a density of the image to be recorded, and a second table corresponding to said second recording means for determining the discharging of said plurality of inks having different densities in accordance with the density of the image to be recorded, and

wherein said recording control changing step changes said image processing step.

4 An ink jet recording apparatus for recording by discharging an ink onto a recording medium in accordance with a recording data using a particular recording means mounted on a mounting portion for exchangeably mounting either a first recording means for discharging or a second recording means for discharging an ink of the predetermined color and having a plurality of densities, and recording method in recording system comprising a host device connected to said ink jet recording apparatus, said method including:

a generating step for generating designated information for instructing recording control by said host device;





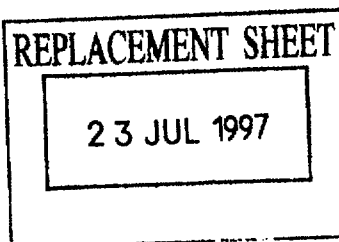
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a recording control changing step of changing a recording control in accordance with the designated information of said information generation step; and

a plurality of image processing steps for processing an image corresponding to said particular recording means to be mounted in accordance with the image to be recorded, wherein said image processing steps determine a discharging of the ink for the recording means, based on a determining the discharging of the ink in accordance with a density of the image to be recorded, and a second table corresponding to said second recording means for determining the discharging of said plurality of inks having different densities in accordance with the density of the image to be recorded,

where said recording control changing step changes said image processing step.





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What is claimed is:

1. An ink jet recording apparatus which records by discharging an ink onto a recording medium in accordance with a recording data, characterized by comprising:

a mounting portion for exchangeably mounting either a first recording means for discharging an ink of a predetermined color and having a single density and a second recording means for discharging an ink of the predetermined color and having a plurality of densities;

image processing means for processing image data corresponding to an image to be recorded, the image processing means forming driving data for controlling driving of said recording means to control a discharge of ink based on a density which image data indicates, the image processing means selectively utilizing a first table for converting image data into image data corresponding to an ink having a predetermined single density and a second table for converting image data into image data corresponding to each of inks having a plurality of densities, and the image processing means forming driving data for discharging ink based on converted image data;

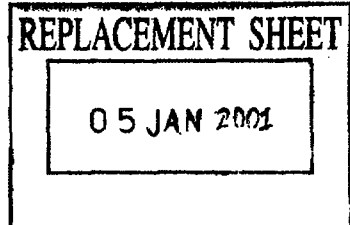
means for receiving designated information, indicating whether the first recording means or the second recording means is mounted in the mounting means, for instructing said image processing means; and

recording control changing means for changing a table for converting image data to be utilized by said image processing means based on said designated information.

2. An ink jet recording apparatus according to claim 1, wherein said first recording means and said second recording means each have a discharge orifice array comprising a plurality of discharge orifices.

3. An ink jet recording apparatus according to claim 2, wherein said second recording means has said discharge orifices disposed in a plurality of sections, corresponding to said plurality of densities.

4. An ink jet recording apparatus according to claim 1, wherein said first recording means and said second recording means each have a discriminated element which is discriminated by said discriminating means.





5. An ink jet recording apparatus according to claim 4, wherein said discriminated means is a plurality of pin members provided at contact points when said first recording means and said second recording means are mounted on said mounting portion.

6. An ink jet recording apparatus according to claim 4, wherein said discriminated means is of a type which is electrically conductive or non-electrically conductive member, and said discriminating means discriminates the type of said recording means by detecting a conductivity of said discriminated means.

7. An ink jet recording apparatus according to claim 1, further comprising:

ink supply means for supplying the inks to be exchangeably mounted on said mounting portion in accordance with a type of said particular recording means mounted on said mounting portion;

wherein said discriminating means makes a discrimination whether said particular recording means to be mounted on said mounting portion is said first recording means or said second recording means by detecting a type of said ink supply means.

8. An ink jet recording apparatus according to claim 7, wherein said ink supply means has a discriminated element in accordance with the type of a corresponding said recording means, and said discriminated element is discriminated by said discriminating means.

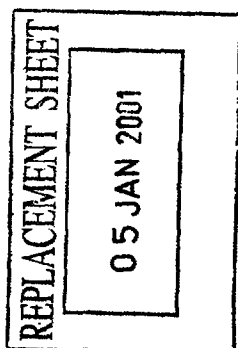
9. An ink jet recording apparatus according to claim 8, wherein said discriminated means is a marking in accordance with corresponding recording means.

10. An ink jet recording apparatus according to claim 1, wherein said particular recording means has heat energy generating means for giving heat energy to the ink, and discharges the ink using that heat energy.

11. An ink jet recording apparatus according to claim 10, wherein said particular recording means causes a state change in the ink by using heat energy generated by said heat energy generating means, and discharges the ink in response to a pressure produced by said state change.

12. An ink jet recording apparatus according to claim 1, further comprising reading means for reading an original image to be recorded on the recording medium.

13. An ink jet recording apparatus according to claim 1, further comprising image information handing means for at least one of transmitting and receiving image information.





14. An image recording apparatus according to claim 13, further comprising reading means for reading an original image to be recorded on the recording medium.

15. An image recording apparatus according to claim 1, further comprising input means for inputting record data to be recorded on the recording medium.

16. An ink jet recording apparatus according to claim 15, wherein said input means is a keyboard.

17. An ink jet recording apparatus as in claim 1, wherein said first recording means and said second recording means each can discharge a plurality of different color inks.

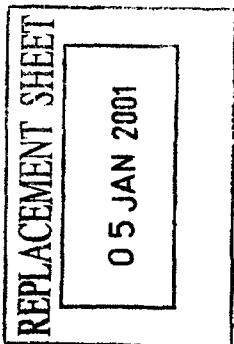
18. An ink jet recording apparatus which records by discharging an ink onto a recording medium in accordance with a recording data and a system comprising a host device connected to said ink jet recording apparatus, said apparatus comprising:

information generating means for generating information signifying whether a particular recording means mounted on said mounting portion is a first recording means or a second recording means, said information generating means being provided in said host device;

a mounting portion for exchangeably mounting either the first recording means for discharging an ink of a predetermined color and having a single density and the second recording means for discharging an ink of the predetermined color and having a plurality of densities;

image processing means for processing image data corresponding to an image to be recorded, the image processing means forming driving data for controlling driving of said recording means to control a discharge of ink based on a density which image data indicates, the image processing means selectively utilizing a first table for converting image data into image data corresponding to an ink having a predetermined single density and a second table for converting image data into image data corresponding to each of inks having a plurality of densities, and the image processing means forming driving data for discharging ink based on converted image data; and

recording control changing means for changing a table for converting image data to be utilized by said image processing means based on said generated information.





19. An ink jet recording apparatus according to claim 18, wherein said first recording means and said second recording means each have a discharge orifice array comprising a plurality of discharge orifices.

20. An ink jet recording apparatus according to claim 19, wherein said second recording means has said discharge orifices disposed in a plurality of sections, corresponding to said plurality of densities.

21. An ink jet recording apparatus according to claim 18, wherein said information generating means is a dip switch provided on the ink jet recording apparatus.

22. An ink jet recording apparatus according to claim 18, wherein said information generating means is an operation panel provided on the ink jet recording apparatus.

23. An ink jet recording apparatus according to claim 18, wherein said information generating means generates said information based on an instruction from host means connected to the ink jet recording apparatus.

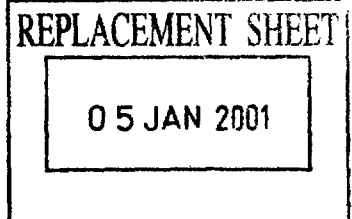
24. An ink jet recording apparatus according to claim 18, wherein said particular recording means has heat energy generating means for supplying heat energy to the ink, and discharges the ink using that heat energy.

25. An ink jet recording apparatus according to claim 24, wherein said particular recording means causes a state change in the ink by using heat energy generated by said heat energy generating means, and discharges the ink in response to a pressure produced by said state change.

26. An ink jet recording apparatus as in claim 18, wherein said first recording means and said second recording means each can discharge a plurality of different color inks.

27. An ink jet recording method for recording by discharging an ink onto a recording medium in accordance with a recording data using a particular recording means for recording mounted on a mounting portion for exchangeably mounting either a first recording means for discharging an ink of a predetermined color and having a single density or a second recording means for discharging an ink of the predetermined color and having a plurality of densities, characterized by including:

a step of receiving designated information, indicating whether the first recording means of the second recording means is mounted in the mounting portion, for instructing recording control;





a recording control changing step of changing a recording control of the recording in accordance with said designated information; and

image processing steps for processing image data corresponding to an image to be recorded, the image processing steps forming driving data for controlling driving of said recording means to control a discharge of ink based on a density which image data indicates, the image processing steps selectively utilizing a first table for converting image data into image data corresponding to an ink having a predetermined single density and a second table for converting image data into image data corresponding to each of inks having a plurality of densities, and the image processing steps forming driving data for discharging ink based on converted image data, and

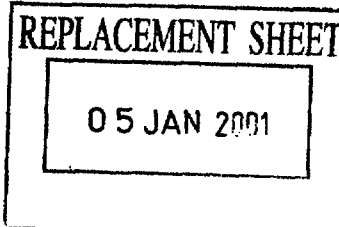
wherein said recording control changing step changes a table for converting image data to be utilized by said image processing step based on said designated information.

28. An ink jet recording method according to claim 27, wherein said first recording means and said second recording means each have a discriminated element which is discriminated in said discrimination step.

29. An ink jet recording method according to claim 27, wherein an ink supply means for supplying the inks is exchangeably mounted on said mounting portion in accordance with a type of said particular recording means to be mounted on said mounting portion, and said discrimination step makes a discrimination as to whether said particular recording means to be mounted on said mounting portion is said first recording means or said second recording means by detecting a type of said ink supply means.

30. An ink jet recording method according to claim 29, wherein said ink supply means has a discriminated marking in accordance with the type of a corresponding said recording means, and said discriminated marking is discriminated in said discrimination step.

31. An ink jet recording method according to claim 27, wherein said particular recording means has heat energy generating means for supplying heat energy to the ink, and discharges the ink using said heat energy.





32. An ink jet recording method according to claim 31, wherein said particular recording means causes a state change in the ink using heat energy generated by said heat energy generating means, and discharges the ink in response to a pressure produced by said state change.

33. An ink jet recording method as in claim 27, wherein said first recording means and said second recording means each can discharge a plurality of different color inks.

34. An ink jet recording method for recording by discharging an ink onto a recording medium in accordance with a recording data using a particular recording means mounted on a mounting portion for exchangeably mounting either a first recording means for discharging or a second recording means for discharging an ink of the predetermined color and having a plurality of densities, said recording method comprising the steps of:

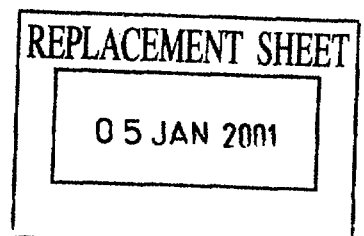
- providing a recording system comprising a host device connected to said ink jet recording apparatus;

- a generating step for generating designated information for instructing recording control by said host device;

- a recording control changing step of changing a recording control in accordance with the information of said information generating step; and

- image processing steps for processing image data corresponding to an image to be recorded, the image processing steps forming driving data for controlling driving of said recording means to control a discharge of ink based on a density which image data indicates, the image processing steps selectively utilizing a first table for converting image data into image data corresponding to an ink having a predetermined single density and a second table for converting image data into image data corresponding to each of inks having a plurality of densities, and the image processing steps forming driving data for discharging ink based on converted image data,

wherein said recording control changing step changes a table for converting image data to be utilized by said image processing step based on said generated information.





35. An ink jet recording apparatus which performs the recording by discharging ink onto a recording medium in accordance with recording data, comprising:

a mounting portion for exchangeably mounting a recording means, the mounting portion being adjusting to selectively mount recording means among a plurality of recording means, each discharging a different kind of ink;

discriminating means for discriminating the recording means mounted on said mounting portion; and

controlling means or executing control in such a manner that an image processing corresponding to a gradation value of image data of a predetermined color in a case where, with respect to a predetermined color, recording can be made by an ink having a single density is differentiated from that in a case where, with respect to a predetermined color, recording can be made by inks having a plurality of different densities, based on a discriminated result by said discriminating means.

36. A controlling method in an ink jet recording apparatus which performs the recording by discharging ink onto a recording medium in accordance with recording data, said apparatus having a mounting portion for exchangeably mounting a recording means, the method comprising the steps of:

a discriminating step for discriminating the recording means mounted on said mounting portion; and

an image processing step for executing a process of image data,

wherein, in said image processing step, an image processing corresponding to a gradation value of image data of a predetermined color in a case where, with respect to a predetermined color, recording can be made by an ink of a single density is differentiated from that in a case where, with respect to a predetermined color, recording can be made by inks having a plurality of different densities, based on a discriminated result by said discriminating means.

REPLACEMENT SHEET

05 JAN 2001

METHOD AND APPARATUS FOR INK JET RECORDING
ABSTRACT OF THE DISCLOSURE

The present invention aims to provide an ink jet recording apparatus and an ink jet recording method which can produce an image excellent in gradation and resolution and allows the image for text, graphics and listing to be obtained at high speed and good quality. The present invention allows a desired recorded image to be obtained by exchangeably comprising an ink jet unit for producing the image excellent in gradation, and an ink jet unit having higher character quality and capable of recording at high speed, and effecting recording control in accordance with the ink jet unit.

FIGURE. 1

