

This Sheet Has Been Replaced



REPLACED SHEETS		SG
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1
INK JET RECORDING APPARATUS AND

INK CARTRIDGE FOR THE APPARATUS

BACKGROUND OF THE INVENTION

5 Field of the Invention

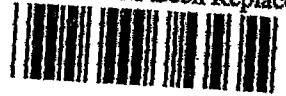
This invention relates to an ink jet recording apparatus provided with an ink jet head for effecting recording with flying ink droplets utilizing the film boiling phenomenon of liquid.

10 The present invention also relates to an ink cartridge interchangeably provided for the ink jet recording apparatus.

Related Background Art

15 In recent years, various ink jet recording methods have been put into practical use because in such recording methods, the creation of noise during recording is negligibly small and in addition, recording can be effected on plain paper.

20 Among them, the ink jet recording method described, for example, in Japanese Laid-Open Patent Application No. 54-51837 (the so-called bubble jet recording method) is such that heat energy is caused to act on ink and the ink subjected to the action of this heat energy causes a sudden volume change (film boiling phenomenon) resulting from a state change and by this action force, the ink is discharged from a discharge port at the end of a recording head unit,



1 whereby flying ink droplets are formed and adhere to a
recording medium to thereby accomplish recording.

The principle of ink droplet formation in
such a recording method is that when an electro-thermal
5 converting member is electrically energized, the ink
in the heat-acting portion subjected to the action of
the heat energy which is ink droplet forming energy
causes a state change resulting from a sudden
increase in volume, that is, the ink in the heat-
10 acting portion causes the creation, growth and
contraction of a bubble very momentarily, whereby
the liquid present between the heat-acting portion and
the discharge opening is discharged as an ink droplet.

By repeating such cycle of creation, growth,
15 contraction and disappearance of the bubble, the ink
is subjected to high heat. Therefore, thermally
unstable ink is liable to cause a chemical change and
in the heat-acting portion, production and precipi-
tation of insoluble matters may occur and further,
20 the recording head may become incapable of dis-
charging the ink. Accordingly, to effect recording
at a high speed for a long time by the use of such an
apparatus, it is very important to improve the
stability of the ink and on the other hand, to set
25 the optimum driving conditions corresponding to the
ink in the recording head.

Figure 1 of the accompanying drawings shows



1 variations with time in the surface temperature T of
the heat-acting surface when an electrical signal
of pulse waveform shown by P is input to a recording
head having an electro-thermal converting member and
5 the volume V of a bubble then created. When the pulse-
like electrical signal P which is switched on and off
is input to the electro-thermal converting member
at a time t_0 and a time t_f , the surface temperature
 T of the heat-acting surface reaches a maximum
10 temperature T_p at the time t_f .

Here, when T_p is higher than the boiling point
 b of the ink which is in contact with the heat-acting
surface, a bubble begins to be created from a time
 $Tb0$ at which $T = Tb$ in the heat-acting portion filled
15 with the ink, and the volume thereof increases with
the lapse of time and reaches a maximum volume V_p at
a time t_p . When the electrical signal P is switched
off at the time t_f , the surface temperature T begins
to attenuate gradually and accordingly, the volume
20 V of the bubble decreases and the bubble disappears
at a time t_{bl} .

In order to ensure the discharge of ink
droplets to be effected efficiently and stably in an
ink jet recording apparatus, for example, in the
25 aforescribed bubble jet recording method, driving
conditions for film boiling such as a voltage, a
pulse width and a frequency at which electrical



1 energy is supplied to the electro-thermal converting
member and further, control such as pre-discharging or
pre-heating for effecting stable practical printing,
or the recovery operation of the recording head are
5 programmed in advance in the ink jet recording
apparatus by hardware or software in accordance with
the characteristic of ink set for the ink jet
recording apparatus. Particularly, in a recording
apparatus of the type in which an ink tank storing
10 therein ink to be supplied to a recording head is
interchangeable for the apparatus, if use is made of
an ink cartridge storing therein ink of other kind
which does not match these various set conditions,
there will not be obtained an appropriate combination
15 of the characteristic of the ink and the driving
conditions and therefore, normal driving of the
recording head cannot be accomplished and recording
of high quality will become difficult to accomplish.
For this reason, usually, the form of the ink
20 cartridge interchangeable for the recording apparatus
is designed exclusively for each apparatus so that
the user may not misuse the ink cartridge.

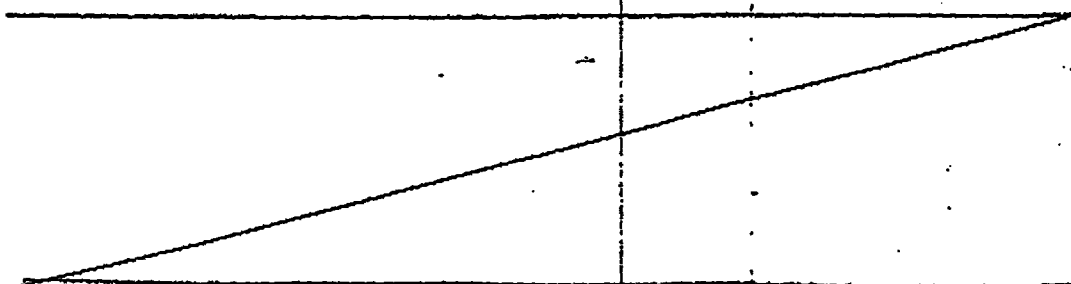
An example of the form of such an ink
cartridge is a box-like form. The ink cartridge is
25 designed such that by the operation of mounting the
ink cartridge on a cartridge mounting portion, a
hollow needle provided on the mounting portion is



1 thrust in the rubber plug of the cartridge so that ink
may be supplied from an ink containing portion in the
cartridge to an ink supply system through the hollow
needle.

5 However, the conventional ink jet recording
apparatus having such an interchangeable ink cartridge
only permits the use of ink fit for the discharge
conditions set in that apparatus and cannot select ink
of different discharge conditions and therefore, the
10 range of use of the ink jet recording apparatus is
limited and a wide range of use of the ink jet
recording apparatus having an excellent recording
characteristic has been difficult. Also, even if ink
having more excellent discharge and recording character-
15 istics is developed in the future, it will become
impossible to use such ink or obtain a satisfactory
state of use because the program in the apparatus is not
proper.

The above-noted problems will hereinafter be
20 discussed specifically and in detail. Some examples of
the typical ink composition usable in an ink jet recording
apparatus are shown in Table 1 below.



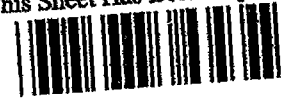
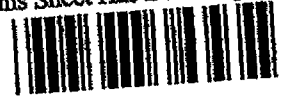


Table 1

Kinds of ink Component	①	②	③
Water [%]	50	50	80
DEG [%]	47	37	17
PEG [%]	0	10	0
Dyestuff [%]	3	3	3

The ink ① is an example of standard ink which exhibits a popular performance in both viscosity and solidification. On the other hand, the ink ② is ink in which the percentage of the component difficult to volatilize is increased relative to the ink ① and therefore which is characterized by a difficulty in clogging the discharge ports of the recording head. Thus, an ink jet recording apparatus using the ink ② does not require a mechanism for preventing the clogging of the discharge ports during the downtime of the ink jet recording head, or can be structurally simplified. However, since the ink ② has relatively high viscosity, it is necessary that discharge of the ink which does not contribute the recording, i.e., an operation called preliminary discharge, be sufficiently performed in advance in the early stage of each use. This may sometimes lead to a reduced



1 throughput. Also, the ink (2) suffers from a dis-
advantage that the ink is ready to blur on the
recording medium and a very high quality of printing
cannot be provided. The ink (3) is ink characterized
5 in that the percentage of water content is increased
relative to the ink (1) and the desiccation of the ink
on the recording medium is quick and recording of high
quality suffering much less from blur can be
accomplished. Further, the ink (3) has a feature that
10 it can be driven at a relatively high frequency because
it permits quick refilling of the nozzle after dis-
charge. However, the ink (3) is ready to desiccate and
therefore, the ink in the discharge ports of the
recording head is ready to solidify as during the
15 downtime of the recording head. Therefore, it is
necessary that the recovery operation such as pumping
and the capping operation be performed frequently
during the downtime of the recording head. Particu-
larly, where the ink (3) is used for a recording head
20 of the bubble jet type in which heat energy is
utilized as ink discharging energy, stable ink dis-
charge cannot be accomplished unless the electrical
energization time is made relatively short (e.g.
2-5 [μ sec]) and correspondingly the driving voltage
25 is made high. According, in the case of a recording
head which can withstand such high driving stress,
printing of high quality can be accomplished, but



1 otherwise there will be obtained printing of low
 quality which is bad in the accuracy of liquid droplet
 shot.

5 Table 2 below specifically shows some examples
 of the driving conditions for the recording head
 relative to the inks in Table 1.

Table 2

Examples of appa- ratus	Kinds of ink	①	②	③
	Driving conditions			
I	Voltage [V]	21	21	28
	Pulse width [μ s]	7	7	3
	Frequency [KHz]	4.5	4.0	6.0
	Number of prelimi- nary discharges (times)	50	128	50
II	Voltage [V]	21	19	21
	Pulse width [μ s]	7	8.5	7
	Frequency [KHz]	2	2	3
	Number of prelimi- nary discharges (times)	50	128	50

The apparatus example I is an apparatus using
 silicon single crystal as the base material of the
 recording head and carrying thereon a recording head
 having a characteristic capable of withstanding
 short pulse energization and high voltage driving
 and responding to a high frequency. The apparatus
 example II is an apparatus using glass as the base



1 material of the recording head and carrying thereon a
recording head which is low in durability to short
pulse energization, high voltage driving and a high
frequency, but is very inexpensive.

5 For example, when the apparatus example I pro-
grammed with the use of the ink (1) having the
standard characteristic being taken into account is
used in a manner in which the frequency of use is
extremely low, it is desirable to use the ink (2)
10 which does not cause clogging. However, it is
necessary that the user change without fail the
substance of the driving program of the recording
head in which are set the conditions for the best
discharge to be accomplished when the ink (1) is used
15 to the substances matching the characteristic of the
ink (2), for example, the conditions such as the number
of preliminary discharges, the pre-heating state, the
driving frequency and the pulse width.

To increase the printing speed in the apparatus
20 example I, the ink (3) can be used, but even in that
case, as described previously, it is necessary that
the user change without fail the driving conditions of
the recording head in accordance with the character-
istic of the ink (3).

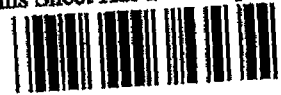
25 However, it is cumbersome and mistakable for
the user to change the driving conditions in accordance



1 with the characteristic of the ink used, and damage is
liable to occur to the recording apparatus due to the
malfunctioning of the recording head. For example,
where use is made of a recording head of the type of
5 the apparatus example II, when the conditions for the
use of the ink (1) are to be changed to the driving
conditions for the use of the ink (3), the head driving
voltage is changed from 21V to 28V and the pulse width
is changed from 7 μ sec to 3 μ sec, whereby there is
10 provided good discharge of the ink (3). However, as
previously described, such driving conditions are not
suitable because they give high stress to the recording
head used in the apparatus example I and may therefore
extremely shorten the life of the recording head.

15 Accordingly, when the life of the recording head is
taken into consideration, for example, the driving
voltage must be changed to 21V and the pulse width
must be changed to the order of 7 μ sec and moreover,
the set frequency must be changed from 6 KHz to 3 KHz.

20 As described above, it is adequate to use ink
which takes into account the used state and the
purpose of use of the ink jet recording apparatus,
but it is difficult for an ordinary user to minutely
change the program in the ink jet recording apparatus
25 body such as the driving conditions and the preliminary
discharge conditions of the recording head with the
kind and driving characteristic of the recording head



1 taken into account so that a change of the ink used
... can be coped with. Even if such change is possible
at all, wrong setting may be effected and abnormal
printing or excessive stress may be given to the
5 recording head, and it will be difficult to ensure
the reliability of the recording apparatus.

Now, when an ink cartridge interchangeable for
the apparatus is mounted in the apparatus body, it
is popular that the ink cartridge is held by a suitable
10 fastening means. Also, in the mounted state of the ink
cartridge, the interior of the ink tank and the ink
supply system on the apparatus body side are
communicated with each other by ink.

However, if the relation between the holding
15 position of the fastening means and the position in
which the communication is effected by ink is not
appropriate or especially there is a play in the
fastening means, the ink communication will not be
secured in spite of the ink tank being held by the
20 fastening means, and the ink supply system and the
ink tank will become spaced apart from each other.
If at this time, for example, the recovery operation
is performed, air may be introduced into the supply
system. If air is thus introduced into the supply
25 system, not only ink discharge will fail to be
properly effected, but also the recording head will
be damaged.



1 On the other hand, when the ink cartridge is
to be interchanged, the user may inadvertently insert
his hand into the cartridge insertion port and have
the fingertip injured or stained with ink. In order
5 to prevent this, there has been provided a protective
device as shown, for example, in Figure 2 of the
accompanying drawings. In Figure 2, the reference
numeral 130 designates an ink tube connected to a
hollow needle 120 and supplying ink to the recording
10 head, the reference numeral 131 denotes a mounting
bed for fixedly supporting the hollow needle 120, and
the reference numeral 132 designates an insertion path
for directly the ink cartridge 104 to its mounted
position.

15 The reference numeral 133 denotes a protective
plate pivotable about a support shaft 134, the refer-
ence numeral 135 designates a torsion coil spring
mounted around the support shaft 134 and biasing the
protective plate 133 in the direction of arrow C, and
20 the reference numerals 136 and 137 denote locking
members for holding the protective plate 133 in an
insertion path closing position as shown and
restraining the movement thereof. That is, these
locking members 136 and 137 are formed symmetrically
25 with respect to each other, and have wedge portions
136A and 137A and locking grooves 136B and 137B at
opposed locations, and are both endowed with



1 resiliency, whereby they can be flexed in the direction
of arrow D. The reference numeral 140 designates
a rubber plug provided in the front face of the ink
cartridge 104, and the reference numerals 141 and 142
5 denote unlocking projection members (hereinafter
referred to as the unlocking members) provided on the
sides of the ink cartridge 104.

In the protective device for the ink cartridge
mounting portion which is so constructed, as long as
10 the ink cartridge 104 is not mounted, the protective
plate 133 is held in its shown position by the locking
members 136 and 137, and even if a finger tip or the
like is inserted into a cartridge guide or the like,
it will strike against the protective plate 133 and
15 will not reach the tip end of the hollow needle 120.
Also, if as shown in Figure 2, the ink cartridge 104
is inserted from the direction of arrow A along the
insertion path 132, the unlocking members 141 and
142 will slidably contact with the wedge portions
20 136A and 137A of the locking members 136 and 137,
respectively, and will push open these members in the
direction of arrow D.

Consequently, the opposite end portions of the
protective plate 133 are liberated from the locking
25 grooves 136B and 137B of these members and also, the
front face of the ink cartridge 104 bears against the
protective plate 133 and pushes it up in the direction



1 of arrow B. Thereafter, the hollow needle 120 thrusts
into the rubber plug 140 of the ink cartridge 104,
whereby there can be brought about a mounted state in
which the supply of ink to the recording head is
5 possible. When the ink cartridge 104 is to be
removed, the ink cartridge 104 is pulled out rearwardly
from its mounted state, whereby the hollow needle 120
is pulled out from the rubber plug 140, and then the
protective plate 133 is pivoted in the direction of
10 arrow C by the spring force of the torsion coil spring
135 and returns to its vertical position and is
sandwiched between the locking members 136 and 137
and restores the state shown in Figure 2.

However, in the conventional ink jet recording
15 apparatus as described above, the locking members 136
and 137 are provided laterally symmetrically and
therefore, even when the user inserts the ink
cartridge 104 with its vertical direction or its
longitudinal direction mistaken, the locked state of
20 the protective plate 133 will be released by the
engagement between the unlocking members 141, 142
and the locking members 136, 137 and the ink cartridge
104 will be directed to its mounted position, and
this has led to the undesirable possibility that the
25 hollow needle 120 is damaged or the ink cartridge 104
itself is damaged and the supply of ink becomes
impossible. Also, an attempt to provide a special



1 device discretely to prevent such an accident would
make the mounting device itself complicated in
structure and result in an increased cost.

Now, some of ink cartridges are in a form which
5 is provided with an ink containing portion and in
addition, a waste ink containing portion for containing
discharged ink, i.e., ink sucked during the recovery
operation performed to prevent the clogging of the ink
discharge ports of the recording head (hereinafter
10 referred to as the waste ink), and with such ink
cartridges, it is possible to scrap the waste ink
contained in the waste ink containing portion, by and
simultaneously with the interchange of the cartridge.

If in an ink jet recording apparatus of such
15 interchangeable ink cartridge type, the recording
operation is performed with no ink cartridge mounted
in the apparatus, recording will not be obtained
because ink supply does not take place. Also, if the
recovery operation is performed, waste ink discharged
20 from the waste ink system side will not be contained
in the ink cartridge but may be released into the
apparatus to thereby contaminate the surroundings, or
the released waste ink may contaminate electric
circuits to thereby cause an accident such as fire.
25 Accordingly, it is desirable to provide detecting
means for informing the user of the mounting of an
ink cartridge in the apparatus.



1 An example of such detecting means is shown in
Figures 3 and 4 of the accompanying drawings. As shown
in Figure 3, a cartridge detecting flag 131 is
comprised of a rotatable flag shaft 131B supported on
5 the upper portion of an insertion port 121, a flag
plate 131C mounted on one end of the shaft, and a
cam portion 131A for rotating the flag shaft 131B, and
on the other hand, a lever member 132 pivotally moved
by the mounting of a cartridge 104 is provided inside
10 the insertion port 121. Thus, when the ink cartridge
104 is inserted into the insertion port 121 and is
surely mounted with a hollow needle 120 being inserted
into a tank, not shown, in the cartridge 104, the
projected portion 132A of the lever member 132 is
15 pressed by the fore end of the cartridge 104, whereby
the tip end portion 132B of the lever pivotally moves
the flag plate 131C through the cam portion 131A and
keeps it in a light intercepting position for a
detecting sensor 124 as shown.

20 Figure 4 shows the details of the detecting
sensor 124 for detecting both of the home position
and the cartridge. The detecting sensor 124 is of the
transmission type and is provided with an optical path
135 between a light emitting element 133 and a light
25 receiving element 134, and is designed such that the
optical path 135 is shielded from light by a home
position detecting flag 130, the flag plate 131C of

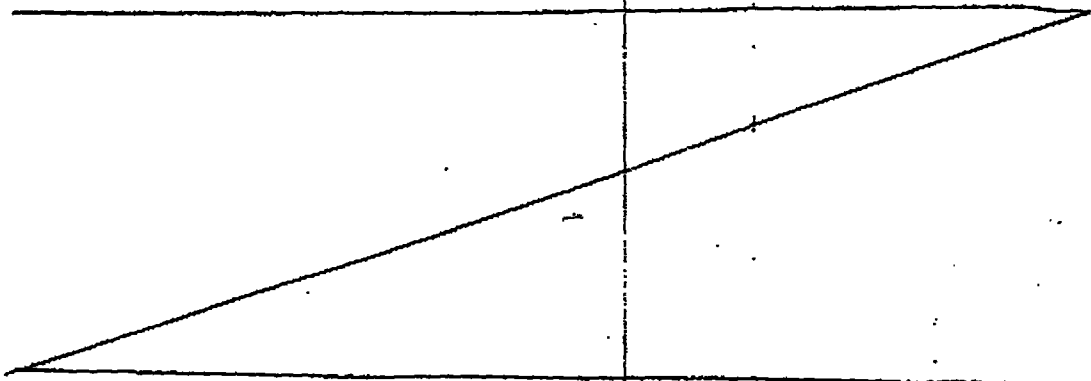


17

1 the ink cartridge detecting flag 131, etc. Accordingly,
when the ink cartridge 104 is mounted, the detecting
sensor 124 detects the flag plate 131C when a carriage
102 has been directed to a detecting position, whereby
5 the mounting of the cartridge is confirmed.

However, in the conventional ink jet recording
apparatus as described above, the home position
sensor is used also as the cartridge detecting sensor
and the number of detecting means is correspondingly
10 decreased, but the information the user wants to
recognize about the ink cartridge 104 is not only the
mounting thereof, but also the information regarding
the color and characteristic of the ink contained in
the ink cartridge 104 as described previously and
15 the remaining amount of ink, and to enable all of such
information to be obtained, the number of flags must
be increased or the number of detecting means
themselves must be increased, and this will result in
complicated structure, which in turn will result in an
20 increased cost.

25



SUMMARY OF THE INVENTION

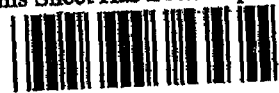
1 So, it is an object of the present invention
to eliminate such problems peculiar to the prior art
and to provide an ink cartridge to which is imparted
5 information for controlling the driving conditions
of a recording head on the basis of ink used.

It is also an object of the present invention
to provide an ink jet recording apparatus of high
performance and high reliability in which an ink jet
10 recording head used changes its driving conditions
so as to fit thereto.

It is a further object of the present
invention to provide a construction of such
correlation that the mounting of an ink cartridge
15 into an apparatus can be reliably accomplished, and
to ensure ink supply, information reading, etc. to
be reliably effected.

It is another object of the present invention
to provide an ink cartridge which is simple in
20 structure and can prevent malfunctioning during the
mounting of the cartridge, and an ink jet recording
apparatus into which such ink cartridge can be
mounted.

It is still another object of the present
25 invention to provide an ink jet recording apparatus
in which a minimum number of detecting means enables
the user to recognize various kinds of information



1 regarding an ink cartridge, and to provide such ink
cartridge.

5 It is yet still another object of the present
invention to provide an ink cartridge which is
interchangeably provided for an ink jet recording
apparatus provided with a recording head for causing
the discharge of ink to thereby effect the recording
of images and which contains said ink therein and
supplies said ink in response to the discharge of
10 said ink, characterized by the provision of a medium
provided with information for controlling the
driving conditions of said recording head.

15 It is also an object of the present invention
to provide an ink jet recording apparatus which
permits the removable mounting therein of an ink
tank cartridge forming a supply source of ink for a
recording head for discharging said ink to a
recording medium to thereby effect recording,
characterized by the provision of:

20 communication means for effecting the
communication between said ink tank and the supplied
ink;

25 reading means for reading the information
regarding said ink tank cartridge itself from an
information presenting member provided on said ink
tank cartridge to present said information; and

holding means for holding said ink tank



1 cartridge;

5 a position in which said ink communication is effected, a position in which said information is read and a position in which said ink tank cartridge is held being disposed in the named order in the direction of mounting of said ink tank cartridge.

10 It is a further object of the present invention to provide an ink tank cartridge forming a supply source of ink for a recording head for discharging said ink to a recording medium to thereby effect recording, characterized by the provision of:

15 an information presenting member provided to present the information regarding the ink tank cartridge itself;

a communication member for effecting the communication of the supplied ink with an apparatus body; and

20 a held member for being held by said apparatus body;

25 said communication member, said information presenting member and said held member being disposed so that the communication of said supplied ink, the reading of said information and said holding may be effected in the named order with the mounting operation of said ink tank cartridge.

It is still a further object of the present



1 invention to provide an ink jet recording apparatus
characterized by the provision of:

an ink tank cartridge which forms a supply
source of ink for a recording head for discharging
said ink toward a recording medium to thereby effect
5 recording and which is provided with a member for
presenting inherent information regarding said ink
tank cartridge itself and second information
differing from said inherent information and is
removably mountable in an apparatus body;

10 communication means for effecting the
communication between said ink tank cartridge and
the supplied ink;

reading means for reading said inherent
information and said second information; and

15 holding means for holding said ink tank
cartridge;

a position in which said ink communication is
effected, a position in which said second
20 information is read, a position in which said
inherent information is read and a position in which
said ink tank cartridge is held being disposed in
the named order in the direction of mounting of said
ink tank cartridge.

25 It is another object of the present invention
to provide an ink tank cartridge for an ink jet
recording apparatus which forms an ink supply source



1 for a recording head for discharging ink and which
is removably mountable in the apparatus body,
characterized by the provision of an inherent
information presenting member for presenting
5 inherent information regarding the ink tank
cartridge itself, and a second information
presenting member provided forwardly of said
inherent information presenting member with respect
to the direction of mounting for presenting second
10 information differing from said inherent
information.

It is still another object of the present
invention to provide an ink cartridge which is
mountable on a mounting portion along the insertion
15 path of an ink jet recording apparatus having an
openable-closable plate openably and closably held
in the insertion path to said mounting portion, and
locking members for restraining said openable-
closable plate from the opposite sides of said
insertion path to inhibit the opening movement
20 thereof and which contains therein ink to be
supplied to a recording head and in which unlocking
members engageable with said locking members to
thereby release the restraint of said locking member
during the mounting of said ink cartridge are
25 projectedly provided on opposite sides,
characterized in that said unlocking members are

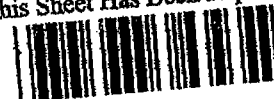


1 provided asymmetrically with respect to the
direction of insertion into said insertion path.

5 It is yet still another object of the present
invention to provide an ink jet recording apparatus
which is provided with an openable-closable plate
provided in an insertion path for directing to a
mounting portion an ink cartridge containing therein
ink to be supplied to a recording head and openably
and closably held, and locking members for
10 restraining said openable-closable plate from the
opposite sides of said insertion path to inhibit the
opening movement thereof and in which the restraint
of said locking members can be released by unlocking
members projectedly provided on the opposite sides
15 of said ink cartridge during the insertion of said
ink cartridge into said insertion path,
characterized in that said unlocking members and
said locking members are disposed asymmetrically
with respect to the direction of insertion of said
20 ink cartridge.

It is another object of the present invention
to provide an ink jet recording apparatus in which
is removably mounted an ink cartridge containing
therein ink to be supplied to a recording head for
25 discharging the ink to thereby effect recording,
characterized by the provision of:

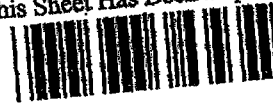
a flag member provided on said ink cartridge



1 and adapted to be protruded toward a path along
which a carriage is moved only when said ink
cartridge is mounted on a mounting portion; and
a photosensor provided on said carriage and
5 capable of being shielded from light by said flag
member.

It is still another object of the present
invention to provide an ink cartridge which is
removably mounted on the fixed mounting portion of
10 an ink jet recording apparatus for supplying
discharged ink to a recording head carried on a
movable carriage, characterized by the provision of
a flag member capable of being protruded and
contained, and means for protruding said flag member
15 toward a path along which said carriage is moved
only when said ink cartridge is mounted on said
mounting portion, the light interception of a
photosensor provided on said carriage being possible
by said flag member.

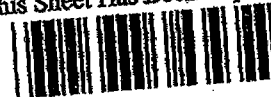
20 By providing on an ink cartridge a medium
including information for driving an ink jet head,
the driving conditions of the ink jet head matching
the composition of ink can be automatically set by
an ink jet recording apparatus itself, and this
25 leads to the possibility of providing an ink jet
recording head which is simple to operate and high
in reliability.



1 Also, there can be provided an ink cartridge
2 which can be prevented from being erroneously
3 inserted by the user and which has information for
4 properly controlling the driving of a recording
5 head.

6 Further, in a position wherein an ink
7 cartridge is held in an apparatus body, the
8 communication between an ink supply system and ink
9 is effected prior thereto and therefore, the ink
10 communication state can be secured near the held
11 position of the ink cartridge. In addition, prior
12 to the holding, the information regarding the ink
13 cartridge is readable and therefore, the
14 impossibility of reading or misjudgment does not
15 occur near the held position. Furthermore, the ink
16 communication is effected prior to reading and
17 therefore, even if the recording operation is
18 immediately started in response to reading, there
19 will occur no inconvenience such as the introduction
20 of air into the ink supply system, and even if
21 conversely, the ink cartridge is pulled out during
22 the recording operation, this can be detected before
23 the ink communication is cut off and therefore,
24 there will occur no similar inconvenience if the
25 operation is discontinued.

 Also, according to the present invention, in
the position wherein the ink cartridge is held in



1 the apparatus body, the communication between the
ink supply system and ink is effected prior thereto
and therefore, the ink communication state can be
secured near the held position of the ink cartridge.
5 Further, the inherent information regarding the ink
cartridge becomes readable near the held position,
and information differing from said information is
read in a predetermined range from the ink
communication position to the vicinity of the held
10 position and therefore, if design is made such that
a warning is given in response to the reading of
this information, the unsatisfactory holding of the
ink cartridge can be detected to obviate the falling
off thereof.

15 Furthermore, the horizontal positions of the
unlocking members provided on the ink cartridge side
and the horizontal positions of the locking members
provided correspondingly to them are made
asymmetrical with respect to the direction of
20 insertion, i.e., different from each other with
respect to the vertical direction or the direction
of insertion, and therefore, even if the ink
cartridge is inserted into the mounting portion with
the vertical direction or the longitudinal direction
thereof being mistaken, the locking members and the
25 unlocking members will not come into engagement with
each other and the locked state will not be released



1 and thus, the ink cartridge will be prevented from
being mounted by mistake and accordingly, any damage
attributable to wrong mounting can be prevented.

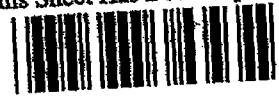
5 Also, according to the present invention, the
flag member capable of being protruded and contained
which is provided on the ink cartridge is protruded
from the cartridge toward the path along which the
carriage is moved when the ink cartridge is mounted
on the mounting portion and therefore, the mounting
10 of the ink cartridge can be detected by the
photosensor carried on the carriage, and by
variously changing the form of the flag member and
characterizing each ink cartridge, the information
for a plurality of ink cartridges can be
15 individually judged by a combination thereof with
the moved position of the carriage.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Figure 1 is a characteristic graph showing
the relation between an applied pulse and the growth
of a bubble.

Figure 2 is a perspective view showing the
construction of an ink cartridge mounting mechanism
according to the prior art.

25 Figure 3 shows the construction of an ink
cartridge detecting device according to the prior
art.



1 Figure 4 illustrates a photosensor for the
2 detecting device of Figure 3.

3 Figure 5 is a schematic perspective view
4 showing an embodiment of the ink cartridge according
5 to the present invention.

6 Figure 6 is a block diagram showing a
7 construction for controlling the driving of a
8 recording head by the information of the ink
9 cartridge.

10 Figure 7 is a flow chart showing an example
11 of the sequence until printing is accomplished by
12 the information of the ink cartridge.

13 Figure 8 is a schematic perspective view
14 showing another embodiment of the ink cartridge
15 according to the present invention.

16 Figures 9 to 15 are schematic perspective
17 views showing further embodiments.

18 Figure 16 is a schematic perspective view
19 showing the installed position of a medium carried
20 on an ink cartridge.

21 Figure 17 is a schematic view showing an
22 example of the ink jet recording apparatus.

23 Figure 18 is a perspective view showing an
24 ink jet recording apparatus according to an
25 embodiment of the present invention with the top
26 cover thereof removed.

27 Figures 19A and 19B are a perspective view



1 and a fragmentary cross-sectional view,
respectively, showing an example of the construction
of the ink cartridge mounting portion of the
apparatus according to the present invention.

5 Figure 20 is a cross-sectional view showing
an example of the construction of an ink cartridge
according to an embodiment of the present invention.

Figure 21 is a perspective view for
illustrating each portion for effecting the mutual
coupling between the ink cartridge and the body
10 side.

Figure 22 illustrates the relation in the
coupling position of each portion concerned in
coupling in the present embodiment relative to the
insertion of the ink cartridge.
15

Figures 23A - 23E illustrate inconveniences
which occur when the coupling position relation as
in the present embodiment is not adopted.

Figures 24A and 24B are a fragmentary
enlarged view and a coupling position relation
20 illustration, respectively, showing an improved
embodiment of the ink cartridge of Figures 21 and
22.

Figures 25A and 25B are block diagrams
showing a control system for the construction shown
25 in Figure 24 and a flow chart showing an example of
the operation thereof, respectively.



1 Figure 26 is a perspective view showing an
example of the construction of an ink cartridge
mounting mechanism according to the present
invention.

5 Figures 27A and 27B illustrate the normal
cartridge mounting operation by the embodiment of
Figure 26.

Figures 27C and 27D illustrate a wrong
mounting operation.

10 Figure 28 is a perspective view showing the
construction according to another embodiment of the
present invention.

Figures 29A and 29B illustrate still another
embodiment of the present invention.

15 Figures 30A and 30B illustrate the
construction of the ink cartridge according to the
present invention before and after the cartridge is
mounted.

20 Figures 31A - 31C are perspective views
showing the three kinds of forms of the flag member
in the ink cartridge according to the present
invention.

25 Figures 32A and 32B illustrate the operation
of another embodiment of the ink cartridge according
to the present invention in a state in which ink is
present and a state in which ink is absent,
respectively.



1 DESCRIPTION OF THE PREFERRED EMBODIMENTS

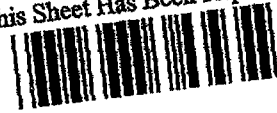
Some embodiments of the present invention will hereinafter be described in detail with reference to the drawings.

5 [Embodiment 1]

Figure 5 is a partly broken-away perspective view showing an ink cartridge 51 removably mountable with respect to an ink jet recording apparatus according to the present invention, and a portion of a connecting device 52 connected to the ink
10 cartridge 51 and provided with a supply portion for supplying ink to the ink jet recording apparatus and a supply receiving portion for receiving waste ink from the ink jet recording apparatus, the connecting
15 device 52 being provided on the ink jet recording apparatus side.

In Figure 5, the reference numeral 12 designates the housing of the ink cartridge 51 which is usually made by plastic molding in accordance with the shape or construction of the cartridge
20 containing portion of the ink jet recording apparatus body.

The reference numeral 13 denotes a hermetically sealed type ink container for containing ink therein. In the present embodiment,
25 the ink container 13 uses a flexible ink bag in which ink is enclosed. The reference numeral 15



1 designates an ink supply portion formed of an
elastic material such as silicone rubber. This ink
supply portion is connected to the ink bag through
an ink conducting tube 15a, and when the ink
5 cartridge 51 and the ink jet recording apparatus are
connected together, the ink supply portion provides
a portion into which a hollow ink needle 16
installed in the connecting device 52 of the ink jet
recording apparatus is inserted to thereby supply
10 the ink in the ink bag into the ink jet recording
apparatus.

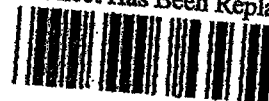
Any ink forcibly discharged from an ink jet
recording head by the filling of the recording head
with ink or by the recovery operation or the like of
the recording head passes through waste ink
15 collecting tubes 16a and 16b installed in the ink
jet recording apparatus body and is fed into a waste
ink reservoir 18 through a hole 17 formed in the
housing of the ink cartridge. The reference numeral
19 designates a medium having information indicative
20 of the kind of the ink in the ink cartridge. The
medium used in the present embodiment is a resistor
(having a predetermined resistance value selected
from among 0 to $\infty \Omega$). The reference characters 19a
and 19b denote terminals provided on the ink
25 cartridge side to electrically connect the medium to
the ink jet recording apparatus body. When the ink



1 cartridge is completely connected to the ink jet
recording apparatus body, these terminals 19a and
19b are electrically connected to pin terminals 20a
and 20b prepared in the ink jet recording apparatus
5 body. These pin terminals are electrically
connected to a control circuit in the ink jet
recording apparatus body, which control circuit can
electrically freely read the information of these
elements.

10 Figure 6 is a block diagram showing the
manner in which the ink cartridge 51 shown in Figure
5 is connected to the ink jet recording apparatus
53. By the ink cartridge 51 being mounted in the
ink jet recording apparatus 53, the medium 19
15 carried on the ink cartridge is connected to the
interface 54 of the apparatus 53 side, whereby the
information of the medium 19 is transmitted. On the
basis of this information, control as will be
described later, for example, the table of ROM 56
20 including a conversion table, is selected, and on
the basis thereof, the driving of a recording head
59 is controlled by a head driving control device
61.

25 Figure 7 shows a series of operation
sequences when the power source switch of the ink
jet recording apparatus body is closed in a state in
which the ink cartridge 51 is mounted with respect



1 to the ink jet recording apparatus 53 shown in
Figures 5 and 6 and the terminals 19a and 19b of the
medium 19 of the ink cartridge 51 are electrically
connected to the pin terminals 20a and 20b of the
5 apparatus side and the ink supply system is
connected to the apparatus body.

At a step S101, a power source switch is
closed. At a step S102, whether the ink cartridge
is mounted with respect to the apparatus is judged.
10 If the ink cartridge is not mounted, a warning lamp
is turned on at a step S103. If the ink cartridge
is judged to be mounted, at a step S104, the
resistance value of the medium carried on the ink
cartridge is read. At a step S105, in conformity
15 with the read resistance value, data is read out
from a data table. At a step S106, the data is
judged, and if the data is absent, the warning lamp
is turned on at a step S107. If the data is
present, at a step S108, the data is transferred to
a driving RAM. Thus, at a step S109, the recording
20 head is driven in accordance with a predetermined
table, and at a step S110, whether printing is
possible or whether a printing signal is present is
judged, and if printing is possible by the printing
signal, printing is effected at a step S111. If
25 printing is not possible, return is made to the step
S109, where processing is effected to make the



recording head capable of printing. Of course, the detection of the presence or absence of the ink cartridge may be effected by detecting the medium carried on the ink cartridge.

Table 3 below shows an example of the conversion table of the resistance values of the resistor on the ink cartridge and the ink jet driving conditions, etc. for those resistance values.

Table 3

Resistance value	Voltage	Pulse width	Frequency	Number of preliminary discharges
[k Ω]	[V]	[μ s]	[kHz]	[times]
0	0	0	0	0
0.5	21	7	3	128
1	21	7	4	128
5	28	3	3	128
10	28	3	4	50
100	28	3	6	50
200	28	2.5	6	50
∞	0	0	0	0

Resistance value vs. head driving conditions conversion table recorded in the ink jet recording apparatus body.



1 This conversion table is pre-recorded in the
control ROM in the ink jet recording apparatus.
After the presence of the ink cartridge is
confirmed, the information on the ink cartridge is
5 read as the resistance value.

Where for example, the kind of the ink jet
recording apparatus 53 is the apparatus example I in
Table 2 and the kind of the ink is the ink ② in
Table 1, if the resistance value of the resistor on
10 the cartridge corresponding thereto is 1 k Ω , the
information that the driving voltage is 21 V, that
the pulse width is 7 μ sec, that the driving
frequency is 4 KHz and that the number of
preliminary discharges is 128 times is read from the
15 conversion table recorded in the ROM 56 which is
shown in Table 3, by the CPU 55, and then is
transferred as the data during the driving of the
ink jet recording head to a particular area of the
RAM 56. Likewise, if the resistance value
20 corresponding to the ink ③ is 100 k Ω , the
conditions that the driving voltage is 28 V, the
pulse width is 3 μ sec, the driving frequency is 6
KHz and the number of preliminary discharges is 50
times are read from the conversion table.

25 When the recording head 59 is actually driven
to effect printing, the CPU 55 again indicates the
aforementioned data from said determined area of the



1 RAM to a reading head controller 58. Of course, the
table differs from apparatus to apparatus, and for
the ink ③, in the apparatus example II, the driving
voltage is 21 V, the pulse width is 7 μ sec, the
5 driving frequency is 3 KHz and the number of
preliminary discharges is 50 times, and further, if
the clog preventing mechanism is a very simple
device and the ink ③ is unsuitable, if the data on
the conversion table in that apparatus is made to
10 have a particular value (in this example, 0) for
identification, the ink jet recording apparatus will
judge that setting is impossible, and can produce an
alarm. Thus, any ink which is difficult to
discharge when used in a recording head having a
15 predetermined characteristic can be automatically
discriminated.

Further, by sufficiently securing the
capacity of the conversion table, many expected
kinds of driving conditions are input to the
conversion table, whereby there can be realized an
20 ink jet recording apparatus which can cope with
excellent ink in the future. In the aforedescribed
embodiment, description has been made with respect
to an example in which reading is effected from the
conversion table and the driving voltage, the pulse
25 width, the driving frequency and the number of
preliminary discharges are all made variable, but it



1 is apparent that it is also possible to form in the
apparatus a circuit in which more simply, for
example, only the driving voltage, only the pulse
width, or only the driving frequency, or a possible
5 combination thereof is set by the resistance value
of the resistor. Also, the information designated
by the medium can include, in addition to these, the
conditions of the pre-heating in which the recording
head is pre-heated to improve the characteristic of
10 the ink or the preliminary discharge in which
discharge not concerned in recording is effected to
improve the recording characteristic, such ink
discharge conditions that optimum discharge can be
obtained during recording, the ink discharge
15 conditions when recording is effected by the use of
inks of plural colors, or the discharge recovery
conditions of the recording head which correspond to
the ink used.

The discharge recovery conditions are
20 performed when the discharge state is deteriorated
before predetermined recording is terminated, and
include, for example, a series of operations of
moving the recording head to a position opposed to a
cap member, thereafter causing the cap to bear
25 against the discharge port surface, driving a pump
for recovery to thereby forcibly discharge the ink
from the discharge port, opening the cap, thereafter



1 effecting idle suction for discharging the ink in
the cap, and cleaning the discharge port surface of
the recording head by a blade, or one of these
operations or a combination of two or more of these
5 operations. That is, the discharge recovery
conditions show the selection of these operations
and a condition for which these operations are
performed under what degree of load, and optimum
conditions are set in conformity with the
10 characteristic of the ink. For example, for ink
which is low in viscosity and easy to dry, it is
necessary to set the discharge recovery operation at
high frequency, and for ink which is high in
viscosity and difficult to dry, the frequency of the
15 discharge recovery operation can be set low. Here,
the frequency includes not only the frequency of the
recording operation, but also the operation load or
the like of the recovery pump in the recovery
operation. Also, the pre-heating conditions are
20 necessary for bringing about such ink conditions
that optimum recording can be accomplished during
recording in conformity with the characteristic of
the ink used. For example, as regards ink of high
viscosity, it is preferable to heat such ink at a
25 somewhat high temperature to reduce the load of the
ink discharge conditions during the recording by the
recording head, and adjust the viscosity of the ink.



40

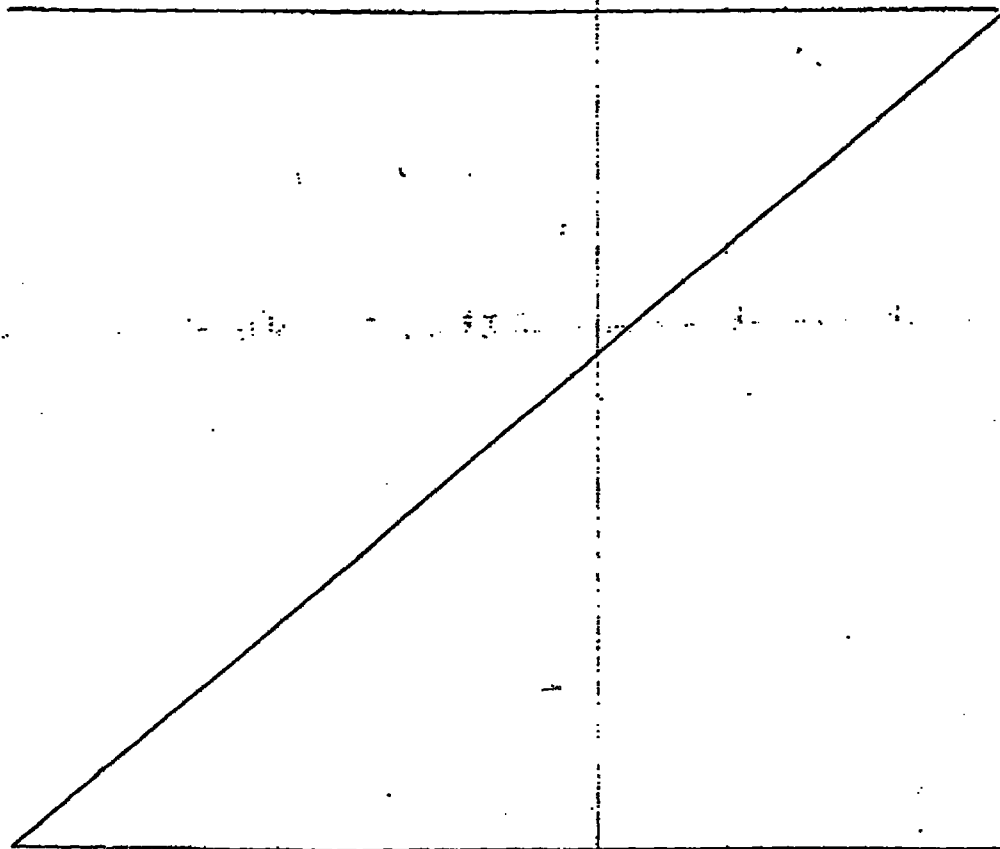
1 By these various conditions being also
included in the conversion table of the body side,
more excellent recording can be accomplished more
easily as compared with a case where discharge
5 conforming to the characteristic of ink is effected
under only the discharge conditions.

As regards the form in which the resistor as
the medium is carried on the ink cartridge, such
resistor may be provided at a predetermined location
10 on the front face of the ink cartridge in which a
collecting portion is provided, but alternatively,
may be provided on the upper surface of the ink
cartridge as shown in Figure 8.

15

20

25





1 In this case, as regards the resistance value
of the resistor, a resistor of different resistance
value may be carried between the terminals of the
cartridge side which are connected to the contacts of
5 the apparatus side, or the expanse of the resistor can
be changed, whereby the resistor may assume one of
various resistance values. As a method of changing the
resistance value of the resistor at this time, it is
possible to utilize a logo type or the like of a
10 predetermined shape. Also, the set resistance value
may be such a value that the conversion table set on the
body side as previously described can be properly read
out.

As a method of carrying this resistor on the
15 ink cartridge, mention may be made of a method of forming
the resistor by printing so that it may directly assume
a predetermined resistance value relative to the upper
surface of the cartridge, or a method of sticking a
label printed with a resistor so that it may assume a
20 predetermined resistance value.

For the mounting with respect to the apparatus
of a cartridge provided with such a resistor having a
predetermined resistance value, design is made such
that the terminal of the resistor and the terminal of
25 the body side scratch each other. This is because in
some cases, stable reading of the resistance value
cannot be accomplished even if the terminals are



1 connected together with their surfaces oxidized and a
film remaining formed thereon, and such instability can
be eliminated by mounting the cartridge in such a
manner that the oxidized film is scraped off.

5 In the foregoing, a resistor has been described
as an example of the resistor carried on the cartridge,
but it is also possible to use a capacitor, a diode, a
coil, a battery or the like for the same purpose.

Figure 9 shows an embodiment of the afore-
10 described ink cartridge in which the information medium
is made removably mountable. In Figure 9, the reference
numeral 28 designates a chip provided with a resistor
which is an information medium. By the chip 28 being
combined with the mating portion of the ink cartridge,
15 this ink cartridge becomes entirely identical in
appearances and function to the ink cartridge shown in
Figure 5. Accordingly, in the manufacture of the ink
cartridge of the present invention, it is unnecessary
to pre-assemble and prepare the housing 12 of the ink
20 cartridge corresponding to the kind of the ink and the
element 19, and it will become easy to prevent the
mixing of products if the chip 28 is mounted when the
ink cartridge is filled with the ink, and efficient
production becomes possible with a result that an
25 inexpensive and highly reliable ink cartridge is realized.



1 [Embodiment 2]

In Embodiment 1, a simple element such as a resistor has been shown as the information medium, but in the present invention, a semiconductor can be employed as another example of the information medium. Figure 10 shows an embodiment of the present invention which is provided with an electrically erasable read-only semiconductor memory array as the information medium in the ink cartridge. The reference numeral 21 denotes the ink cartridge body. The reference numeral 22 designates a semiconductor memory array. Here, the semiconductor memory array is an ROM (read-only memory), an EEPROM (electrically erasable rewritable read-only memory), a battery back-up RAM or the like. The reference numeral 23 denotes a substrate attached accurately to the housing portion of the ink cartridge. This substrate has a terminal portion 26 for fixing the memory array thereto and electrically connecting the memory array to a connector prepared in an ink jet recording apparatus 24. As shown in Figure 10, when the ink cartridge body is inserted into the ink cartridge receiving portion 27 of the ink jet recording apparatus 24, the connector 25 and the terminal portion 26 are electrically connected together. At this time, an ink reservoir and a waste ink reservoir are likewise connected to the connecting device of the ink jet recording apparatus.



1 The series of operation sequences when in this
state, the power source switch of the ink jet recording
apparatus body is closed are similar to those shown in
Figure 7. In the present embodiment, the memory array
5 provided on the ink cartridge permits more information
to be recorded thereon than the information medium
shown in Embodiment 1 (memory arrays of 1 or more (K
byte) as the lowest capacity are now commercially
available) and therefore, the ink jet driving conditions,
10 the discharge recovery conditions, the pre-heating
conditions, etc. are directly written therein as in
the conversion table carried on the apparatus body in
Embodiment 1. Accordingly, the CPU quickly transfers
the information such as the ink jet driving conditions
15 as the data during the driving of the ink jet recording
head from the memory array to a particular area of the
RAM after the closing of the power source switch. When
the recording head is to be driven, the driving may be
effected in a manner similar to that described with
20 respect to Embodiment 1.

A feature of the present embodiment is that as
previously described, the information such as the
driving conditions, etc. matching the ink in the ink
cartridge is recorded in the memory of the ink cartridge.
25 for each kind of the ink jet recording head and therefore
a conversion table need not be prepared on the ink jet
recording apparatus body. Accordingly, it is unnecessary



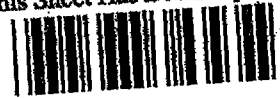
1 to prepare a number of conversion tables in advance.
That is, in the present embodiment, even if new ink
is prepared in the future, only the ROM data of the
ink cartridge can be changed and therefore, the present
5 embodiment is high in expansibility.

Figure 11 shows an example of the ink cartridge
in which the removably mountable information medium
adopts the memory array as described in connection
with Figure 10. In Figure 11, the reference numeral
10 30 designates a semiconductor memory array such as
ROM, EEPROM or a battery back-up RAM. The semiconductor
memory array 30 has on the housing 31 thereof a terminal
33 for electrically connecting the memory array to the
connector 32 of the ink cartridge. The reference
15 numeral 34 denotes a terminal for electrically connecting
the ink jet recording apparatus body to the memory
array. Accordingly, again in the present embodiment,
it is apparent that an effect similar to that of the
embodiment shown in Figure 9 is obtained.

20

[Embodiment 3]

Figure 12 shows another embodiment of the
present invention in which the information such as the
ink jet recording head driving-conditions are recorded
25 in a memory on the ink cartridge in parallelism to
the direction of insertion of the ink cartridge into
the ink jet recording apparatus. The reference numeral



46

1 35 designates a magnetic tape on which the information
such as the ink jet driving conditions is recorded at
35a in parallelism to the direction of insertion of
the ink cartridge by variations in magnetization polarity,
5 density, etc. Also, in order to prevent unsatisfactory
reading of the information caused by a change in the
insertion speed, exclusive tracks in which timing
information is written at predetermined intervals are
set at 35b in parallelism to the track in which the
10 aforementioned information is written.

As shown in Figure 12, the information such as
the ink jet head driving conditions recorded on the
magnetic tape is successively read by a reading head
36 when the ink cartridge is inserted into the ink jet
15 recording head body. After this information is
transferred to the RAM area in the ink jet recording
apparatus body, the ink jet recording head can be
driven on the basis of this information in the same
manner as in the embodiment shown in Figure 10.

20

[Embodiment 4]

Figure 13 shows another embodiment in which
the method of recording information on the ink cartridge
in the embodiment shown in Figure 12 is changed. In the
25 present embodiment, the information such as the ink jet
driving conditions uses a bar code 37 stuck to the
housing portion of the ink cartridge, in place of the



1 magnetic tape shown in the previous embodiment. Again
in this case, as in the previous embodiment, the
information such as the recording head driving conditions
is successively read by a reading head 38 when the ink
5 cartridge is inserted into the ink cartridge receiving
portion 27 of the ink jet recording apparatus. In the
present embodiment, a bar code need only be printed as
the recording medium and therefore, the medium can be
manufactured relatively easily and an inexpensive ink
10 cartridge can be provided.

[Embodiment 5]

Figure 14 shows another embodiment in which the
method of recording information on the ink cartridge in
15 the embodiment shown in Figure 13 is changed. In
Figure 14, the reference numeral 39 designates an ink
cartridge, and the reference numeral 40 denotes a
three-dimensional information pattern disposed on the
housing of the ink cartridge. The information pattern
20 40 is molded integrally with the housing of the ink
cartridge. The reference numeral 41 designates a
three-dimensional information pattern for timing
information. As shown in Figure 14, the information
such as the ink jet recording head driving conditions
25 recorded on the three-dimensional information pattern
is successively read by a reading cam switch 42 when
the ink cartridge is inserted into the ink cartridge



1 receiving portion of the ink jet recording apparatus.
After this information is transferred to the RAM area
in the ink jet recording apparatus body, the ink jet
recording head can be driven on the basis of this
5 information in the same manner as in the embodiment
shown in Figure 10.

[Embodiment 6]

Figure 15 shows another embodiment in which the
10 method of recording information on the ink cartridge
in the embodiment shown in Figure 14 is changed. In
Figure 15, the reference numeral designates an ink
cartridge, and the reference numeral 41 denotes a
three-dimensional information pattern disposed on the
15 housing of the ink cartridge 40. The information pattern
41 is molded integrally with the housing of the ink
cartridge. The reference numeral 42 designates a
three-dimensional information pattern for timing
information. In the embodiment shown in Figure 15,
20 the information such as the ink jet head driving
conditions so recorded in the three-dimensional
information pattern is successively read by the
photoelectric switch 43 of the ink jet recording head
body when the ink cartridge is inserted into the ink
25 jet recording apparatus. After this information is
transferred to the RAM area in the ink jet recording
apparatus body, the ink jet recording head can be



1 driven on the basis of this information.

The medium for transmitting the information by the aforescribed various systems, as shown in Figure 16, may preferably be disposed, for example, above the
5 ink connecting portion between the ink cartridge and the recording apparatus with respect to the direction of gravity. That is, it is preferable that as shown in the surfaces 44-48 on the cartridge in Figure 16, the information medium or the information delivery
10 portion between the information medium and the ink jet recording apparatus body be positioned above the level line of a cap 15 which is the ink connecting portion between the ink cartridge and the ink jet recording apparatus.

15 By the information medium or the information delivery portion between the information medium and the ink jet recording head being so provided above the ink connecting portion with respect to the direction of gravity, the ink flows downwardly of the cartridge
20 along the direction of gravity even if it leaks from the ink connecting portion and therefore, the medium can be prevented from being wetted by the ink. Thus, adverse effects such as electrical leak, the corrosion of the terminal portion and the unsatisfactory operation
25 of the sensor caused by slight leakage of the ink during the mounting or dismounting of the ink cartridge can be minimized.

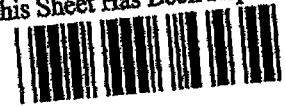


1 The ink cartridge 154 of the present invention
can also be applied to an ink cartridge for supplying
ink to the ink imparting portion 153 of an apparatus
of the type in which as shown in Figure 17, when an
5 ink retaining member 152 passes through the ink
imparting portion, a hole or recess 156 formed in the
ink retaining member 152 is filled with ink and when
the ink reaches the surface of the hole or recess 156
in the ink retaining member 152 filled with ink or the
10 surface of a recording head 151, a desired voltage is
applied to the recording head 151 to thereby discharge
the ink and form an image on a recording medium 157
disposed in opposed relationship with the recording
head 151 and moved on a platen.

15 In this case, as in each of the aforescribed
embodiments, control can be effected such that the
various kinds of information given to the cartridge
154 are transmitted by the interface 159 between the
ink imparting portion 153 and the cartridge and a
20 processing table based on the information is selected
to thereby effect predetermined driving of the head 151.

[Embodiment 7]

 The ink cartridge carrying thereon an information
25 medium in the form as previously described has a
construction as shown, for example, in Figure 19, and
can be applied to an ink jet recording apparatus which

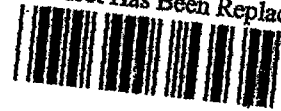


1 is shown with its cover removed.

2 In Figure 18, the reference numeral 201
designates a recording head in the form of a chip, and
the reference numeral 202 denotes a carriage carrying
5 the recording head 201 thereon and enabling the
movement of its own for the scanning by the recording
head 201. On the carriage 202, as will be described
later, there are provided a support member for removably
carrying the recording head 201 thereon, and a cover
10 member (indicated by dot-and-dash line) forming a part
of the recording head 201 and protecting a substrate
printed with a head driving circuit or the like.

The recording head 201 has 64 discharge openings
disposed in the front end portion thereof, and an ink
15 liquid path communicating with each of these discharge
openings is provided. Further, behind the region in
which the ink liquid paths are disposed, there is
provided a common liquid chamber for supplying ink to
these liquid paths. In the ink liquid paths corresponding
20 to 64 discharge ports, there are provided electro-
thermal conversion elements generating discharge
energy available to discharge the ink liquid from
these discharge ports and electrode wiring for supplying
electric power to the electro-thermal conversion
25 elements.

These electro-thermal conversion elements and
electrode wiring are formed on a substrate formed of



1 silicon or the like by the film-forming technique, and
partition walls, a top plate, etc. formed of resin or
a glass material are layered on this substrate, whereby
said discharge openings, said ink liquid paths and
5 said common liquid chamber are constructed. Further
rearwardly of said construction in the recording
head 201, a driving circuit for driving the electro-
thermal conversion elements on the basis of a recording
signal is provided in the form of a printed substrate.

10 In the carriage 202, rearwardly of the above-
described recording head 201, there is disposed a
connector substrate 212 through a connector 209. On
the connector substrate 212, there are disposed the
connector 209 for connection to the recording head 201
15 and a connector for connection to a flexible cable from
the control circuit of the apparatus body. Also, a
capacitor, a resistor, etc. are mounted on the connector
substrate 212, and by these, the drop of the power
source voltage supplied through the flexible cable and
20 the mixing of noise with a signal are compensated for.
Further, the connector substrate 212, as will be
described later, is supported on a slide member so that
it may slide with the opening-closing movement of the
cover member and the connector 209 may be connected
25 to the terminal of the recording head 201.

The carriage 202 is slidably and pivotably
engaged with a guide shaft 203 through an engagement



1 portion 262a, and the guide shaft 203 is provided over
an area longer than the width of recording paper so as
to be orthogonal to the direction in which a recording
medium such as recording paper is conveyed. Also, the
5 carriage 202 is connected to a portion of a belt, not
shown, extended in parallelism to the guide shaft 203,
and by this belt being driven by a carriage motor, not
shown, the movement of the carriage 202 along the guide
shaft 203, i.e., the scanning movement of the recording
10 head 201, becomes possible. Also, the carriage 202
and the recording head 201 obtain the force for
pivotal movement about the guide shaft 203 from their
own gravity, and with this force as a biasing force,
they bias a paper keep plate 208 to be described
15 through a slide member provided on the carriage 202 for
sliding on the paper keep plate. Thereby, the recording
head 201 can keep a predetermined spacing between it
and the recording paper used in conformity with the
thickness of the recording paper.

20 The recording paper 206 fed from a paper
supply cassette, not shown, or fed manually is supplied
to the apparatus body through a paper supply port
comprised of an upper paper guide 207a and a lower
paper guide 207b. The paper keep plate 208 having a
25 curvature is continuous to the extension of the upper
paper guide 207a. The paper keep plate 208 is
disposed so as to press the recording paper against a



1 paper feeding roller 205, and is formed of such a
material that the frictional force created between the
paper keep plate and the recording paper during the
pressing is smaller than the frictional force created
5 between the paper feeding roller 205 and the recording
paper. Also, the lower paper guide 207b extends to
the region in which the paper feeding roller 205 is
disposed parallel to the paper keep plate 208.

Thus, the recording paper 206 fed from the
10 paper supply port is conveyed by one line each upwardly
in the apparatus with the rotation of the paper feeding
roller. At this time, the recording paper 206 slides
on a plate-like platen 207 while the spacing between
it and the recording head 201 is regulated to a
15 predetermined magnitude by the paper keep plate 208 and
the platen 207.

The recording head 201, with its scanning
movement, discharges ink droplets to the recording area
of the recording paper 206 opposed thereto to thereby
20 effect recording of one line, and by this recording
and the conveyance of the recording paper for said
one line, recording of each one line is sequentially
effected, whereby characters, images or the like are
formed. The recording paper 206 on which recording
25 has been effected, with the conveyance thereof, is
discharged onto a paper discharge tray, not shown, by
paper discharge rollers 204 and spurs 240A and 240B



1 provided above the recording paper conveyance path.
Five pairs of such spurs 240A and 240B are provided
correspondingly to the paper discharge rollers 204,
and a spur cleaner is interposed between each pair of
5 spurs. A member for supporting these spurs and spur
cleaners is not shown in Figure 18. The spurs 240A
are designed to impart a pressure force to the paper
discharge rollers 204 with the recording paper
interposed therebetween, and the spurs 240B are designed
10 to regulate the recording paper conveyance path between
them and the platen 207. The paper discharge rollers
204 are rotatively driven so as to be greater in
peripheral speed than the paper feeding roller 205,
whereby the recording paper 206 in the portion thereof
15 constituting the recording area is pulled upwardly and
thus, the recording paper 206 can be prevented from
floating up from the platen 207.

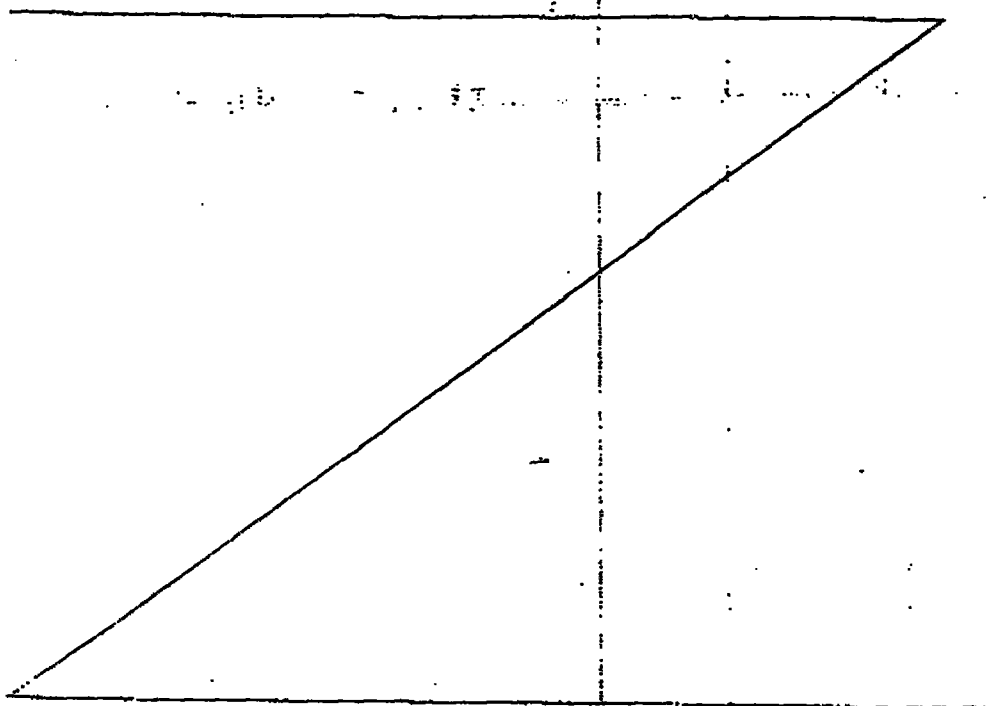
Near the home position in the area continuous
to the scanning area of the recording head 201, there
20 are provided a series of constructions for the discharge
recovery process. That is, there are provided a blade
226 for removing water drops, dust, etc. on the discharge
port surface in which the discharge ports are disposed
by the wiping movement thereof, an absorbing portion
25 225 for removing water drops, etc. on the discharge
port surface chiefly by absorbing them, and a cap 213
for effecting the capping for the hermetic sealing of



1 the discharge port surface, idle discharge and ink
absorption. These members are designed to be movable
back and forth relative to the moving area of the
recording head 201 while being supported as a unit by
5 a moving support member 214, and performs their
respective operations at appropriate timing. Also,
the ink absorption in the cap 213 is effected by a
pump 224 communicating with the cap 213 through the
hollow portion of the moving support member 214 and
10 a tube. During the capping by the cap 213, a hole
formed in a cap arm 217 mounted on a side of a holding
member for the cap 213 and a projected portion provided
on the carriage 202 are engaged with each other, whereby
the recording head 201 is precluded from rotating
15 rearwardly to thereby ensure the capping of the
discharge port surface by the cap 213.

20

25





1 The rotation of the paper feeding roller 205,
and the paper discharge rollers 204, and the operations
in the discharge recovering mechanism, i.e., the back
and forth movement of the cap 213, the blade 226 and
5 the absorbing member 225 as a unit and the absorbing
operation by the pump 224, are performed by the
utilization of the rotative driving force of a feed
motor 221. That is, the rotative driving force of the
feed motor 221 mounted on a portion of the apparatus
10 body frame is first transmitted to a transmission
switching gear train 219. In this gear train 219, the
selection and switching of each gear is effected by the
movement of a selection gear (not shown) operatively
associated with the movement of the carriage 202, i.e.,
15 the scanning movement by the recording head 201, the
movement to the home position or the discharge recovery
device and the stoppage at these positions. Thereby,
the rotation of each gear in the gear train 219 is
transmitted to the paper feeding roller 205 and the
20 paper discharge rollers 204 through an intermediate feed
gear 220, and transmitted to the cap 213, etc. finally
through a cam 216, and further transmitted to the pump
224 through a pump gear 222 and a pump cam 223.

 The supply of ink to the recording head 201 is
25 effected from an ink cartridge 227 mounted in the
recording apparatus body, through a flexible tube
capable of following the movement of the carriage 202.



1 Also, the moved position of the carriage 202 is
detected by counting the number of steps of the
carriage motor with the position of engagement between
a home position sensor 211 provided on the carriage
5 202 and a home position detecting flag provided near
the end of the movement area of the carriage 202 as
the reference.

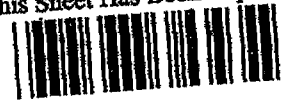
Description will now be made of the construction
of the ink cartridge 227 according to the present
10 embodiment and the construction of the mounting portion
of the body side on which the ink cartridge is mounted.

Figures 19A and 19B show an example of the
construction of the mounting portion of the body side.

First, in Figure 19A, the reference numeral 302
15 designates a cartridge inserting portion for receiving
the insertion of the ink cartridge 227. The reference
numeral 304 denotes a contact holder for holding leaf
spring-like contacts 306A and 306B as means for reading
the information provided on the ink cartridge 227.

20 The contact holder 304 is combined with the inserting
portion 302 by a latch portion 308 being engaged with
a hole 310 in the inserting portion 302. The reference
numeral 312 designates a connector for connecting the
contacts 306A and 306B to a body control unit.

25 The reference numeral 314 denotes a hollow
needle member which enters the interior of a containing
bag for ink to be supplied which is contained in the ink



1 cartridge 227. The hollow needle member 314 is formed
with an ink conducting aperture 316 in the tip end
portion thereof. An ink supply tube is mounted on the
other end of the needle 314, and the tube is connected
5 to a common liquid chamber portion in a head chip 110
provided on the recording head 201. Means for detecting
the amount of remaining ink can be provided intermediately
of this ink supply system.

The reference numeral 318 denotes a waste ink
10 pipe for directing waste ink to an ink absorbing member
which enters the ink cartridge 227 and is contained
therein. The waste ink is ink discharged during the
ink refreshing process, for example, in the ink supply
system or the common liquid chamber, or ink discharged
15 during the recovery process.

The reference numeral 320 designates clicks as
a fastening means for the ink cartridge 227. One click
320 is provided on each side of the inserting portion
302. These clicks 320, as shown in Figure 19B, receive
20 the insertion of the cartridge 227 by an engagement
portion 322 being resiliently flexed with the engagement
thereof with a side of the cartridge 227 during the
insertion of the cartridge 227, and hold the cartridge
227 in that position by the engagement portion 322
25 restoring its original shape when a recess 332 in the
cartridge 227 reaches the clicks.

Figure 20 shows an example of the construction



1 of the ink cartridge 227 according to the present
embodiment.

In Figure 20, the reference numeral 340 denotes
an ink bag containing therein ink to be supplied. .
5 The ink bag 340 is provided with a plug 342 made, for
example, of rubber. The needle 314 is inserted into
this plug 342 and further enters the interior of the ink
bag, whereby ink communication is accomplished. The
reference numeral 344 designates an ink absorbing member
10 for receiving the above mentioned waste ink. The
aforescribed medium for transmitting the characteristic
of the ink in the cartridge is attached to a portion of a
side or the upper surface of the ink cartridge 227.

Figure 21 illustrates each portion for coupling
15 the ink cartridge 227 to the body side. In Figure 21,
the reference numeral 346 denotes a wiring resistance
pattern provided on the upper surface of the ink cartridge
227, and the control unit of the apparatus body can
detect the presence or absence of the mounted ink
20 cartridge in conformity with the conduction/non-
conduction between the contacts 306A - 306B through
the wiring resistance pattern 346. Also, by this wiring
resistance pattern being made into a resistance pattern
having a resistance value determined in conformity with
25 the color or density or the like of the ink containing
this pattern, the control unit of the apparatus body can
read the information thereof.



1 In the present embodiment, the location and
dimensions of each coupling portion are determined so
that an inserted position (1) in which the needle 314
penetrates through the plug 342 with the insertion of
5 the ink cartridge 227 and the aperture 316 comes to the
interior of the ink bag 340, whereby ink communication
is accomplished, a position (2) in which the contacts
306A and 306B are connected to the wiring resistance
pattern 346 and a position (3) in which the clicks 320
10 are engaged with recesses 332, whereby the ink cartridge
227 is held may lie in the named order in the direction
of insertion. That is, design is made such that when
the operation inserts the cartridge 227, the needle 314
first enters the interior of the ink bag 340 and when
15 the cartridge is further inserted, the contacts 306A and
306B are then connected to the resistance pattern 346
and only when the cartridge is still further inserted,
the clicks 320 come into engagement with the recesses
332. In the case of the present embodiment, the ink
20 cartridge 227 contains the waste ink also therein and
therefore, it is desirable that in the position (1),
the waste ink pipe 318 be also positioned in the ink
cartridge 227.

The above-described positional relation is
25 shown in Figure 22. In Figure 22, (4) indicates a
position in which the ink cartridge 227 finally strikes
in the direction of insertion, and the range from (3)



1 to (4) is a range in which the cartridge 227 is movable
in its held position due to the back-lash of the clicks
320 and recesses 332, or a range in which the clicks 320
come into engagement with the recesses 332 and the
5 cartridge 227 is further inserted until it strikes
against the innermost part of the inserting position
302.

If such positional relation is not assumed,
there will occur inconveniences as shown in Figure 23.

10 That is, in the relation shown in Figure 23A,
even if cartridge holding is done, the information
regarding the cartridge cannot be read through the
contacts 306A and 306B and therefore, in some cases,
the control unit of the apparatus body may judge that
15 the cartridge is not yet inserted. In the relation
shown in Figure 23B, contact connection is effected
prior to ink communication and therefore, the control
unit of the apparatus body may judge that the cartridge
has been mounted, and may start a predetermined operation,
20 whereby air may be introduced from the needle 314 into
the ink supply system. This also holds true of the
relation shown in Figure 23C and moreover, if the
operation discontinues the inserting operation by the
confirmation of a click sound, ink communication will
25 not be provided at all.

Also in the relations shown in Figures 23D and
23E, in spite of cartridge holding being done, there is

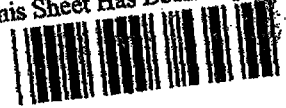


1 a case where the needle 314 is out in that range or
contact connection becomes unstable.

In contrast, according to the relation as shown
in Figure 22, ink communication, contact connection and
5 cartridge holding take place in the named order during
the insertion of the cartridge and therefore, the
operator only need confirm cartridge holding simply
by a click sound or the like. Also, even if the control
unit of the apparatus body immediately starts its
10 operation in response to contact connection, there will
not occur the inconvenience that air is introduced into
the ink supply system, and even if conversely, the
cartridge 227 is pulled out during the operation of the
control unit of the apparatus body, the control unit of
15 the apparatus body will detect it before ink communication
is cut off and therefore, a similar inconvenience will
not occur if the operation is discontinued.

Figure 24A shows a further improvement in the
above-described construction. In the example shown
20 there, the wiring resistance pattern is divided into
two, and the pattern lying forwardly with respect to
the direction of insertion of the cartridge is a pattern
346A for short-circuiting the contacts 306A-306B, and
the pattern lying rearwardly is a resistance pattern
25 346B having a resistance value determined in conformity
with the color, density, etc. of the ink.

Figure 24B shows the relation among a range



1 within which ink communication is done in such a
construction, a range within which the contacts 306A
and 306B are in contact with the pattern 346A, a range
within which the contacts 306A and 306B are in contact
5 only with the pattern 346B, and a range within which the
cartridge is held.

In Figure 24B, (1) indicates a limit position in
which ink communication is done as described above, (3)
indicates a limit position in which the cartridge 227 is
10 held, and (4) indicates the innermost position in which
the cartridge 227 strikes. Also, (2A) indicates a limit
position on this side with respect to the direction of
insertion in which the contacts 306A and 306B are in
contact with the pattern 346A and are short-circuited,
15 and (2B) indicates a limit position on this side with
respect to the direction of insertion in which the
contacts 306A and 306B are off the pattern 346A and in
contact only with the pattern 346B and the resistance
value of this pattern is read. Here, it is desirable
20 that the position (2B) be the position (3) or a position
near it, and in the present example, a position near
the position (3) in the direction of insertion of the
cartridge in which particularly the engagement between
the clicks 320 and the recesses 332 is released and the
25 cartridge 27 is ready to slip out.

The relation among the various positions is as
shown, and an effect similar to that in the case of



1 Figure 21 is obtained, but in the present embodiment, a
more excellent effect is obtained by performing the
following operation.

Figure 25A diagrammatically shows the essential
5 portions of a control circuit according to the present
embodiment. In Figure 25A, the reference numeral 400
designates the control unit of the apparatus body which
may be in the form of a microcomputer having a CPU for
effecting the process of Figure 25B and other control of
10 the entire apparatus, an ROM storing therein a program
or the like corresponding to the process procedure, and
an RAM for working. The reference numeral 410 denotes a
detector for detecting the resistance value between the
contacts 306A and 306B. When said resistance value is
15 "0", the detector 410 indicates that the contacts are
short-circuited by the pattern 306A, and when said
resistance value is infinity, it indicates that the ink
cartridge 227 is not yet mounted, and when said
resistance value is a predetermined value, it indicates
20 that the ink cartridge 227 is properly held. The
reference numeral 420 designates a display device for a
message or the like, or output means of sound or the
like, or a notice unit which may comprise a combination
thereof. The letter I denotes an operation stopping
25 signal for each portion.

Figure 25B shows an example of the operation
procedure of the present embodiment and this procedure



1 can be started at suitable timing during the closing of
the power source switch of the apparatus or during the
interchange of the ink cartridge 227, and in addition,
during the recording operation.

5 When this procedure is started, the resistance
value is first read at a step S1. If at this step, the
resistance value is infinity, it means a case where the
cartridge 227 is not mounted and therefore, advance is
made to a step S3, where the operation of each portion
10 is maintained in its stopped state, and at a step S5,
the operator is noticed to promote to insert the cartridge
227.

On the other hand, if the resistance value is "0",
it means that the cartridge 227 is ready to slip out and
15 therefore, advance is made to a step S7, where the
operation of each portion is stopped, whereafter at
a step S9, the operator is noticed to promote the
operation for the cartridge 227 to be surely held.

Further, if the resistance value is a predetermined
20 value, it means that the cartridge 227 is already surely
held and therefore, the information (the color or the
like of the ink) regarding the cartridge corresponding
to that resistance value is recognized and a setting
process corresponding thereto is carried out (a step S11).

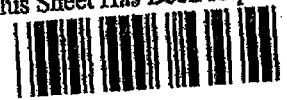
25 That is, when the operator has inserted the
cartridge 227 but the clicks 320 have not come into the
recesses 332, or when the engagement therebetween has be



1 released for some reason or other, the cartridge
holding is not complete and therefore the cartridge is
liable to slip out. In such a case, the contacts 306A
and 306B are connected to the pattern 346A, whereby the
5 control unit 400 of the apparatus body becomes unable to
read the inherent information of the cartridge 227 and
therefore, the control unit 400 of the apparatus body
can recognize such a situation and switch off the
operation of the apparatus, thereby noticing the
10 operator to promote to surely insert the cartridge 227.
Thus, the operator can be noticed of such a danger that
the cartridge 227 will slip out of the apparatus.

If the positional relation as described above can
be basically kept with regard to the reading position for
15 the information regarding the supplied ink communication
and the cartridge and the cartridge holding position, it
is of course possible that the cartridge and the
inserting portion therefor adopt suitable constructions.
For example, the cartridge holding need not always
20 resort to the clicks and recesses. Further, the reading
of the information regarding the ink cartridge need not
always be electrical, but may be, for example, optical.
Furthermore, in the above-described embodiment, the
waste ink is also introduced into the cartridge, but the
25 cartridge may also be of the type which effects ink
supply alone.

By adopting such a construction, reliable reading



68

1 of the information can be accomplished in the cartridge
carrying thereon the information medium as previously
described, and the driving of the recording head best
suited for the ink used can be accomplished.

5

[Embodiment 8]

Figure 26 shows another example of the ink
cartridge mounting mechanism according to the present
invention. In Figure 26, the reference numeral 304
10 designates an example of the ink cartridge according to
the present invention, and the reference numerals 341
and 342 denotes unlocking members projectedly provided
on the left and right side walls of the ink cartridge
304. The reference numerals 336 and 337 designate
15 locking members according to the present invention which
are provided along the left and right sides of an
insertion path 332. In the present embodiment, the left
and right locking members 336 and 337 differ in shape
from each other, as shown.

20

In the case of the present embodiment, the
unlocking members 341 and 342 and the locking members
336 and 337 are all disposed at the same level above
the bottom surface of the insertion path 332, but the
unlocking members 341 and 342 differ in their projected
25 position in the direction of insertion. In this case,
it is desirable in preventing the error of manufacture
and malfunctioning that the amount of deviation between



1 the unlocking members be 5 mm or more.

Thus, when the ink cartridge 304 is further
inserted from the state shown in Figure 25, the locking
member 342 may reach the end of the wedge portion 337A
5 of the locking member 337 in a state in which the
unlocking member 341 has reached the end of the wedge
portion 336A of the locking member 336. The reference
characters 336B and 337B designate locking grooves in
the respective locking members, the reference character
10 336C denotes an escape portion, and the reference
characters 336D and 337D designate returning wedge
portions provided to return a protective plate 333
smoothly from its pushed-up position to its locked
position as shown.

15 Reference is now had to Figures 27A-27D to
describe the cartridge mounting operation in the ink
cartridge mounting mechanism constructed as described
above. First, when the ink cartridge 304 is mounted in
a normal posture, as shown in Figure 27A, the unlocking
20 members 341 and 342 provided on both sides of the ink
cartridge 304 slidably contact with the wedge portion
336A of the locking member 336 and the wedge portion
337A of the locking member 337, respectively, and
pivotally move the locking members 336 and 337 in
25 opposite directions as shown in Figure 27B to thereby
liberate the protective plate 333 from the restraint by
the locking grooves 336B and 337B, and rotate the



70

1 protective plate 333 in the direction of arrow B
-- against the spring force of a spring 335 as shown in
Figure 26, whereby the ink cartridge 304 can be
directed to its mounted position.

5 However, when the ink cartridge 304 is mounted
upside down by mistake as shown, for example, in Figure
27C, the unlocking members 341 and 342 pivotally move
the locking members 336 and 337 as shown in Figure 27D and
thus, the protective plate 333 is not liberated from
10 these locking members. Also, even if the locking members
336 pivotally moves at all, the unlocking member 342
will be stopped in the escape portion 336C and the front
face of the ink cartridge will bear against the
protective plate 333. Consequently, the inserting
15 movement of the ink cartridge 304 will be precluded by
the protective plate 333 and the ink cartridge 304 will
not be directed to its mounted position. Although not
shown, when the ink cartridge 304 is about to be mounted
with its front and rear reversed, the unlocking members
20 are likewise absent and therefore the locking members 336
and 337 are not operated. Thereby the reliability of the
cartridge mounting is ensured and thus, the transmission
of the information from the information medium carried
on the cartridge can also be reliably accomplished.

25

[Embodiment 9]

Figure 28 shows still another embodiment of



1 the present invention. In the ink cartridge 304
according to this embodiment, the unlocking members 341
and 342 provided on both sides thereof are made to
differ from each other in the level from the insertion
5 path 332. Again in the present embodiment, it is
desirable for the same reason as set forth in the
previous embodiment that the amount of the deviation
between the unlocking members be 5 mm or more. Thus,
the locking members 336 and 337 are also disposed so
10 as to keep levels corresponding to the unlocking
members 341 and 342.

In the ink cartridge mounting mechanism
constructed as described above, even if the ink
cartridge 304 is inserted upside down, the left and
15 right unlocking members 341 and 342 will not come into
engagement with the locking members 336 and 337, and if
the ink cartridge is inserted with its front and rear
reversed, the unlocking members are not present on the
first half of the cartridge, whereby the locked state of
20 the protective plate 333 is not released and thus, wrong
mounting is prevented.

Figures 29A and 29B show an ink cartridge
according to yet still another embodiment of the present
invention. The present embodiment is such that the
25 locations of the unlocking members are changed for each
ink cartridge and for example, ink cartridges containing
therein inks which differ in the characteristics thereof

1 such as color, etc. can be correctly mounted on their
corresponding mounting portions. That is, the ink
cartridge 304A shown in Figure 29A and the ink
cartridge 304B shown in Figure 29B are made to differ
5 in the locations of unlocking members 341 and 342 in the
direction of height and the amounts of horizontal
deviation thereof differ from each other as indicated
by D1 and D2.

So, assuming that for example, red ink is
10 contained in the ink cartridge 304A and black ink is
contained in the ink cartridge 304B, although not shown,
locking members provided on the mounting portion of a
red ink supply system and the mounting portion of a black
ink supply system are made to correspond to the levels of
15 the unlocking members 341 and 342, whereby even if a
wrong attempt is made to mount an ink cartridge of
a different color, the mounting thereof can be precluded
and at the same time, the mounting of the individual ink
cartridges 304A and 304B themselves in a wrong posture
20 can be prevented. By wrong mounting being thus
prevented, the reliable transmission of information
can be accomplished in the cartridges of the aforescribed
construction each having as information medium and
optimum driving of the recording head matching the ink
25 used can be accomplished.



1 [Embodiment 10]

Figures 30A and 30B show another embodiment of the ink cartridge according to the present invention. In these figures, the reference numeral 401 designates an ink cartridge having therein an ink containing portion, not shown, the reference numeral 402 denotes a shutter kept slidable along an opening 401A in the upper surface of the cartridge 401, the reference character 402A designates a shutter projection projected upwardly from the shutter 402, and the reference numeral 403 denotes a coil spring interposed between the shutter 402 and a spring receiving wall 401B. By this coil spring 403, the shutter 402 is biased leftwardly along the opening 401A and the shutter projection 402A is caused to bear against the end edge of the opening 401A to thereby keep the opening 401A closed.

The reference numeral 404 designates a flag member pivotable about a support shaft 405 and formed, for example, of a material capable of intercepting infrared light. The support shaft 405 is journaled to the wall portion of the cartridge 401. The reference numeral 406 denotes a torsion coil spring provided around the support shaft 405 and having one end thereof restrained by the flag member 404 and the other end secured to the wall portion of the cartridge 401. The torsion coil spring 406 biases the flag member 404 clockwise about the shaft 405 to thereby bias the same toward



1 the back side of the shutter 402. On the other hand,
the reference character 422A designates a stopper
portion projectedly provided from a cartridge guide
422 toward a cartridge insertion path 426. When the
5 ink cartridge 401 is inserted from right to left as
viewed in Figure 30A, the shutter projection 402A bears
against the stopper portion 422A, and with a further
inserting operation thereafter, it serves to open the
shutter 402 against the spring force of the spring 403.

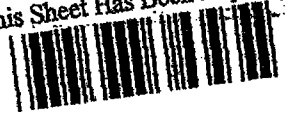
10 The reference numeral 424 denotes a light detecting
sensor of the transmission type endowed, for example,
with the infrared light detecting function. The sensor
424 is carried on a carriage. When the ink cartridge 401
is inserted from the state of Figure 30A along the
15 cartridge insertion path 426, the shutter 402 is opened
by the stopper portion 422A as previously described, and
in the completely mounted state of the ink cartridge 401
shown in Figure 30B, the shutter 402 is fully opened and
at the same time, the flag member 404 is cocked up by
20 the spring force of the torsion coil spring 406 and bears
against the stopper portion 422A, and is kept in a
posture for intercepting the optical path of the
detecting sensor 424. The end portion 402B of the
shutter 402 which is projectedly provided along the
25 direction of the opening therein serves to suppress
the cocking-up of the flag member 404 when the ink
cartridge 401 does not assume its completely mounted



1 position as shown in Figure 30B, but assumes an
incompletely mounted position, and as long as the flag
member 404 is not cocked up, said end portion 402B is
not detected by the detecting sensor 424 and thus, the
5 incomplete insertion of the ink cartridge 401 can be
prevented. Accordingly, in this case, it is preferable
to keep the gap between the flag member 404 and the
shutter 402 as small as possible, and by doing so, the
timing at which the flag member 404 is cocked up, i.e.,
10 the timing at which the ink cartridge 401 is completely
mounted, can be made more accurate.

Also, when the ink cartridge 401 is to be
removed from the recording apparatus, the ink cartridge
401 is drawn out rightwardly from the state of Figure
15 30B, whereby the flag member 404 is pushed by the
stopper portion 402A and is rotated counterclockwise
and also the shutter 402 is moved by the spring force
of the coil spring 403 in a direction to close the
opening 401A, and in the completely drawn out state of
20 the cartridge, the flag member 404 is housed under the
shutter 402.

In the ink cartridge thus constructed, the flag
member for detecting the mounting of the cartridge which
is provided in the cartridge itself is housed in the
25 interior thereof before the cartridge is mounted and
thus, does not spoil the external appearance of the
cartridge and the cartridge is easy to handle, and on



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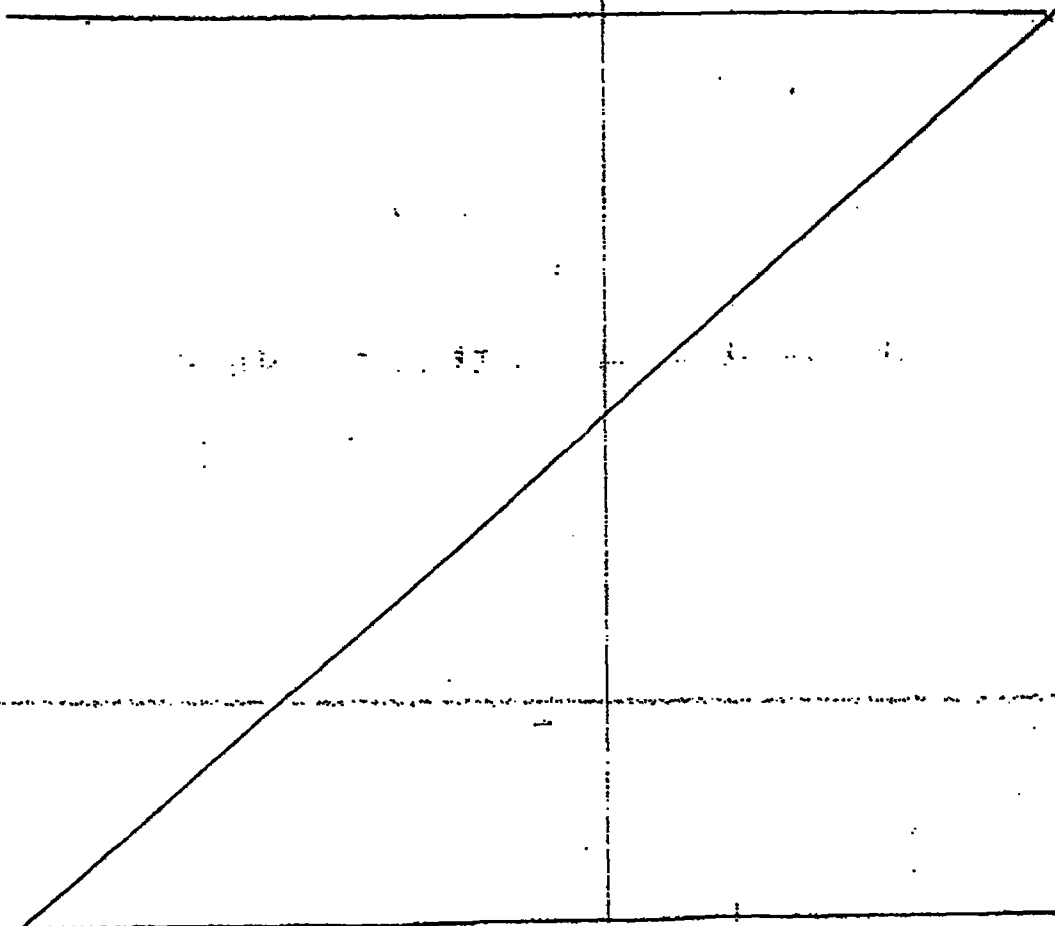
1 the other hand, it is only required on the recording
2 apparatus side to dispose a hole for cocking up and down
3 the flag member and a stopper portion provided in the
4 cartridge guide and moreover, as will be described
5 later, by a simple construction, various kinds of
6 information regarding the ink cartridge can be provided
7 to the user with high reliability.

8 Such a construction enables the cartridge to
9 be reliably mounted with respect to the apparatus and
10 therefore, for example, in the case of a cartridge
11 carrying an information medium thereon, the corresponding
12 information is reliably transmitted.

15

20

25





1 Figures 31A-31C shows another embodiment of
the ink cartridge according to the present invention.
In these figures, only a flange member 404 is shown,
and the reference characters 404A, 404B and 404C designate
5 the light intercepting portions thereof. By the light
intercepting portions 404A, 404B and 404C being so changed
in accordance with the direction along the support shaft
405 thereof, i.e., the direction of movement of the
carriage, the detecting position by the detecting sensor
10 shown in Figures 30A and 30B can be changed, and different
information regarding the ink cartridge 401 (in the
case of the present embodiment, three kinds of information)
can be obtained due to the difference in the detecting
position. This is an example of other form of the afore-
15 described information medium. Accordingly, the flange
member 404 which differs in the position of the light
intercepting portion as described above from cartridge
to cartridge containing ink therein is used so as to
show the kind, the characteristic or the like of the
20 ink contained in the cartridge 401, and the number of
the kinds of the information is not limited to three
as described above.

The amount of information which can be handled
differs depending on the resolving power during the
25 carriage scanning and the detection width of the detecting
sensor, but where design is made such that detection
of a width of 20 mm is done, for example, by scanning



1 for 2 mm each, a flag member in which the light inter-
cepting portion is changed in position at a unit of
2 mm is provided in each cartridge, whereby ten kinds
of information can be obtained. If an attempt is made
5 to obtain such information by the conventional system,
ten independent flags will become necessary and moreover,
such flags will have to be arranged at intervals of
2 mm on the recording apparatus side, and this will
unavoidably lead to an increased number of parts as
10 well as the complication, bulkiness and increased cost
of the apparatus, whereas by constructing the cartridge
as shown in the present embodiment, it becomes possible
to save the space by a minimum number of parts and yet
provide numerous kinds of information regarding the
15 ink cartridge.

Figures 32A and 32B show still another embodiment
of the present invention and a construction for transmit-
ting information indicative of the presence or absence
of ink. The present embodiment is one in which for
20 an ink bag 430 in the cartridge 401, there is provided
a flag for informing the user that the amount of ink
remaining in the ink bag has become, for example, a
predetermined amount or less. The reference numeral
440 designates that flag member, and in the present
25 embodiment, in the end portion of that side of the flag
member 440 on which a support shaft 405 is provided,
there is formed a contact portion 440A protruded



1 substantially in the form of a semicircle, and such
--a contact portion 440A may always keep contact with
the surface of the ink bag 430 even in the completely
mounted state of the ink cartridge 401 as shown in Figures
5 32A and 32B and the state of the ink cartridge before
mounted, although not shown.

The reference numeral 441 denotes longitudinal
slots formed in two wall portions of the ink cartridge
401 which are parallel to the plane of the drawing sheet,
10 and the support shaft 405 of the flag member 440 is
fitted in these slots 441 and supported for vertical
movement and rotational movement. Also, in the case
of the present embodiment, a torsion coil spring 406
mounted around the support shaft 405 has a spring force
15 for biasing the flag member 440 clockwise and biasing
the support shaft 405 itself downwardly along the slots
441, and biases the contact portion 440A of the flag
member 440 toward the ink bag 430.

According to the ink cartridge 401 thus constructed,
20 before the cartridge 401 is mounted at a predetermined
mounting position along an insertion path 426, the flag
member 440 is housed under the shutter 402 in the same
manner as described previously in connection with Figure
30A, but when the cartridge is surely mounted at the
25 predetermined mounting position, the flag member 440
rises in the manner as shown in Figure 32A or 32B. Thus,
simultaneously with the rising of the flag member, the



1 contact portion 440A of the flag member 440 is biased
toward the surface of the ink bag 430 by the spring
force of the torsion coil spring 406.

So, in the ink cartridge 401 thus provided with
5 the ink bag 430 as ink containing means, when ink is
sufficiently stocked in the ink bag 430, the entire
flag member 440 rises at a high position as shown in
Figure 32A and thus, the light intercepting portion
440B thereof is kept at a height for intercepting the
10 optical path 435 of a detecting sensor 424, and when
the carriage has been directed to the position of the
cartridge 440, the presence of ink is detected by the
detecting sensor 424 carried on the carriage. Also,
when the ink becomes exhausted, the flag member 440
15 is kept in a low position as shown in Figure 32B even
if it rises, whereby the flag member 440 does not inter-
cept the optical path 435 of the detecting sensor 424,
and the ink is judged to be absent.

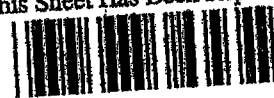
As is apparent from the foregoing description,
20 according to the present invention, a medium including
the information for driving the ink jet head is provided
on the ink cartridge, whereby the ink jet recording
apparatus itself can automatically set the driving
conditions of the ink jet head matching the composition
25 of ink and therefore, there can be provided an ink jet
recording apparatus which is simple to operate and high
in reliability.



1 Also, there can be provided an ink cartridge
which can be prevented from being erroneously inserted
by the user and which has information for properly
controlling the driving of the recording head.

5 Also, as described above, according to the present
invention, in the position wherein an ink tank in the
form of a cartridge forming an ink supply source is
held in the apparatus body, the ink communication with
the ink supply system is done prior thereto and therefore,
10 the ink communication state can be secured near the
held position of the ink tank. Also, the information
regarding the ink tank is readable prior to the holding
of the ink tank and therefore, impossibility of reading
or misjudgment does not occur near the held position.
15 Further, the ink communication is done prior to reading
and therefore, even if the recording operation is
immediately started in response to reading, there will
not occur the inconvenience that air is introduced into
the ink supply system, and even if conversely, the ink
20 tank is pulled out during the recording operation, it
can be detected before the ink communication is cut
off and therefore, no similar inconvenience will occur
if the operation is discontinued.

Further, as described above, according to the
25 present invention, in the position wherein an ink tank
in the form of a cartridge forming an ink supply source
is held in the apparatus body, the ink communication



1 with the ink supply system is done prior thereto and
therefore, the ink communication state can be secured
near the held position of the ink tank. Also, the
inherent information regarding the ink tank becomes
5 readable near the held position, and information differing
from said information is read in a predetermined range
from the ink communication position to the vicinity
of the held position and therefore, if design is made
such that a warning is given in response to the reading
10 of the said information, the unsatisfactory holding
of the ink tank can be detected to obviate the shipping
out thereof.

Furthermore, as has hitherto been described,
according to the present invention, unlocking members
15 projected from the opposite sides of the ink cartridge
and locking members provided on both sides of the inser-
tion path for the ink cartridge and unlockable by the
respective unlocking members are provided asymmetrically
with respect to the direction of insertion of the ink
20 cartridge and therefore, even if a wrong attempt is
made to insert the ink cartridge with its vertical direc-
tion or its longitudinal direction being mistaken, the
ink cartridge can be prevented from being erroneously
mounted and accordingly, damage to the ink cartridge
25 by the hollow needle or damage to the hollow needle
which would make the supply of ink impossible can be
eliminated.



1 Further, any special expensive device is not
required for the prevention of such erroneous mounting,
but it is only required to simply change the installed
positions of the locking members and the unlocking members.
5 Furthermore, even where a plurality of kinds of inks
are used, erroneous mounting can be prevented for the
respective ink cartridges.

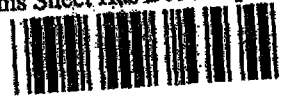
Also, as has hitherto been described, according
to the ink jet recording apparatus of the present inven-
10 tion and the ink cartridge therefor, a transmission
type photosensor shielded from light by a flag member
existing in the movement path of the carriage is provided
on the carriage and a flag member adapted to protrude
toward the movement path of the carriage only in the
15 mounted state of the ink cartridge is provided on the
ink cartridge, and the transmission type photosensor
is shielded from light by the flag member provided on
the ink cartridge, whereby the mounting of the ink
cartridge may be detected and therefore, not only the
20 mounting of the ink cartridge is detected by a small
number of parts and simple structure, but also the form
of the flag member is made different for each ink cartridge,
whereby many kinds of information such as the kind,
characteristic, etc. of ink can be classificatorily
25 recognized by the user and in addition, the quantity
of remaining ink can be detected.

The present invention brings about an excellent



1 effect particularly in a recording head and a recording
2 apparatus of the bubble jet type which has been put
3 forward by Canon, Inc., among the ink jet recording
4 systems.

5 As regards the typical construction and principle
6 of this system, a construction is preferable which uses
7 the basic principle disclosed, for example, in U.S.
8 Patents Nos. 4,723,129 and 4,740,796. This system is
9 applicable to both of the so-called on-demand type and
10 the so-called continuous type, and particularly in the
11 case of the on-demand type, the present invention is
12 effective because at least one driving signal correspond-
13 ing to recording information and providing a rapid
14 temperature rise exceeding nuclear boiling is applied
15 to an electro-thermal converting member disposed cor-
16 respondingly to a sheet or a liquid path in which liquid
17 (ink) is retained, thereby causing the electro-thermal
18 converting member to generate heat energy and causing
19 film boiling on the heat-acting surface of a recording
20 head with a result that a bubble in the liquid (ink)
21 can be formed correspondingly at one to one to said
22 driving signal. By the growth and contraction of the
23 bubble, the liquid (ink) is discharged through a discharge
24 port to thereby form at least one droplet. If this
25 driving signal is made into a pulse shape, the growth
and contraction of the bubble take place appropriately
on the spot and therefore, discharge of the liquid (ink)



1 which is particularly excellent in responsiveness can
2 be accomplished, and this is more preferable. The
3 driving signal of such pulse shape may suitably be one
4 as described in U.S. Patents Nos. 4,463,359 and 4,345,262.

5 The adoption of the conditions described in U.S. Patent
6 No. 4,313,124 which is an invention relating to the
7 temperature rise rate of said heat-acting surface would
8 lead to the possibility of accomplishing more excellent
9 recording.

10 As regards the construction of the recording
11 head, besides the construction as disclosed in the
12 aforementioned patents which comprises a combination
13 of discharge ports, liquid paths and electro-thermal
14 converting members (a straight liquid flow path or a
15 perpendicular liquid flow path), the constructions using
16 U.S. Patents Nos. 4,558,333 and 4,459,600 which disclose
17 constructions in which the heat-acting portion is disposed
18 in a bent area are also covered by the present invention.
19 In addition, the present invention is effective for

20 a construction based on Japanese Laid-Open Patent Applica-
21 tion No. 59-123670 which discloses a construction in
22 which a slit common to a plurality of electro-thermal
23 converting members is the discharge portion of the
24 electrothermal converting members, or a construction

25 based on Japanese Laid-Open Patent Application No. 59-
138461 which discloses a construction in which an opening
for absorbing the pressure wave of heat energy corresponds



1 to the discharge portion.

Further, the recording head of the full line
type having a length corresponding to the width of the
largest recording medium on which the recording apparatus
5 can effect recording may be of a construction as disclosed
in the above-mentioned publications wherein that length
is satisfied by a combination of a plurality of recording
heads, or of a construction as a single recording head
formed as a unit, and the present invention can display
10 the above-described effect more effectively.

In addition, the present invention is also
effective in a case where use is made of a recording
head of the interchangeable chip type which is adapted
to be mounted on an apparatus body to thereby make the
15 electrical connection to the apparatus body or the supply
of ink from the apparatus body possible, or a recording
head of the cartridge type provided integrally on the
recording head itself.

Also, the addition of recovery means, preliminary
20 auxiliary means, etc. for the recording head provided
as the construction of the recording apparatus of the
present invention can more stabilize the effect of the
present invention and is therefore preferable. Specifi-
cally mentioning these, they are capping means, cleaning
25 means and pressurizing or suction means for the recording
head, an electro-thermal converting member or a heating
element discrete therefrom or pre-heating means comprising



1 a combination of these, and it is also effective for
2 accomplishing stable recording to carry out the preliminary
3 discharge mode in which discharge not concerned in
4 recording is effected.

5 Further, the recording mode of the recording
6 apparatus is not limited to a recording mode using only
7 the main color such as black, but may use a recording
8 head constructed as a unit or a combination of a plurality
9 of recording heads, and the present invention is very
10 effective for an apparatus provided with a plurality
11 of different colors or at least one of full colors
12 provided by mixed colors.

13 The above embodiments of the present invention
14 have been described as using liquid ink, but, the present
15 invention also permits the use of ink which is in the
16 solid phase at room temperature or ink which becomes
17 softened at room temperature. In the above-described
18 ink jet recording apparatus, it is popular to regulate
19 the temperature of ink itself within a range from 30°C
20 to 70°C and effect temperature control so that the
21 viscosity of the ink may be within a stable discharge
22 range and therefore, use can be made of ink which assumes
23 the liquid phase when the recording signal used is
24 imparted. In addition, the temperature rise by heat
25 energy is positively used as the energy for the change
26 of ink from its solid phase to its liquid phase to thereby
27 prevent said temperature rise, or ink which solidifies

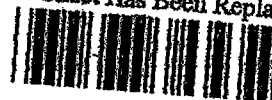


1 when left as it is used for the purpose of preventing
the evaporation of the ink, and at any rate, the use
of ink having a nature that is liquefied only by heat
energy, such as ink which is liquefied by the imparting
5 of heat energy conforming to the recording signal and
is discharged in the form of liquid or ink which already
begins to solidify at a point of time whereat it reaches
the recording medium is also applicable to the present
invention. In such a case, the ink may assume the form
10 as described in Japanese Laid-Open Patent Application
No. 54-56847 or Japanese Laid-Open Patent Application
No. 60-71260 wherein the ink is retained as liquid or
solid in recesses or through-holes in a porous sheet
and is opposed to an electro-thermal converting member.
15 In the present invention, what is most effective for
each ink mentioned above is what executes the above-
described film boiling system.

An ink cartridge interchangeably provided
for an ink jet recording apparatus provided with a
20 recording head for causing the discharge of ink to
thereby effect the recording of an image, and contain-
ing the ink therein and effecting the supply of the
ink in conformity with the discharge of the ink is
characterized by the provision of a medium provided
25 with information for controlling the driving conditions
of the recording head.



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Claims 1 to 9 for the Divisional Application relating to the
European Patent Application No. 90 114 982.3-2304

5

1. An ink cartridge mountable on a mounting portion
along an insertion path (332) of an ink jet recording
apparatus having an openably-closable plate (333) openably
and closably held in said insertion path (322) to said
10 mounting portion, and locking members (336, 337) for
restraining said openable-closable plate from both sides of
said insertion path (322) to thereby inhibit the opening
movement thereof, said ink cartridge containing therein ink
to be supplied to a recording head and having projectedly
15 provided on the opposite sides thereof unlocking members
(341, 342) engageable with said locking members (336, 337)
during the mounting of said ink cartridge to release the
restraint of said locking members (336, 337), said ink
cartridge being characterized in that said unlocking members
20 (341, 342) are provided asymmetrically with respect to the
direction of insertion into said insertion path (332).

2. An ink cartridge according to Claim 1, characterized
in that said ink jet recording apparatus has mounting
25 portions and insertion paths corresponding to ink cartridges
individually containing a plurality of different kinds of
inks therein, and said unlocking members (341, 342) provided
on said ink cartridges are asymmetrical with respect to the
direction of insertion into said insertion path at positions
30 different for respective corresponding ones of said mounting
portions.

3. An ink cartridge removably mounted on a fixed
mounting portion of an ink jet recording apparatus and
35 supplying discharged ink to a recording head carried on a
movable carriage, characterized by a flag member (404)



capable of being protruded and contained; and means (406) for protruding said flag member toward a path along which said carriage is moved only when said ink cartridge is mounted on said mounting portion; a photosensor (424) provided on said carriage being capable of being shielded from light by said flag member.

4. An ink cartridge according to Claim 3, characterized in that said photosensor (424) is a sensor for detecting infrared light, and said flag member (404) is formed of a material capable of intercepting said infrared light.

5. An ink cartridge according to Claim 4, characterized in that the position in which said flag member (404) shields said photosensor (424) from light is made different along the direction of movement of said carriage to thereby make the detecting position of said photosensor (424), for said flag member (404) different, and different information is obtained for each ink cartridge mounted.

6. An ink cartridge according to Claim 4, characterized by an ink bag (430) containing said ink therein and wherein the level of the position in which said flag member (404) shield said photosensor (424) from light is varied in conformity with the quantity of the ink in said ink bag (430) to thereby detect the presence or absence of said ink.

7. An ink jet recording apparatus comprising an ink cartridge according to Claim 1, characterized in that the locations at which said unlocking members and said locking members are disposed are asymmetrical with respect to the direction of insertion of said ink cartridge.

8. An ink jet recording apparatus according to Claim 7, characterized in that a plurality of ink cartridges are provided so as to individually contain different kinds of



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inks therein, said plurality of ink cartridges are mountable on corresponding mounting portions, respectively, and said unlocking members (341, 342) and said locking members (336, 337) are asymmetrical with respect to the direction of
5 insertion of said ink cartridges at positions different for respective corresponding ones of said mounting portions.

9. An ink jet recording apparatus in which an ink cartridge (401) containing therein ink to be supplied to a
10 recording head for discharging the ink to thereby effect recording is removable mounted, characterized by a flag member (404) provided on said ink cartridge and adapted to be protruded toward a path along which a carriage is moved only when said ink cartridge is mounted on a mounting portion; and
15 a photosensor (424) provided on said carriage and capable of being shielded from light by said flag member (404).



1 ABSTRACT OF THE DISCLOSURE

2 An ink cartridge interchangeably provided
3 for an ink jet recording apparatus provided with a
4 recording head for causing the discharge of ink to
5 thereby effect the recording of an image, and contain-
6 ing the ink therein and effecting the supply of the
7 ink in conformity with the discharge of the ink is
8 characterized by the provision of a medium provided
9 with information for controlling the driving conditions
10 of the recording head.

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FIG. 1

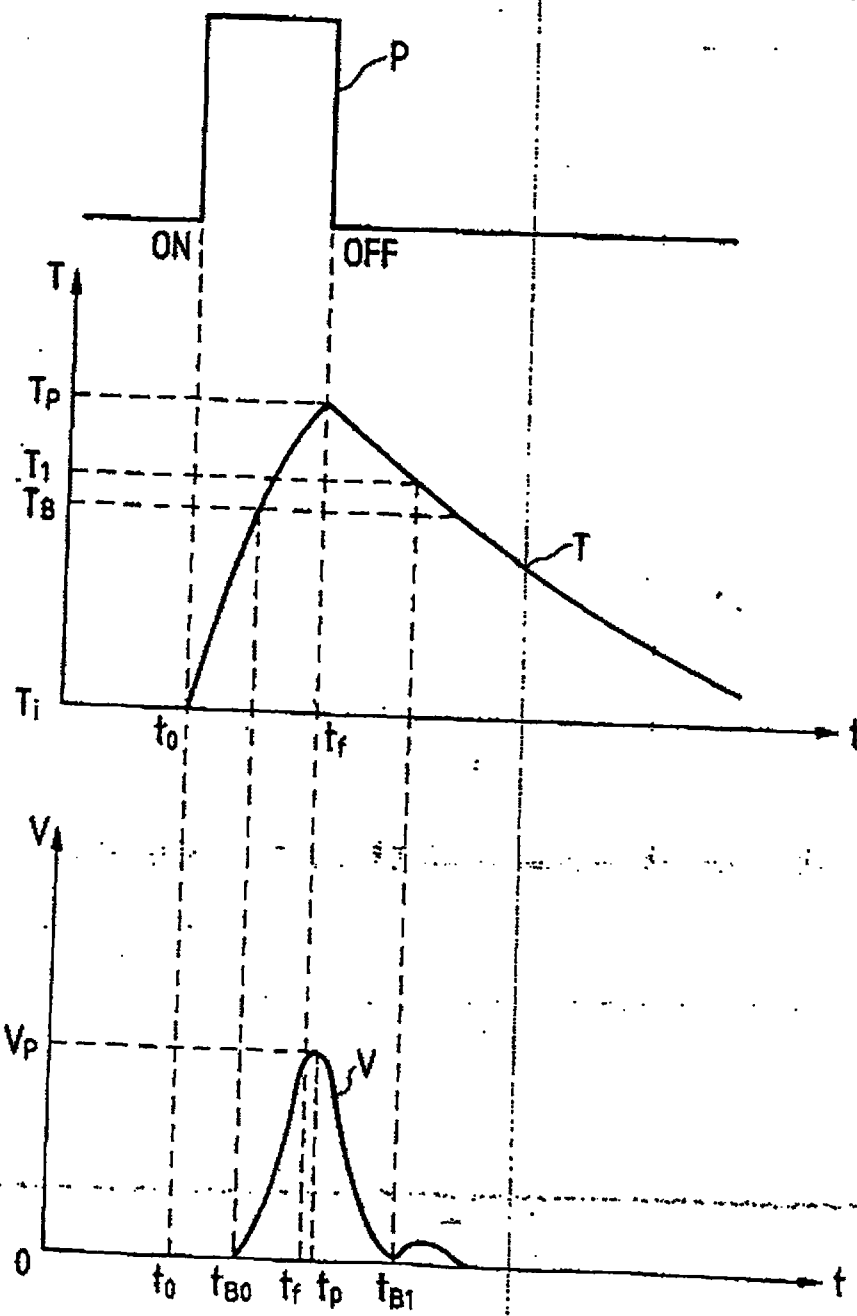




FIG. 2

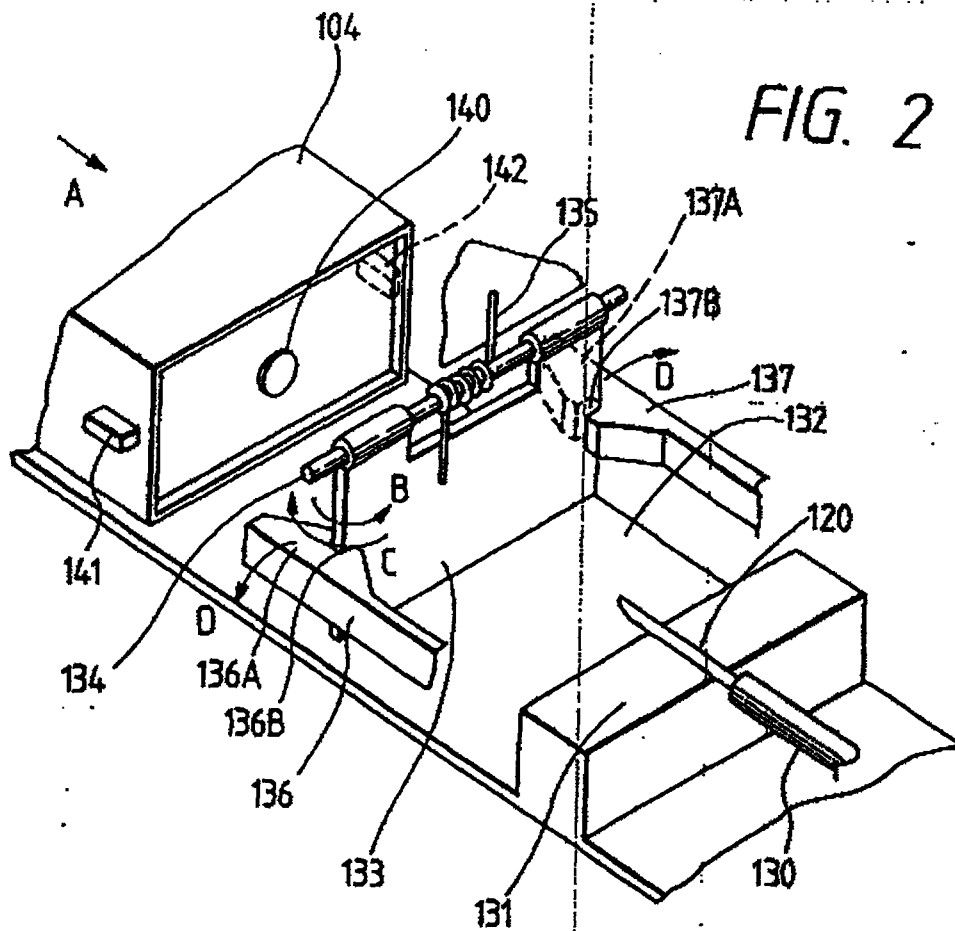
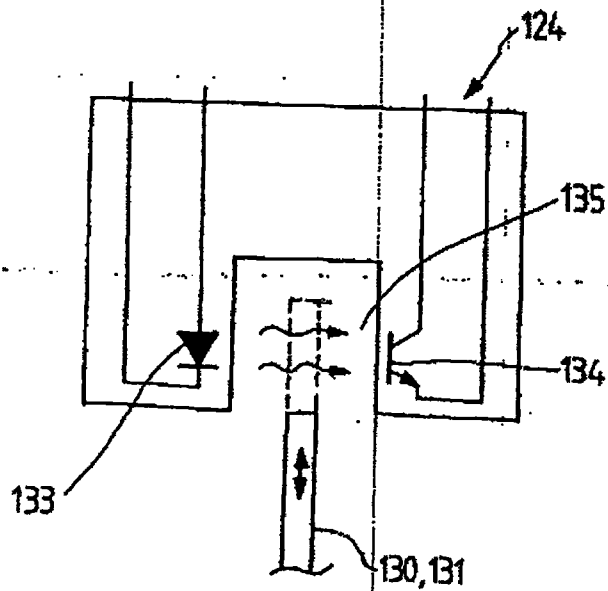
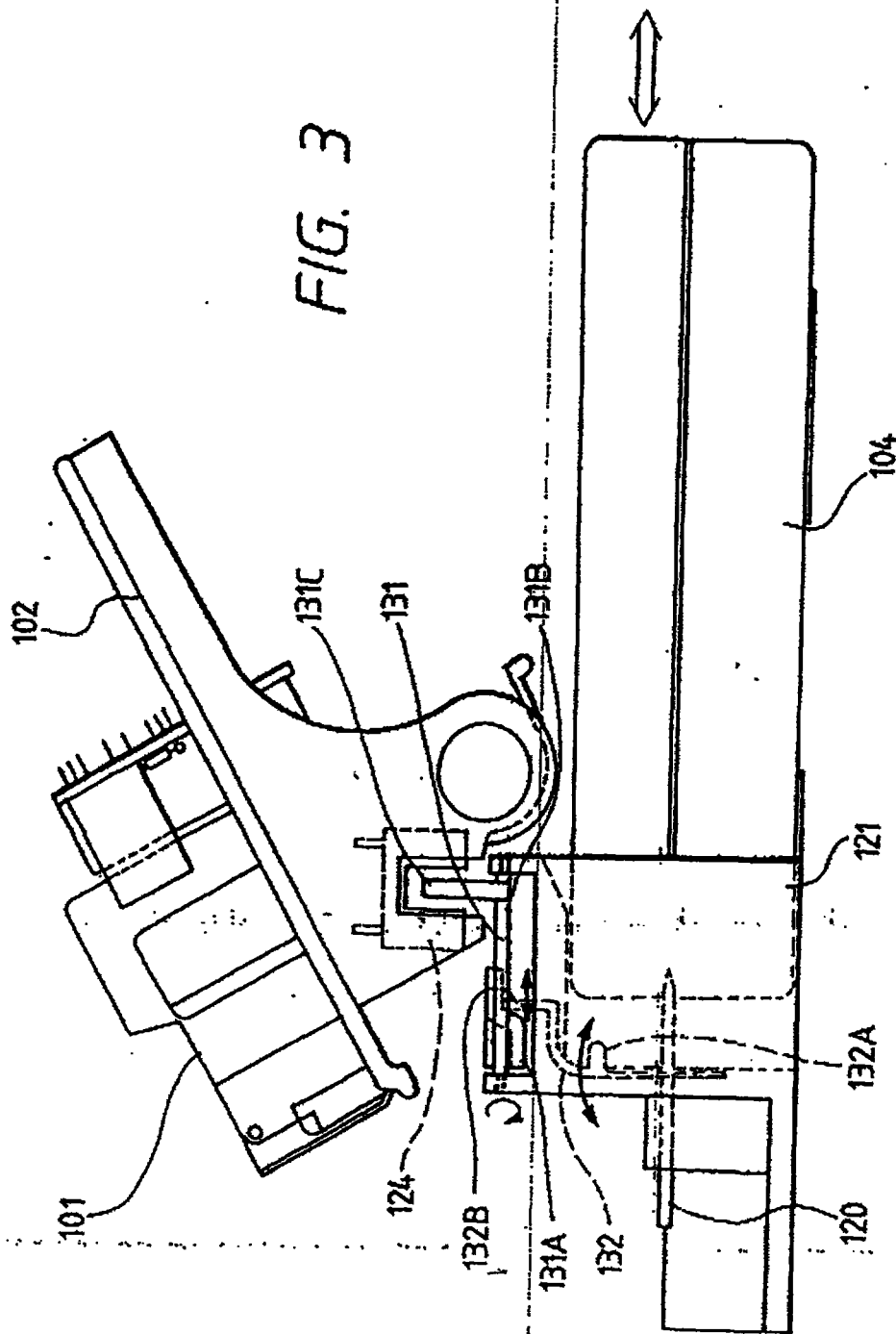


FIG. 4



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FIG. 3



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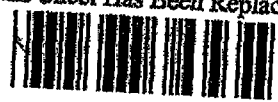
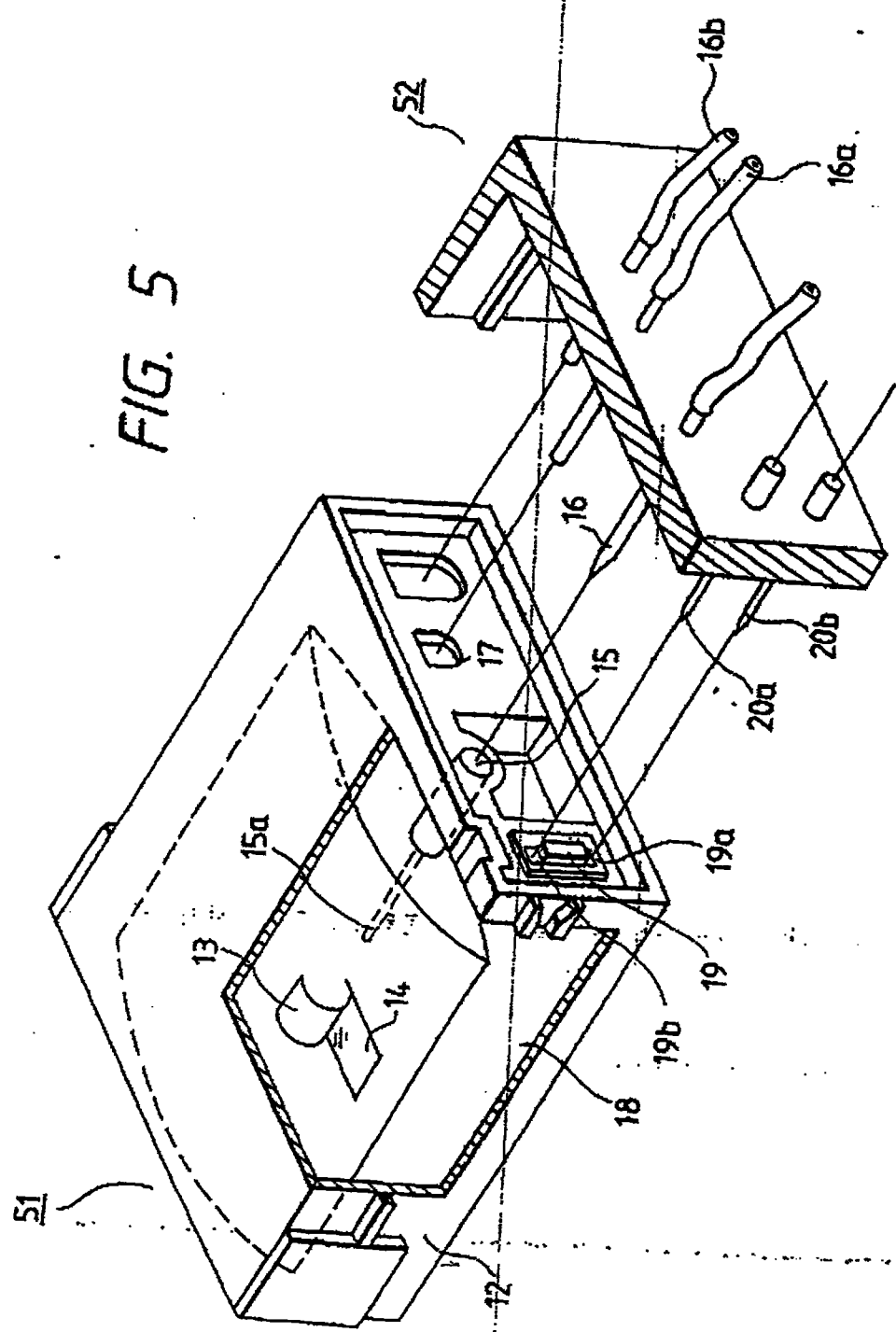


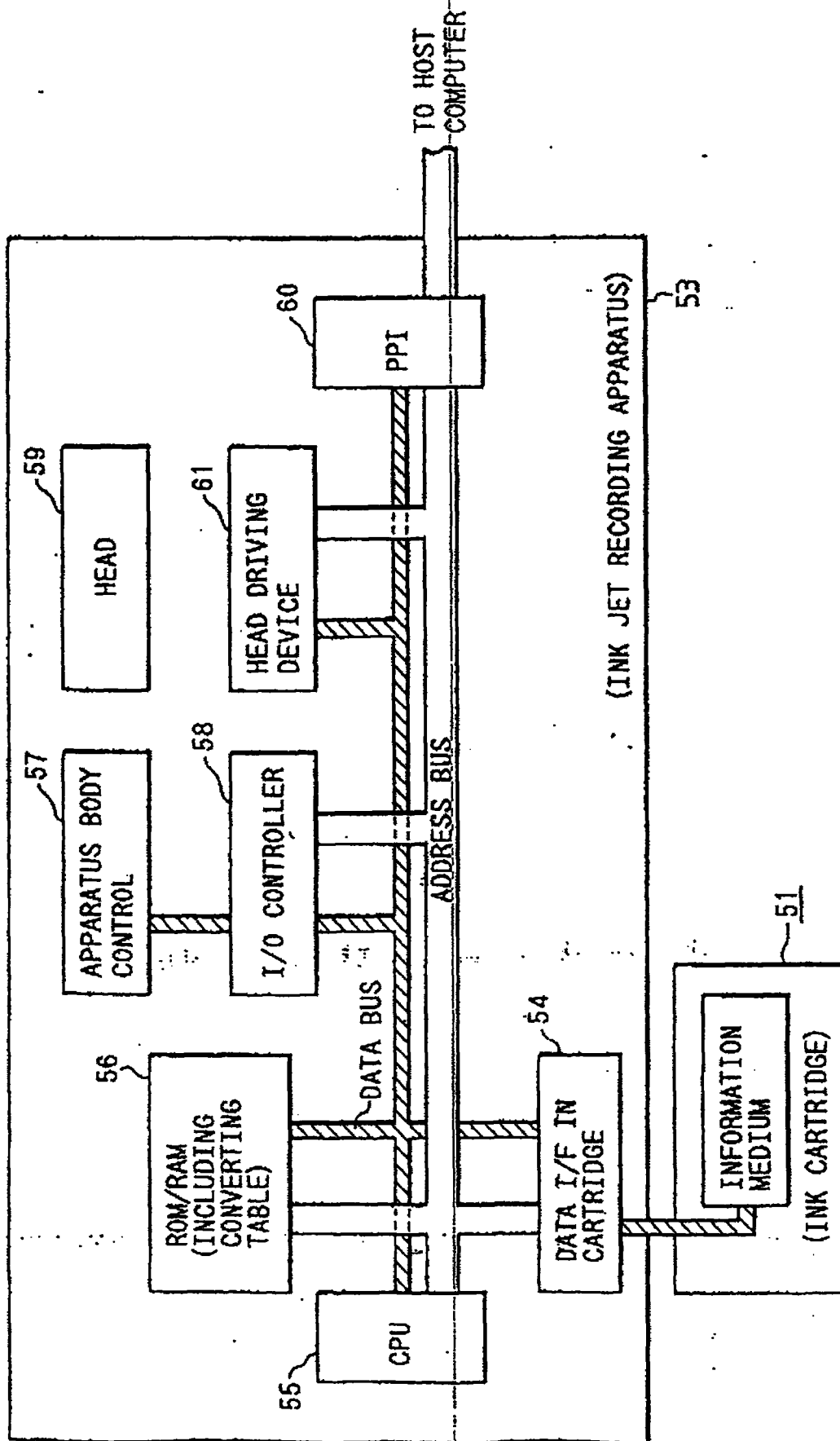
FIG. 5





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FIG. 6



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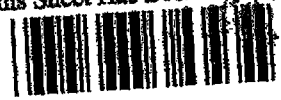
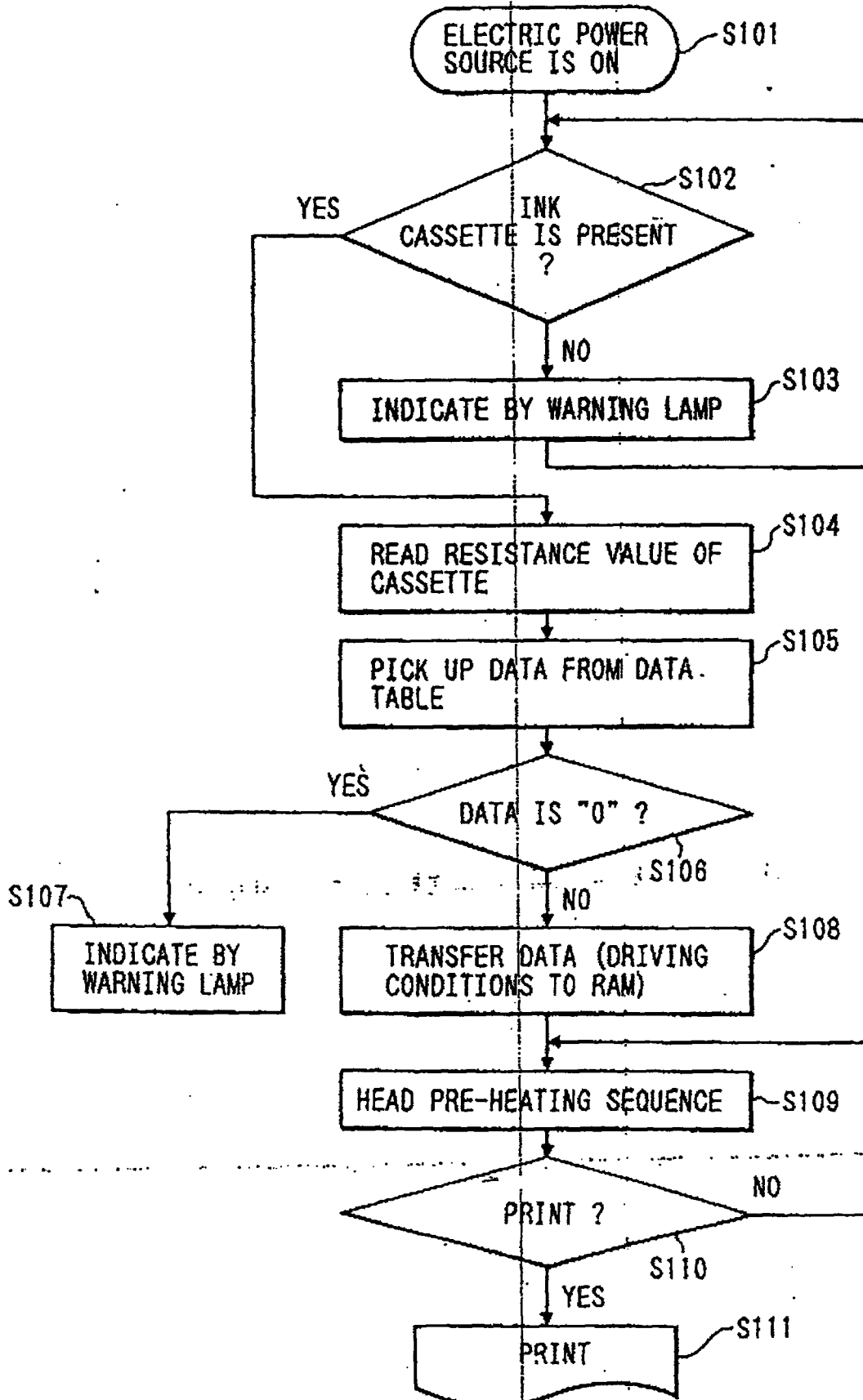


FIG. 7



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FIG. 8

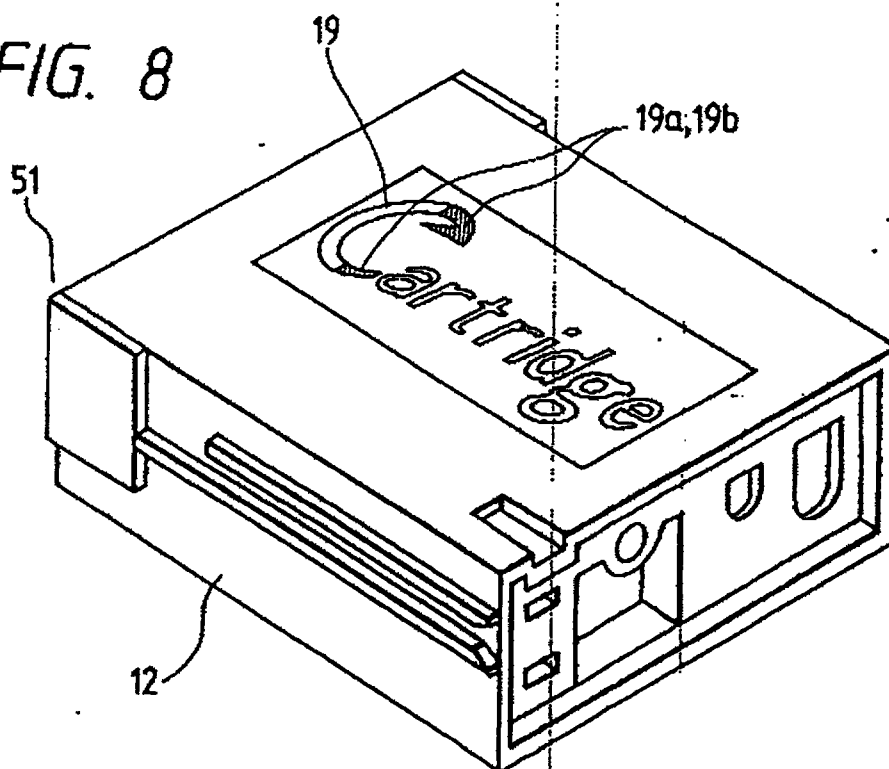
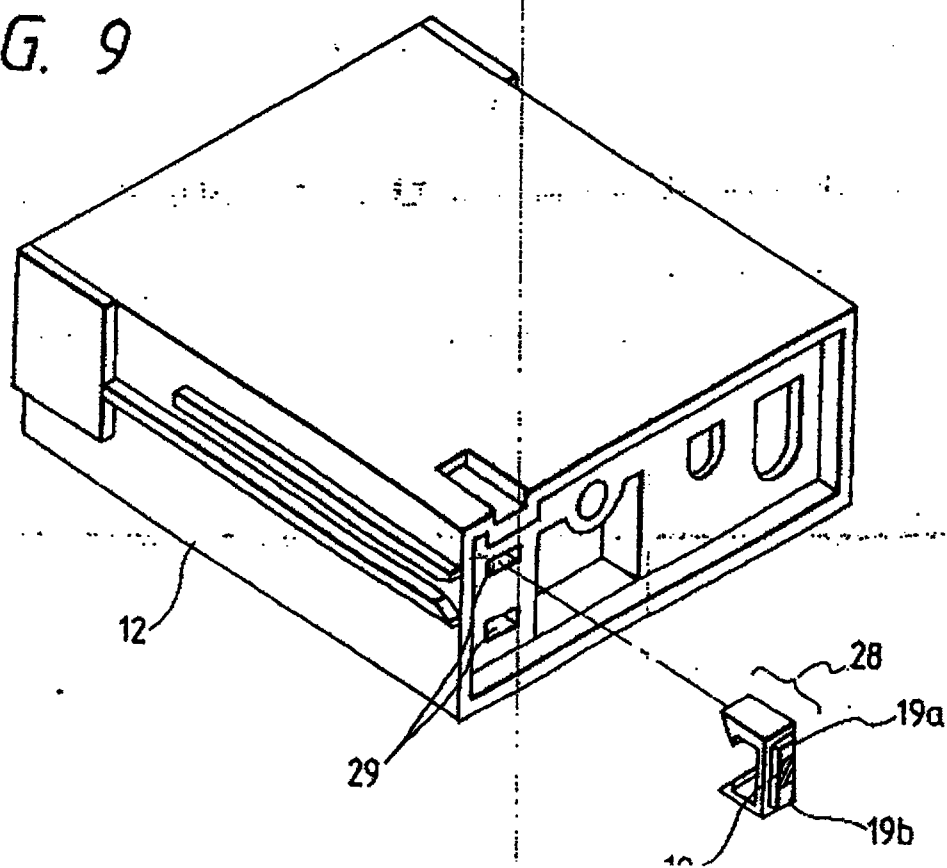


FIG. 9



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FIG. 10

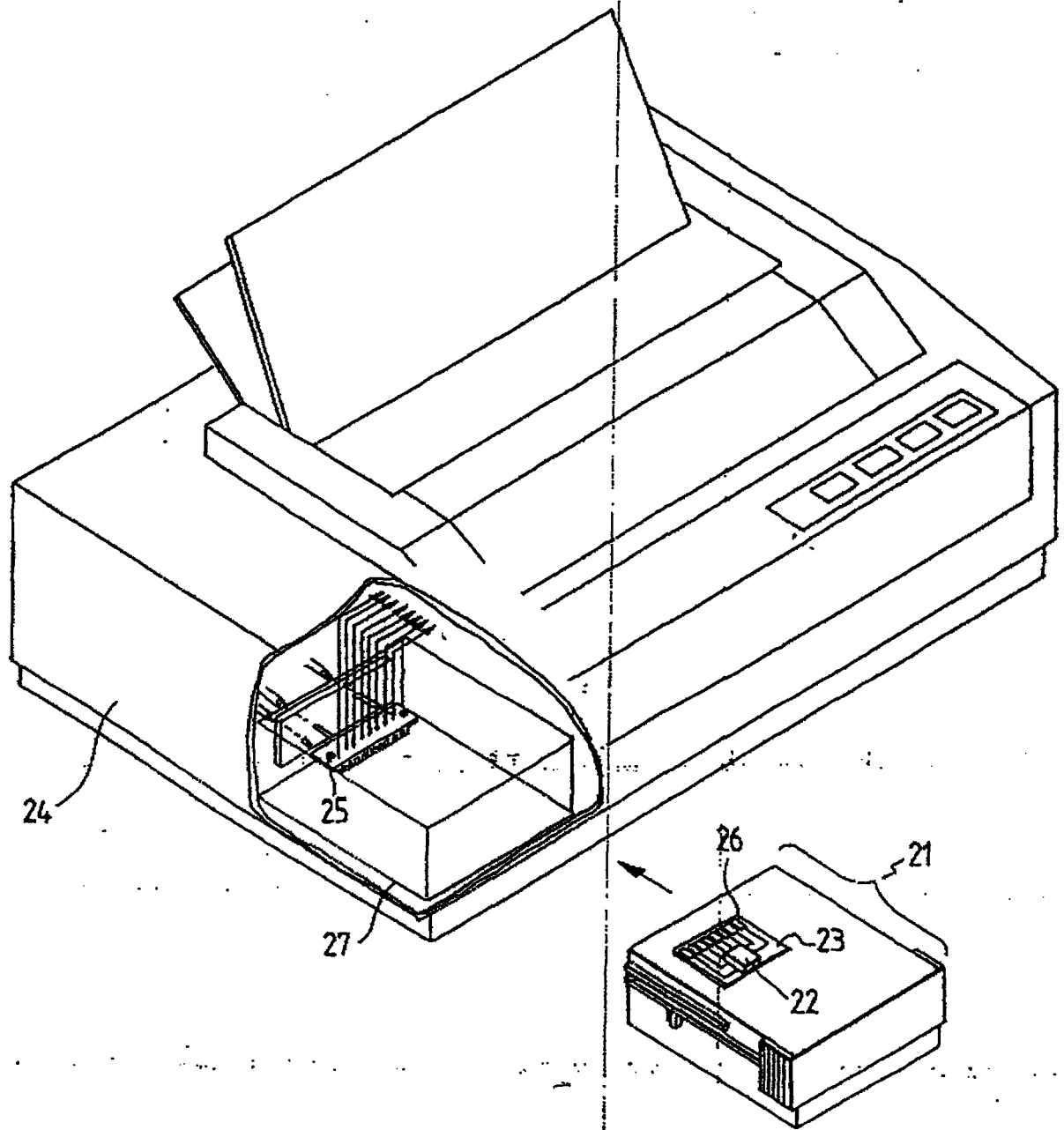




FIG. 11

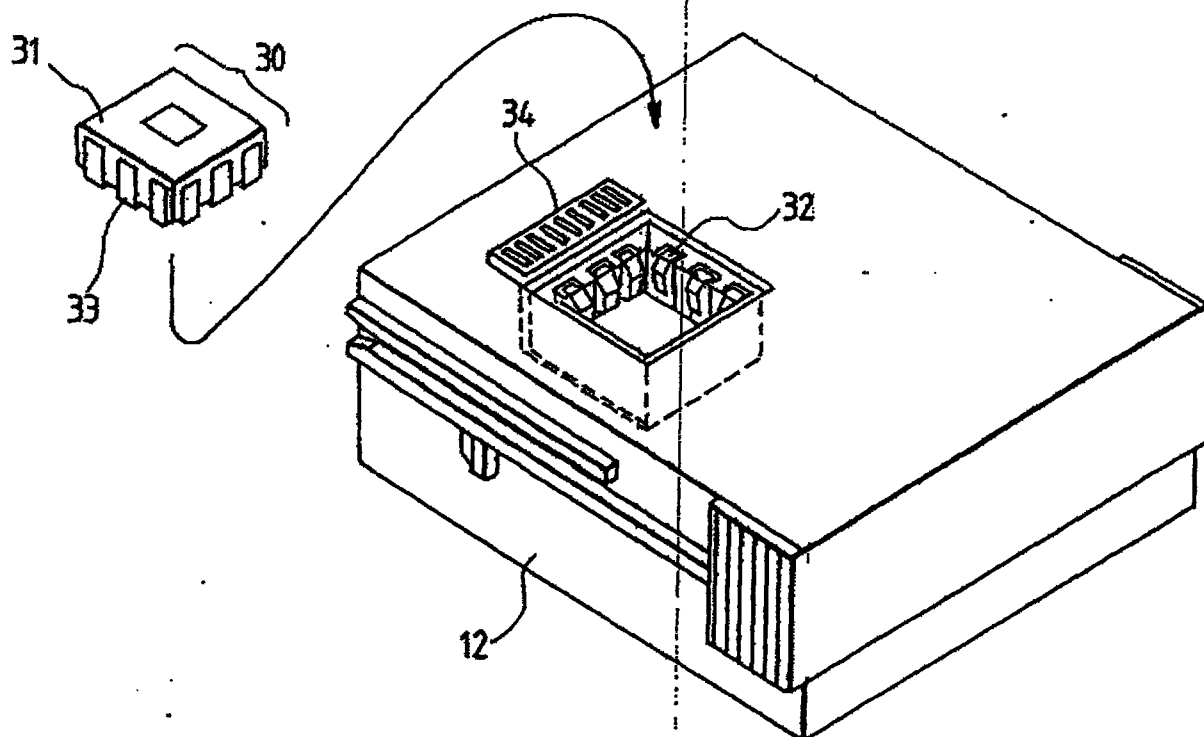
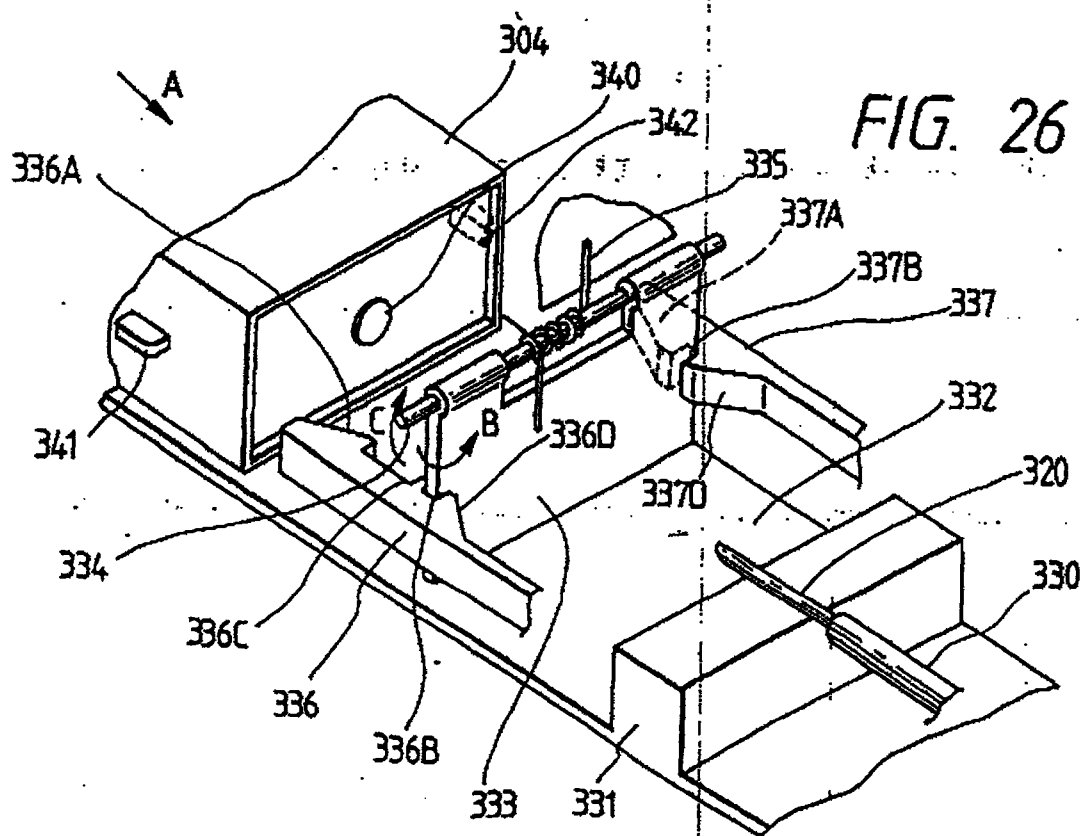


FIG. 26

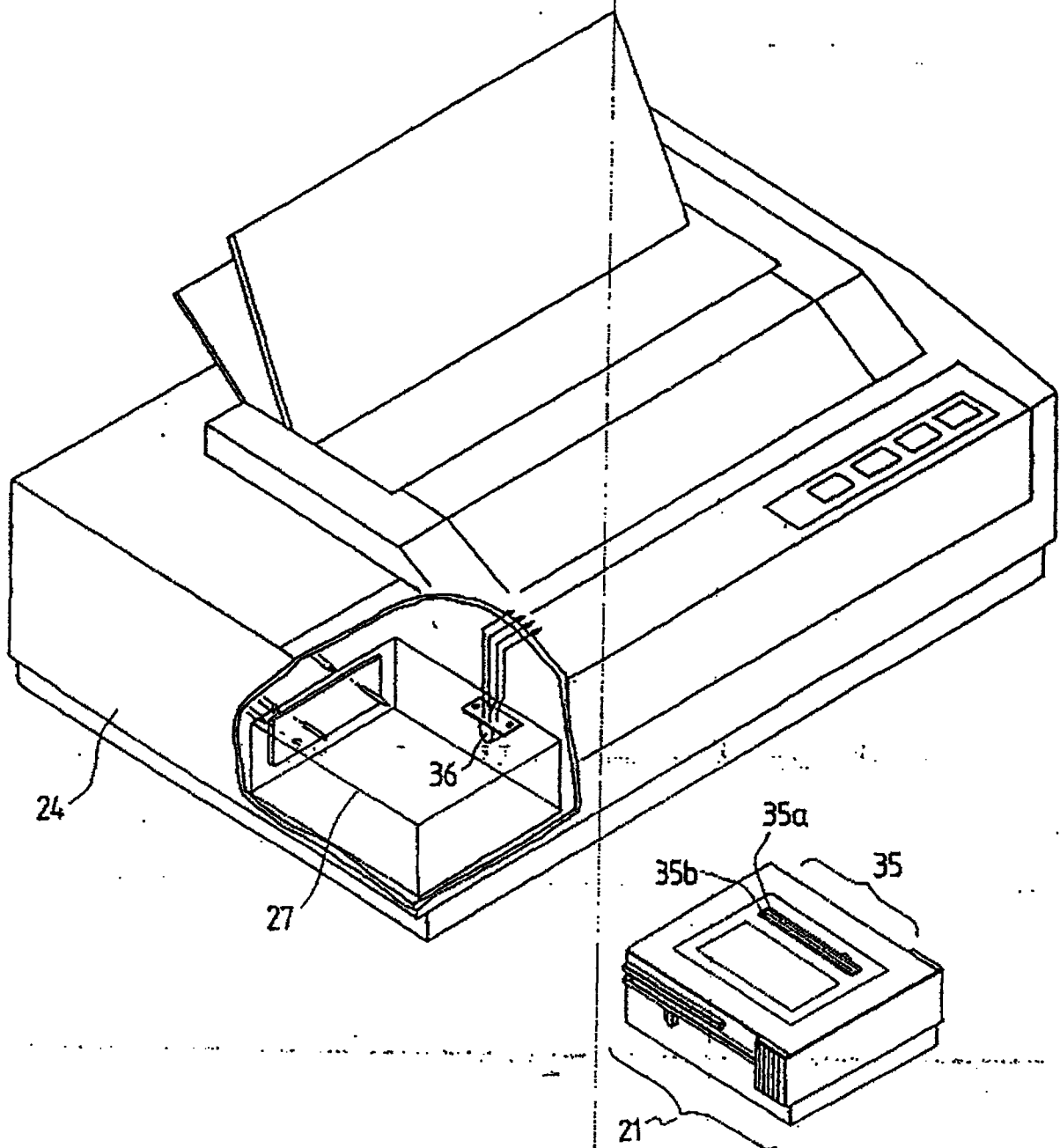


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FIG. 12

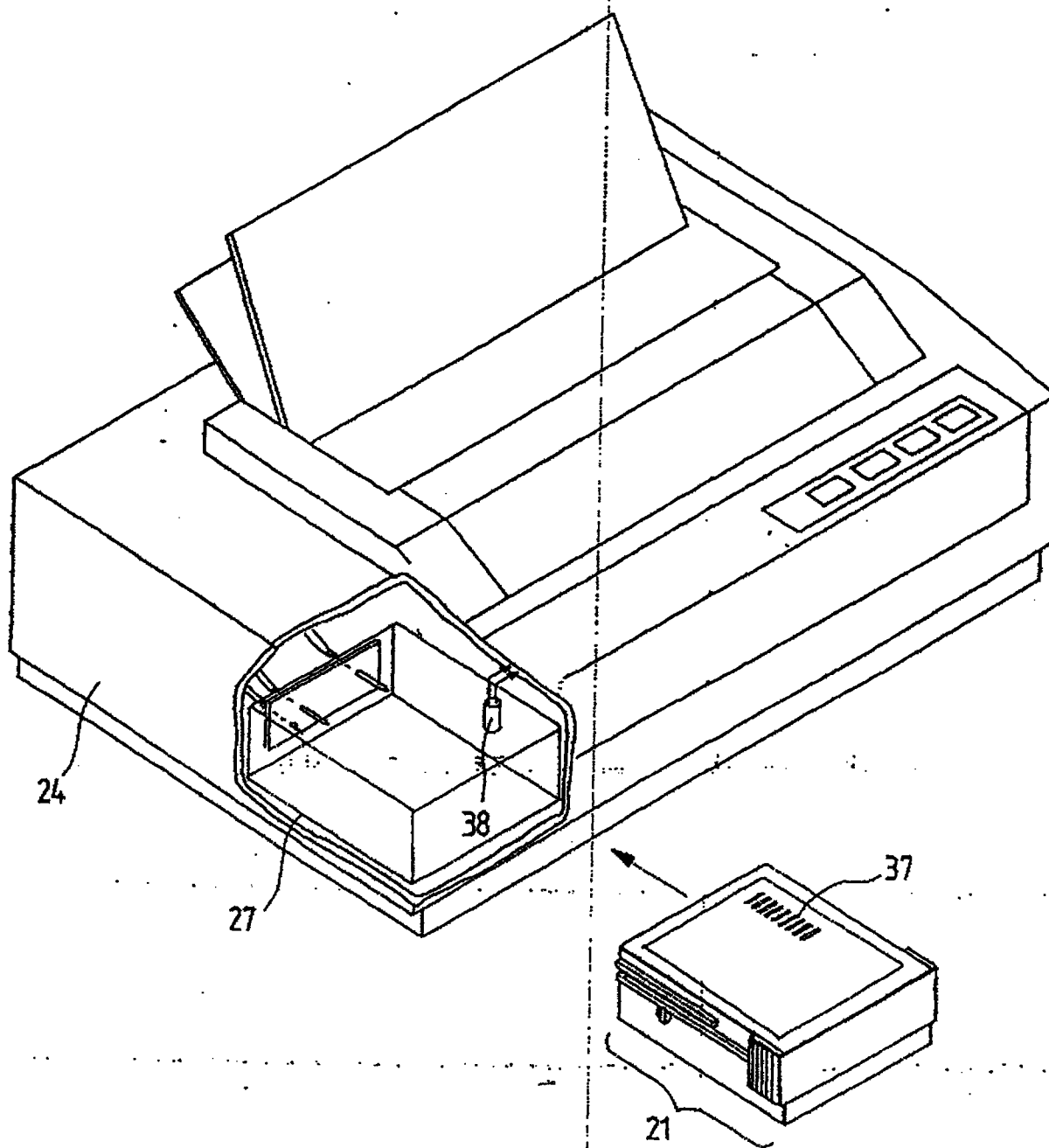


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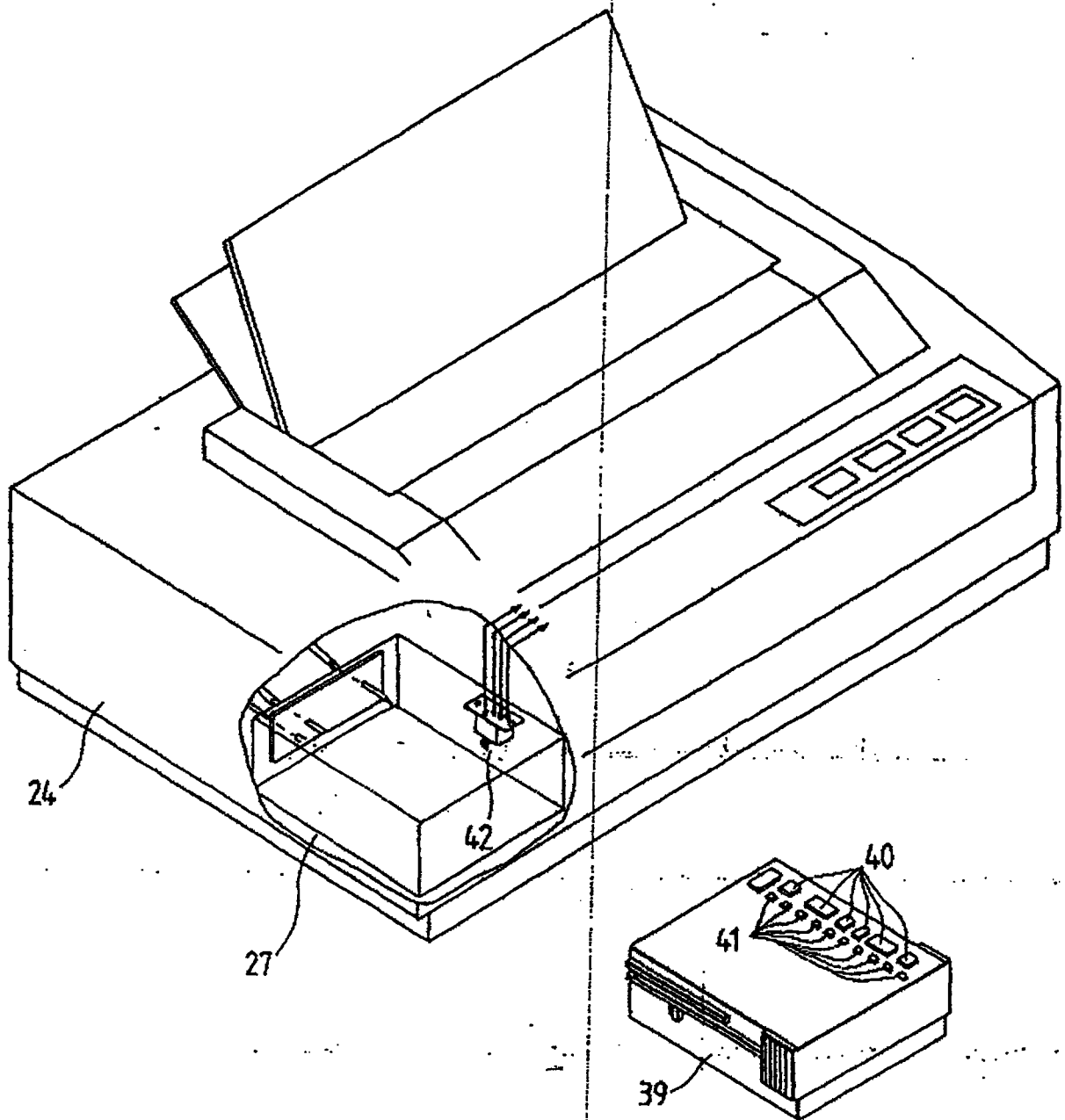
FIG. 13



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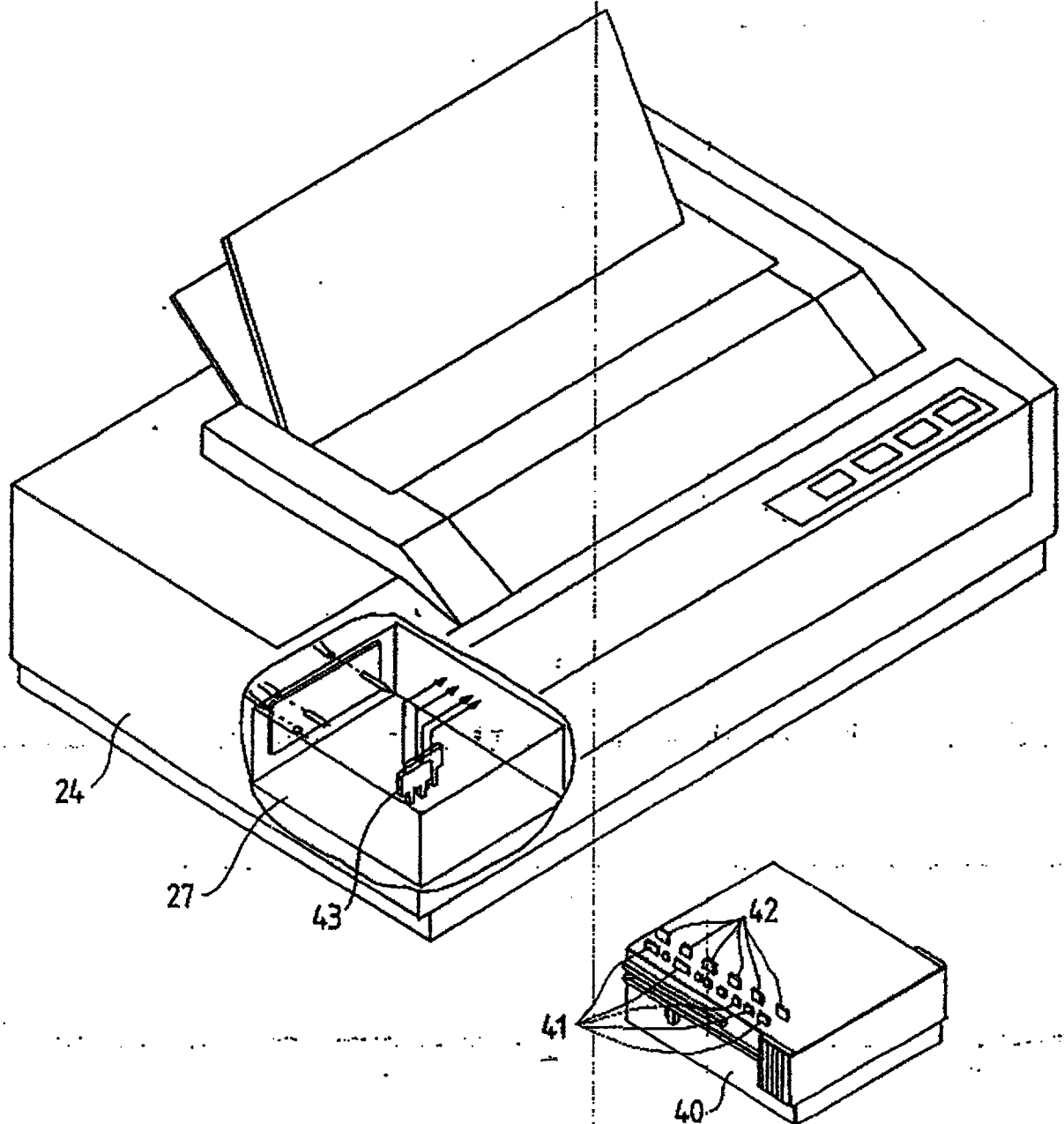
FIG. 14



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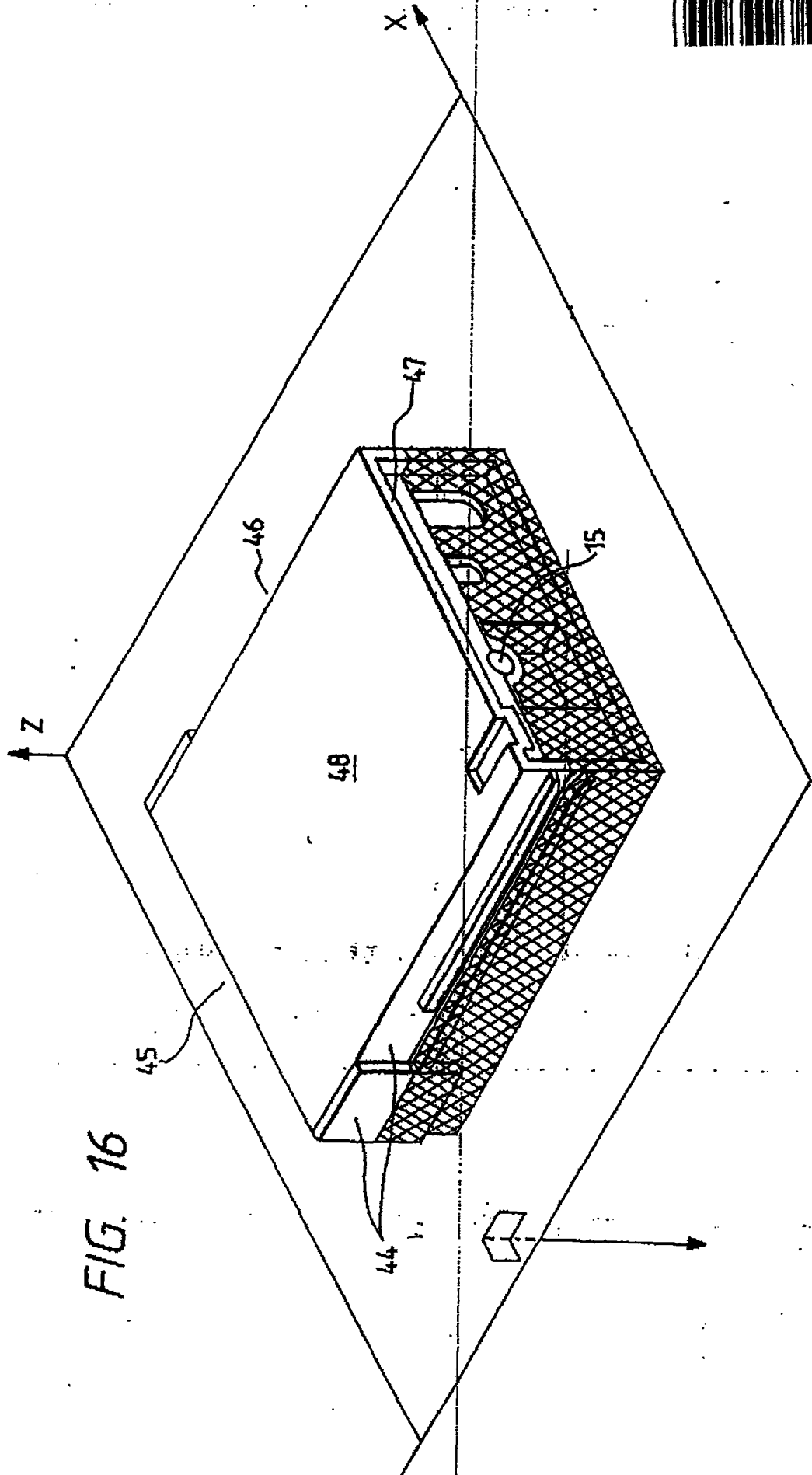

FIG. 15



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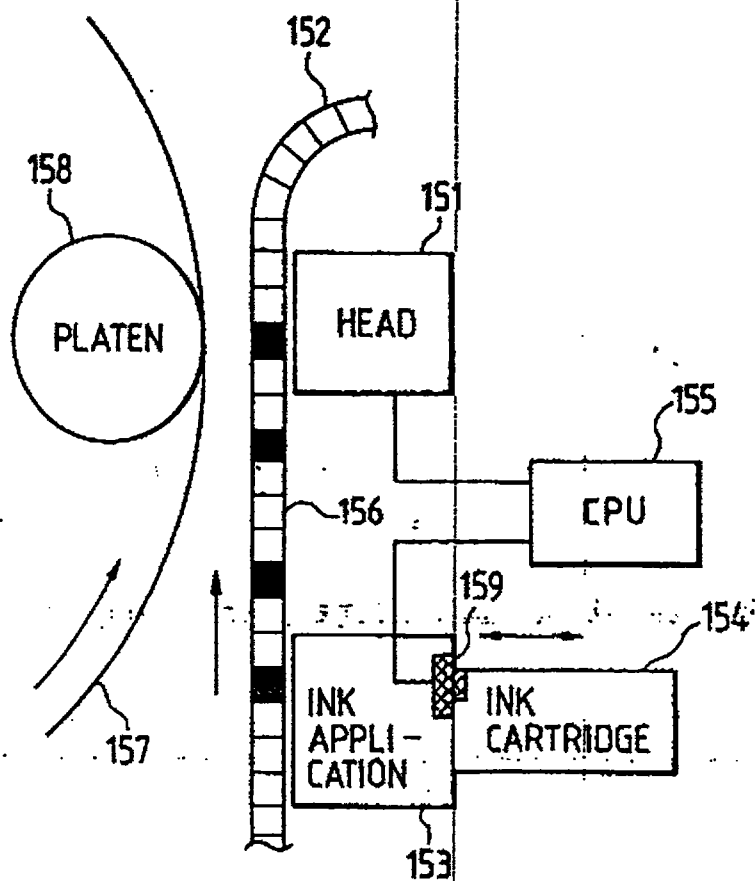


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FIG. 17



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FIG. 19A

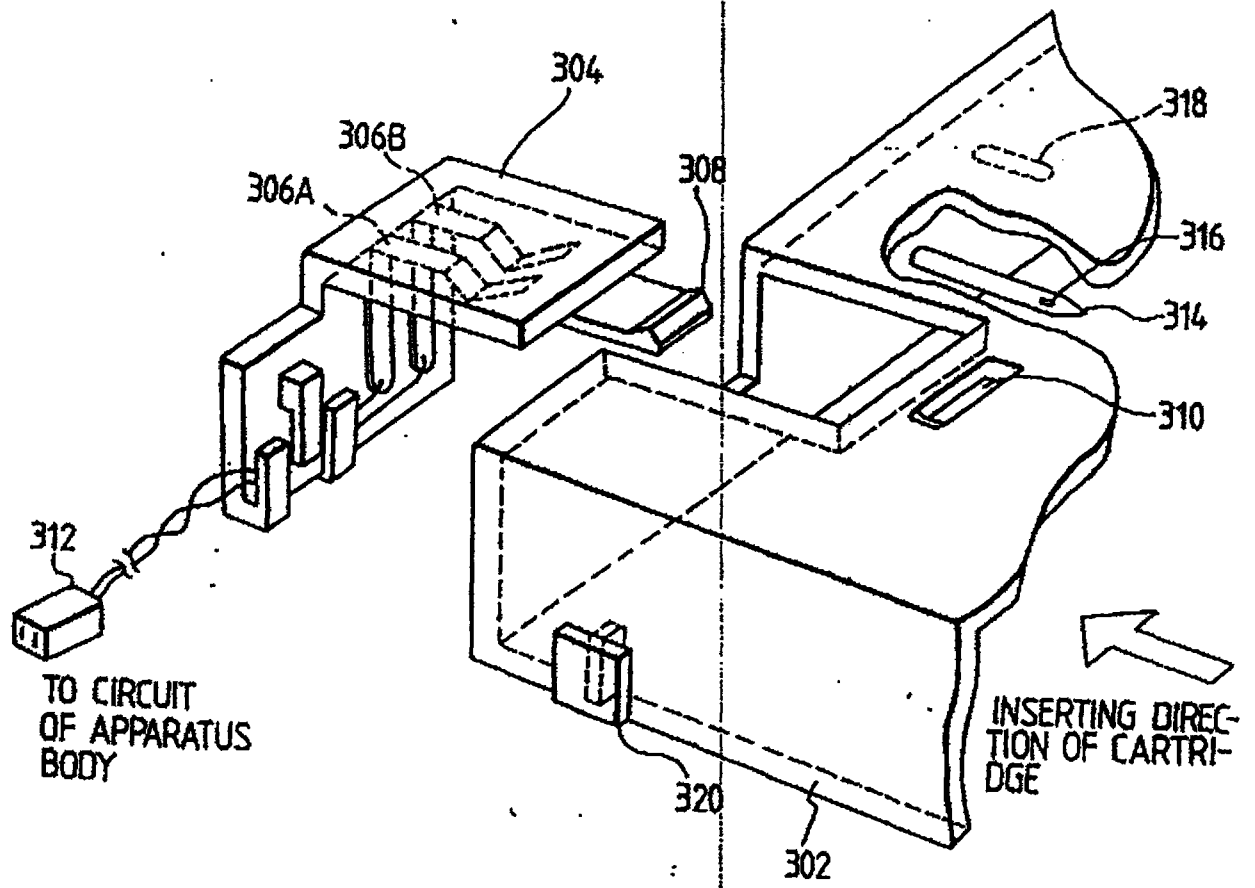
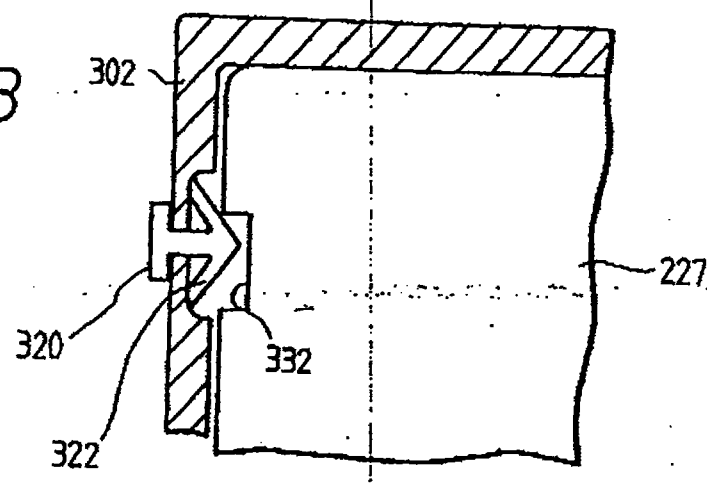


FIG. 19B



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FIG. 20

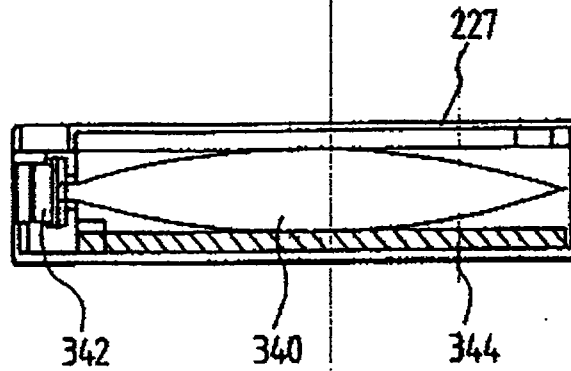
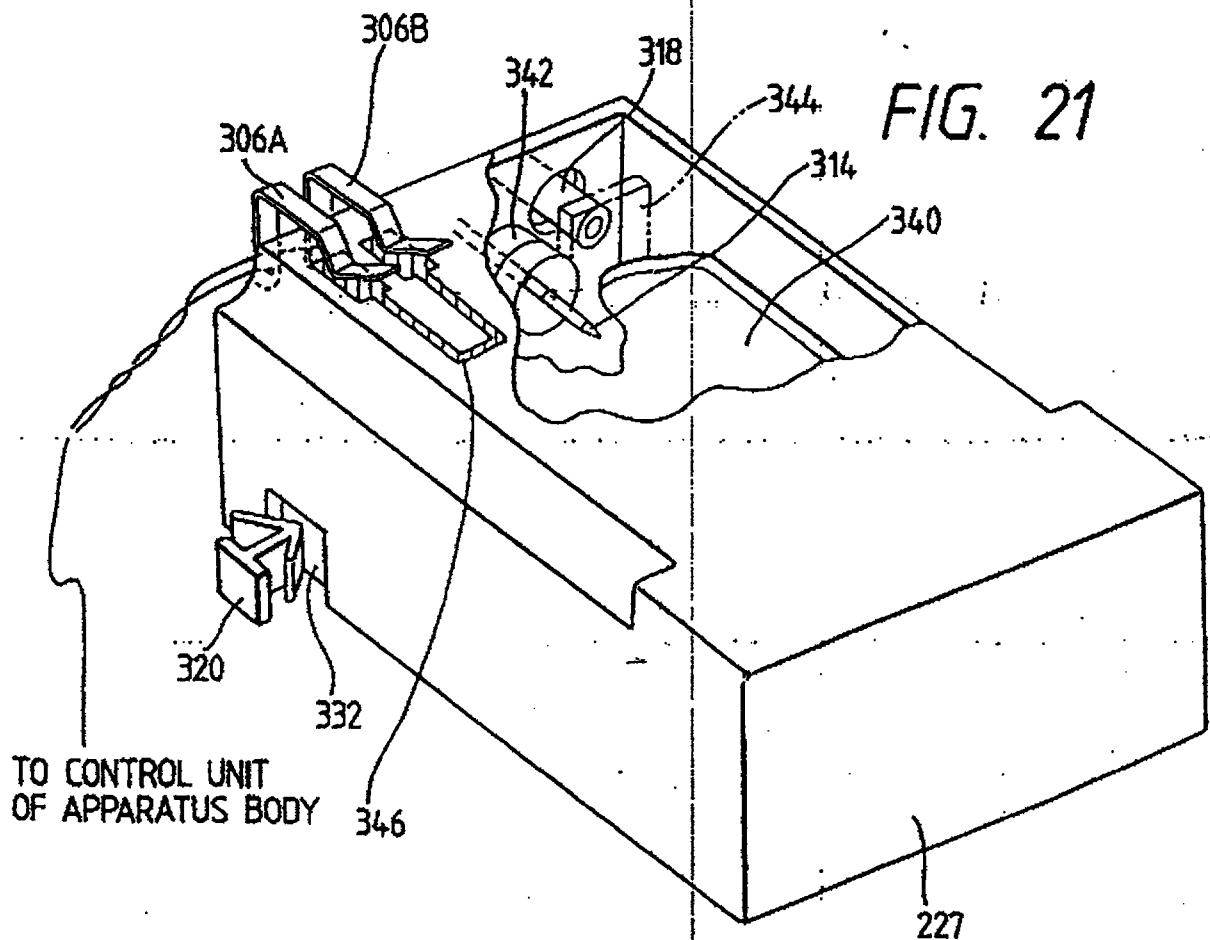


FIG. 21



191
126

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FIG. 22

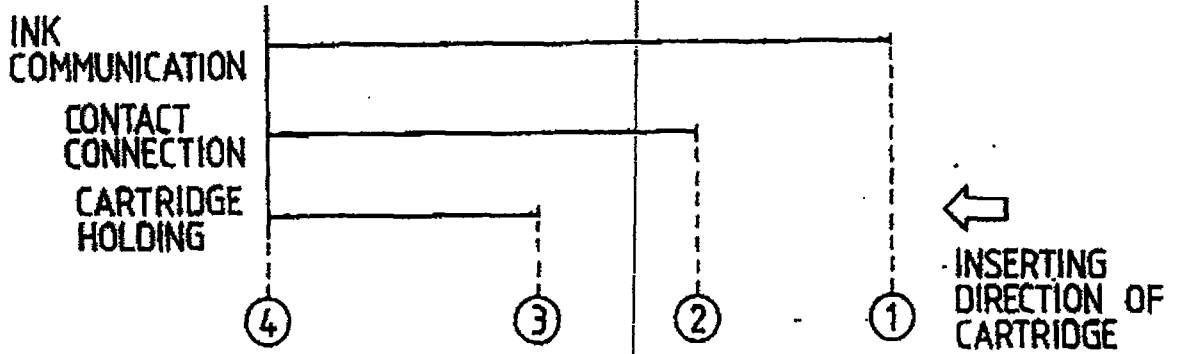


FIG. 23A

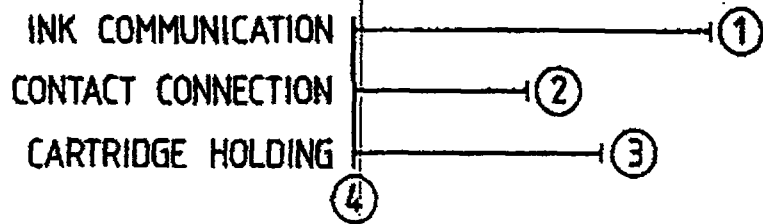


FIG. 23B

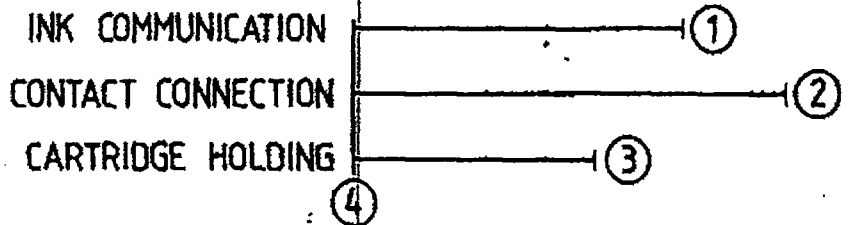


FIG. 23C

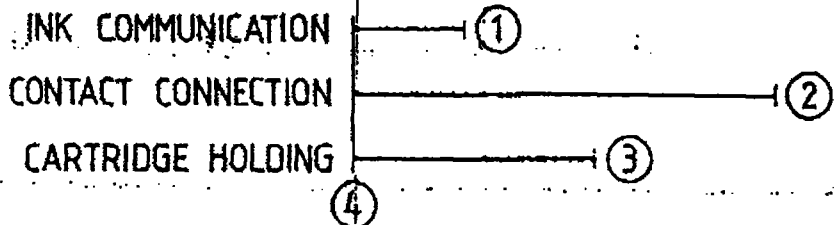


FIG. 23D

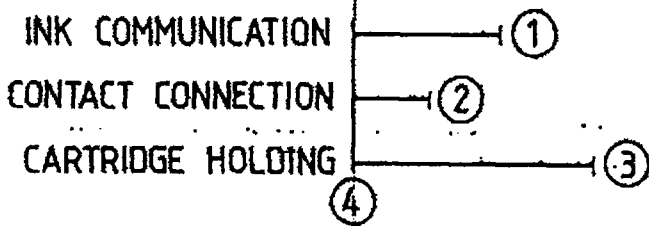
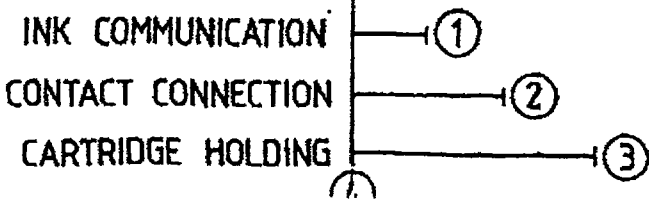


FIG. 23E



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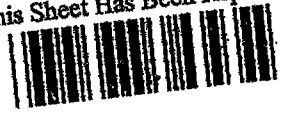


FIG. 24A

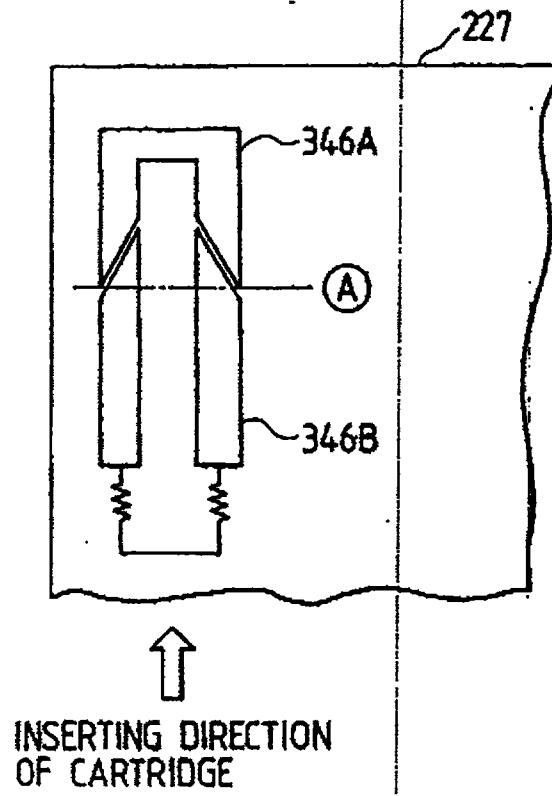
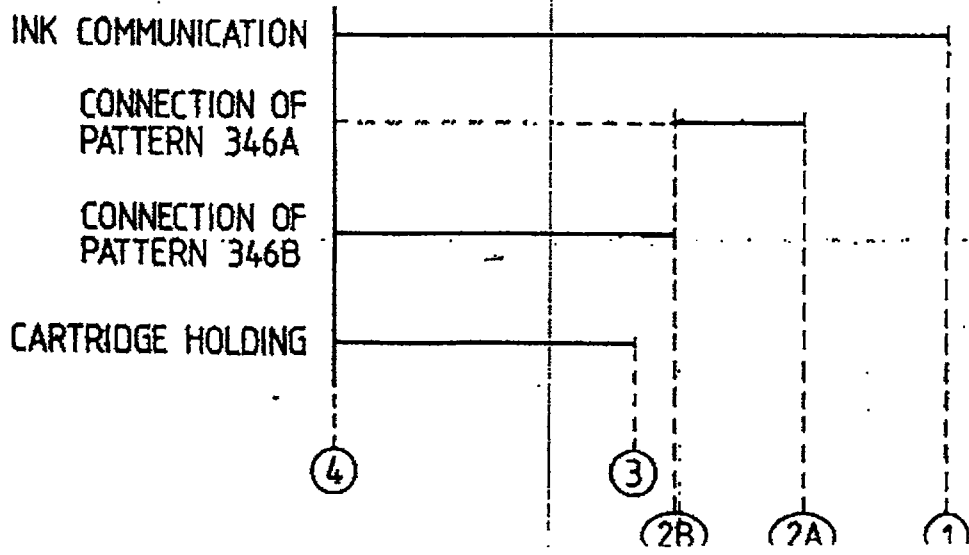


FIG. 24B



211
726

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FIG. 25A

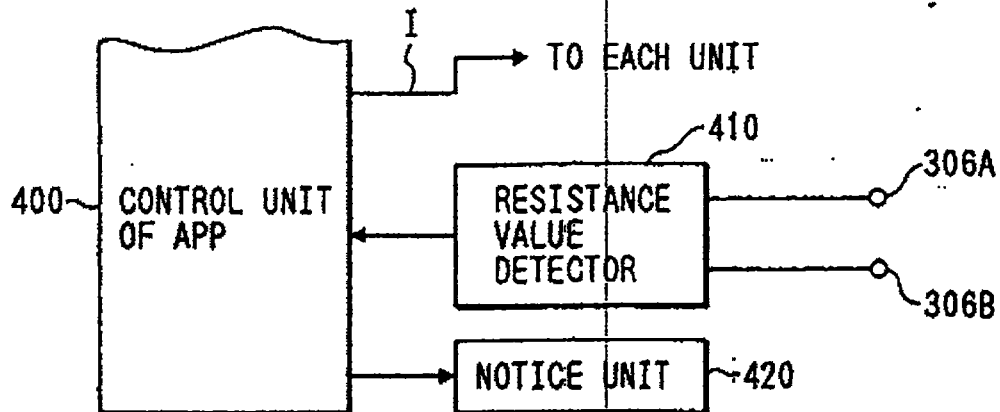
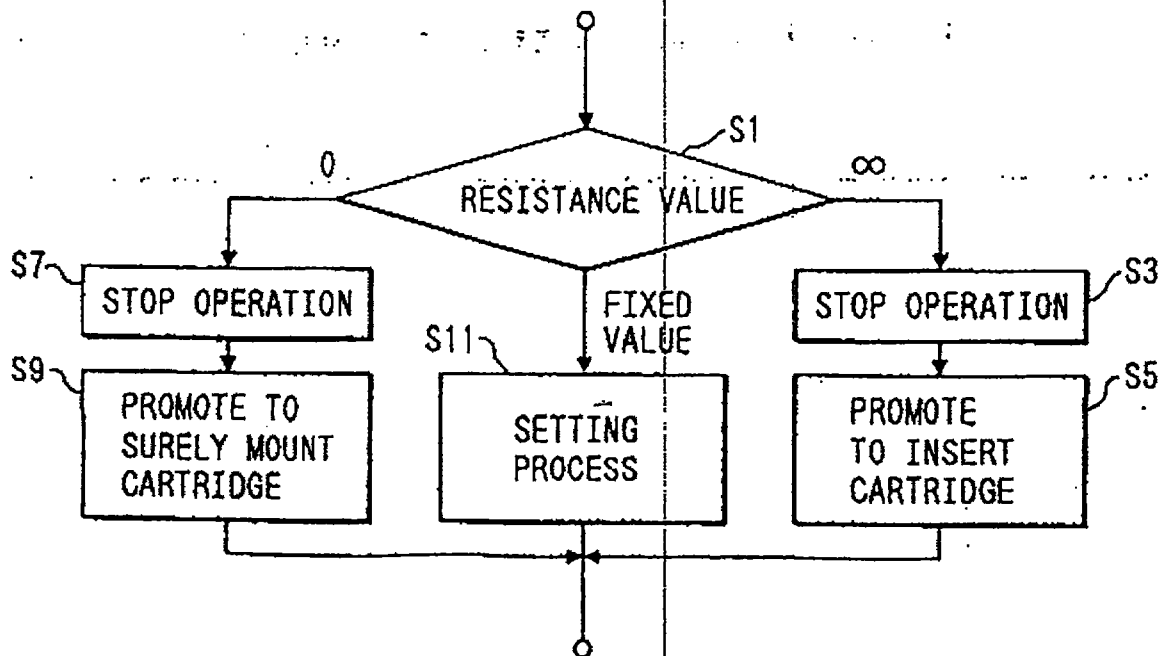


FIG. 25B



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FIG. 27A

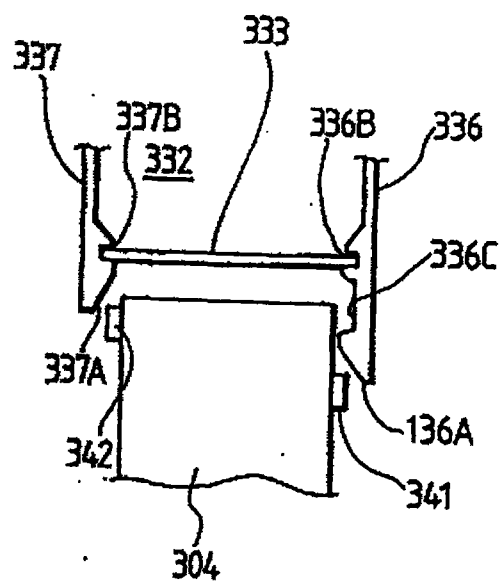


FIG. 27B

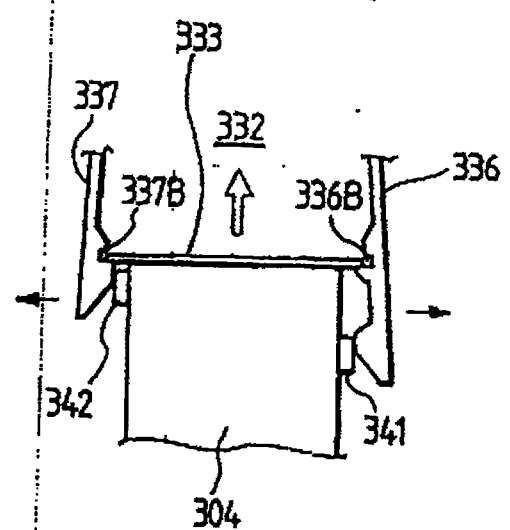


FIG. 27C

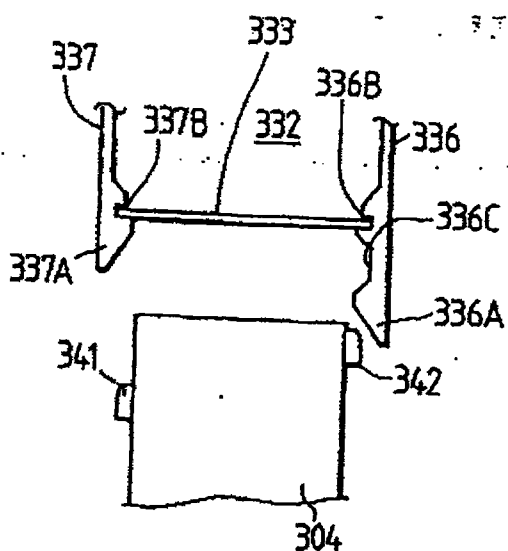
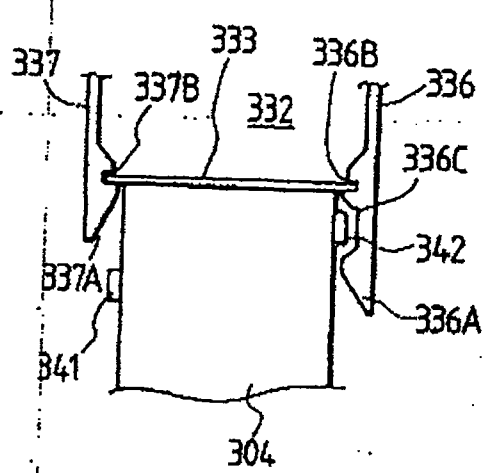
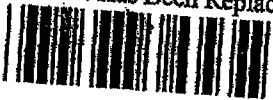


FIG. 27D



231.
/ 26

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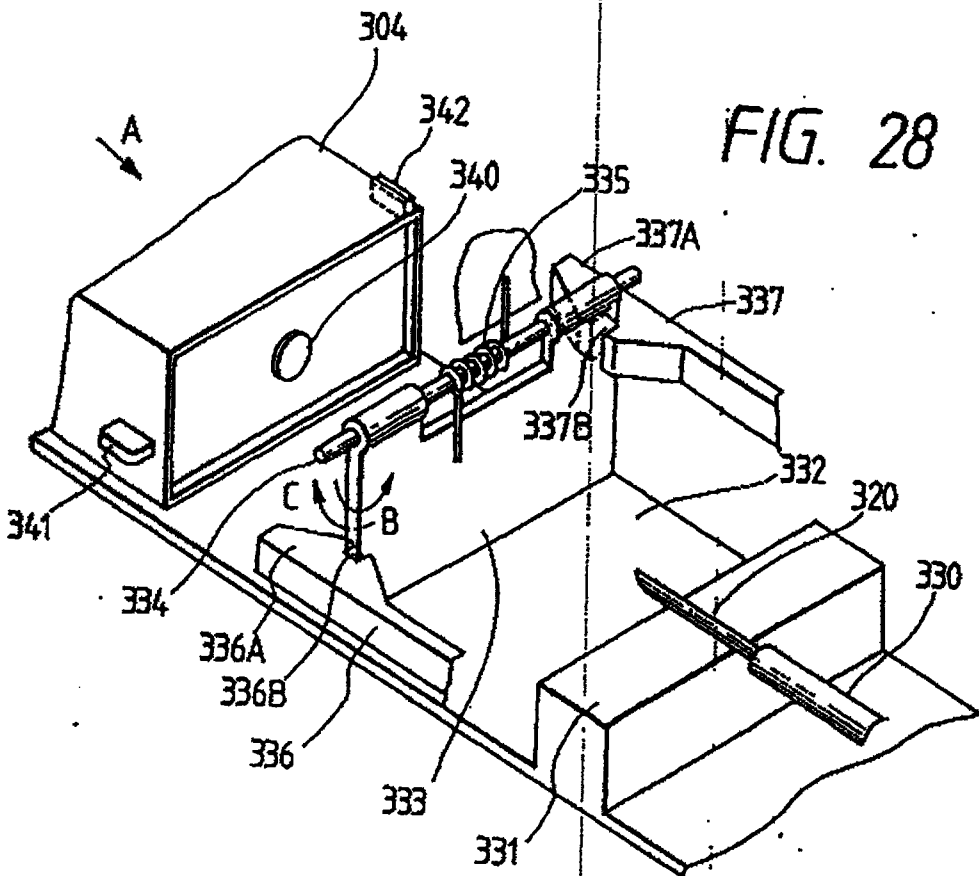


FIG. 28

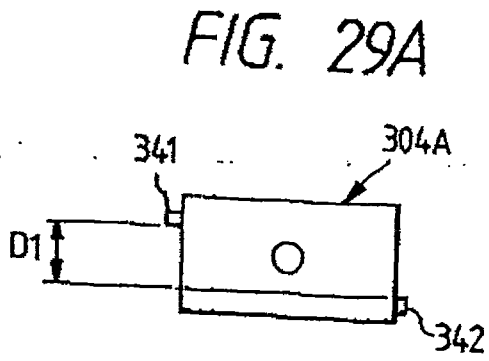


FIG. 29A

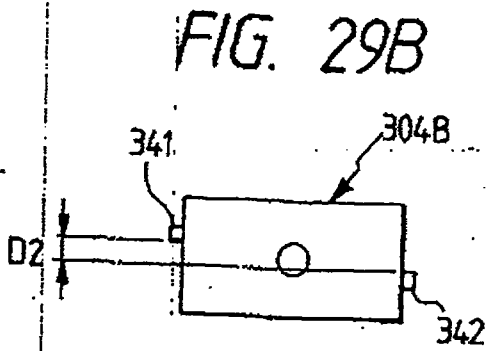


FIG. 29B



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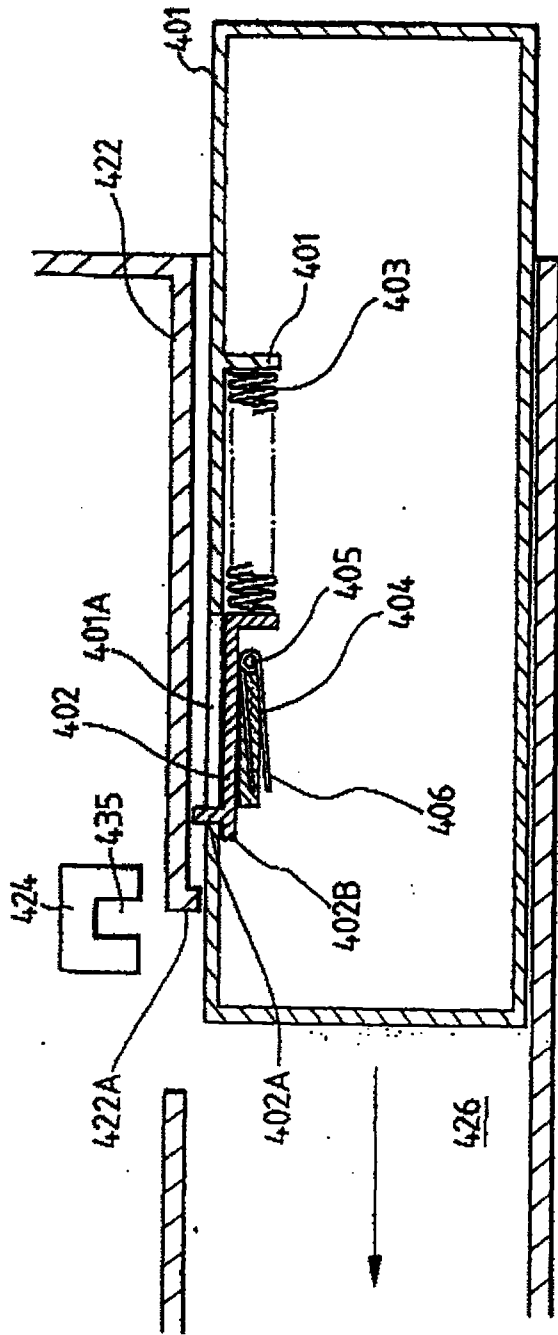


FIG. 30A

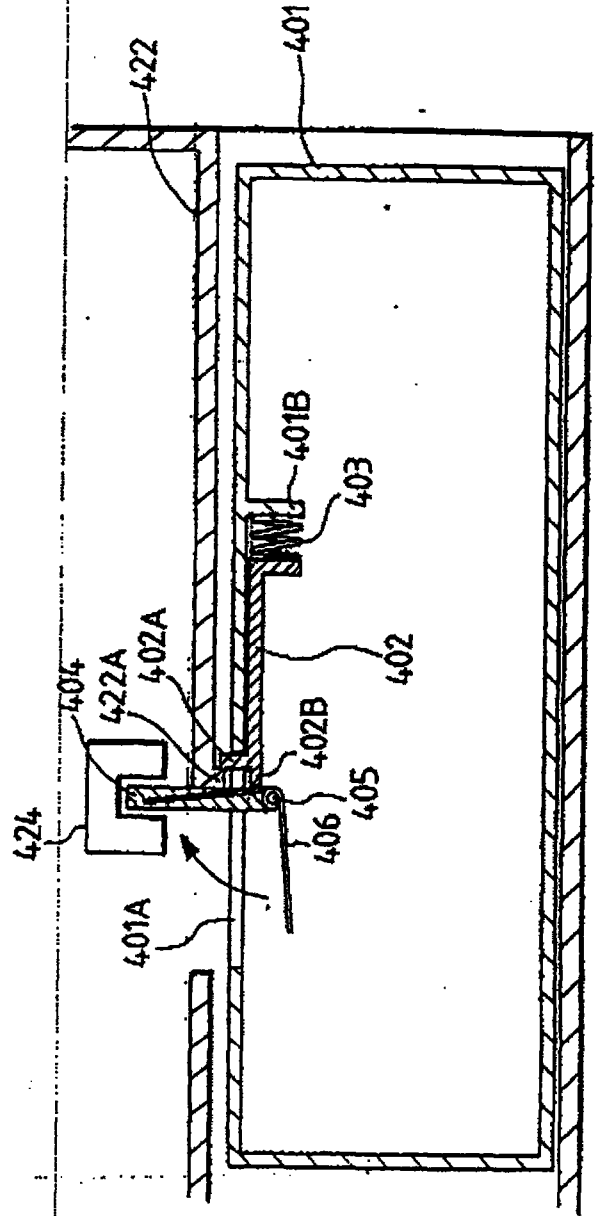


FIG. 30B

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FIG. 31A

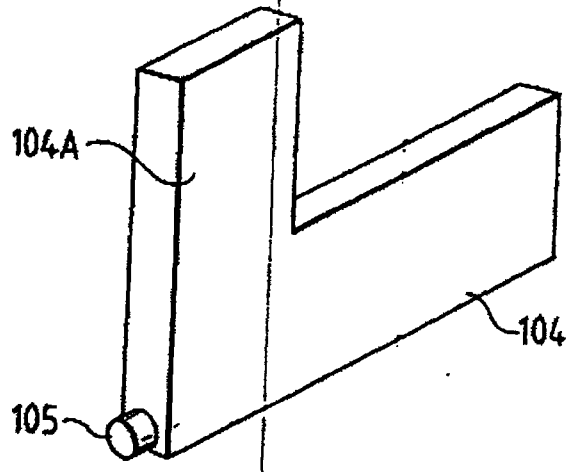


FIG. 31B

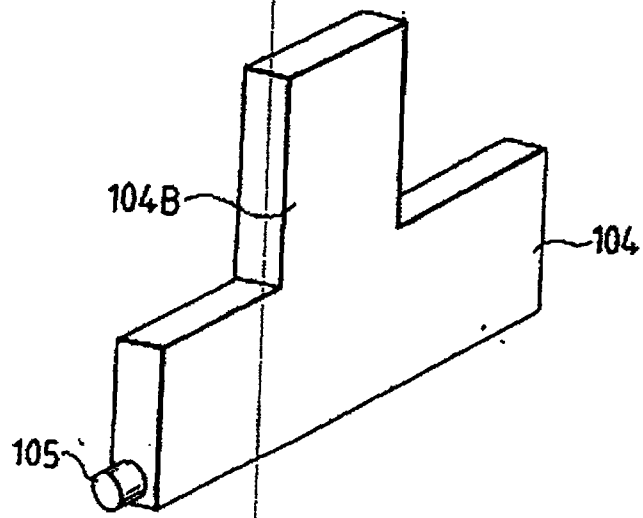
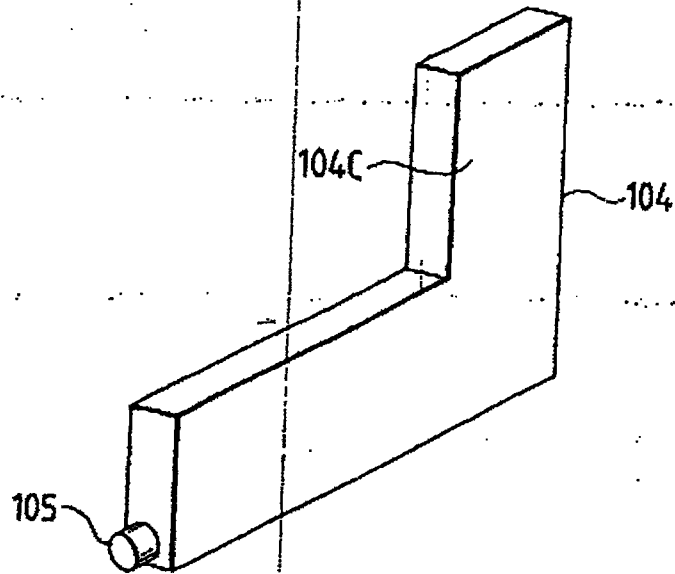


FIG. 31C



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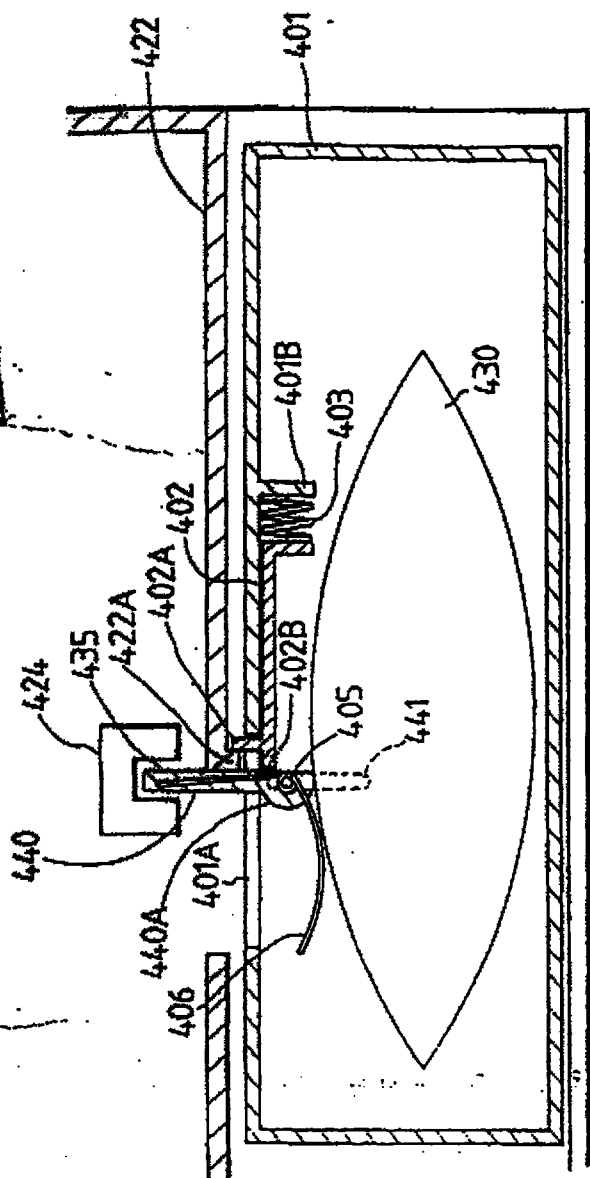


FIG. 32A

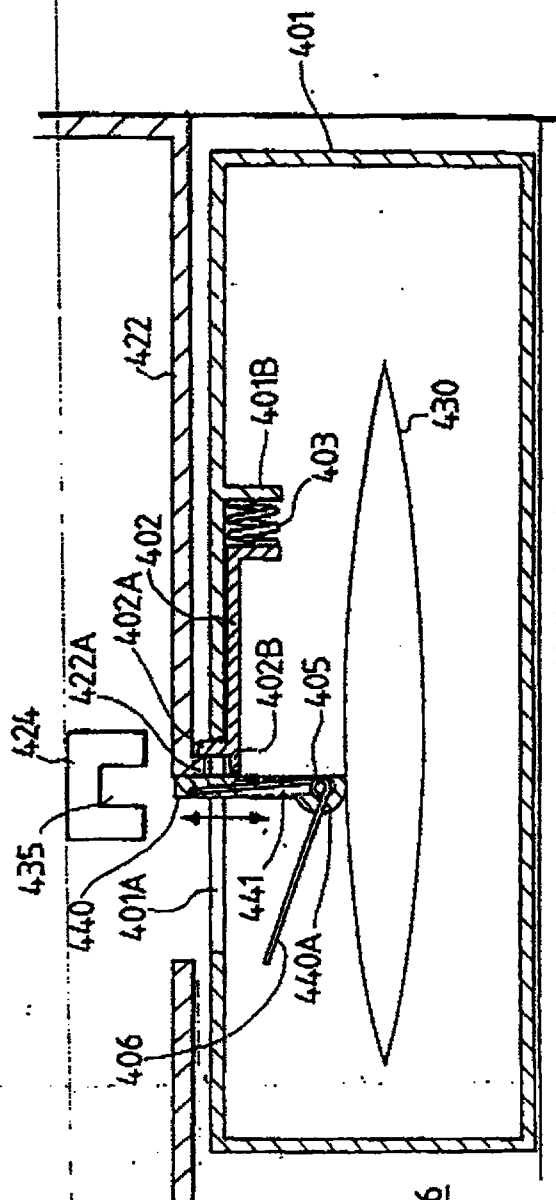
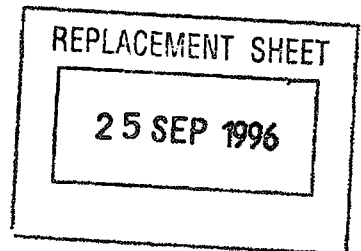


FIG. 32B

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1 INK JET RECORDING APPARATUS AND
 INK CARTRIDGE FOR THE APPARATUS

BACKGROUND OF THE INVENTION

5 Field of the Invention

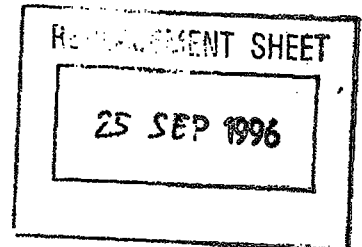
 This invention relates to an ink jet recording apparatus provided with an ink jet head for effecting recording with flying ink droplets utilizing the film boiling phenomenon of liquid.

10 The present invention also relates to an ink cartridge interchangeably provided for the ink jet recording apparatus.

Related Background Art

 In recent years, various ink jet recording
15 methods have been put into practical use because in such recording methods, the creation of noise during recording is negligibly small and in addition, recording can be effected on plain paper.

 Among them, the ink jet recording method
20 described, for example, in Japanese Laid-Open Patent Application No. 54-51837 (the so-called bubble jet recording method) is such that heat energy is caused to act on ink and the ink subjected to the action of this heat energy causes a sudden volume change (film
25 boiling phenomenon) resulting from a state change and by this action force, the ink is discharged from a discharge port at the end of a recording head unit,



1 whereby flying ink droplets are formed and adhere to a
recording medium to thereby accomplish recording.

The principle of ink droplet formation in
such a recording method is that when an electro-thermal
5 converting member is electrically energized, the ink
in the heat-acting portion subjected to the action of
the heat energy which is ink droplet forming energy
causes a state change resulting from a sudden
increase in volume, that is, the ink in the heat-
10 acting portion causes the creation, growth and
contraction of a bubble very momentarily, whereby
the liquid present between the heat-acting portion and
the discharge opening is discharged as an ink droplet.

By repeating such cycle of creation, growth,
15 contraction and disappearance of the bubble, the ink
is subjected to high heat. Therefore, thermally
unstable ink is liable to cause a chemical change and
in the heat-acting portion, production and precipi-
tation of insoluble matters may occur and further,
20 the recording head may become incapable of dis-
charging the ink. Accordingly, to effect recording
at a high speed for a long time by the use of such an
apparatus, it is very important to improve the
stability of the ink and on the other hand, to set
25 the optimum driving conditions corresponding to the
ink in the recording head.

Figure 1 of the accompanying drawings shows

25 SEP 1996

1 variations with time in the surface temperature T of
the heat-acting surface when an electrical signal
of pulse waveform shown by P is input to a recording
head having an electro-thermal converting member and
5 the volume V of a bubble then created. When the pulse-
like electrical signal P which is switched on and off
is input to the electro-thermal converting member
at a time t_0 and a time t_f , the surface temperature
 T of the heat-acting surface reaches a maximum
10 temperature T_p at the time t_f .

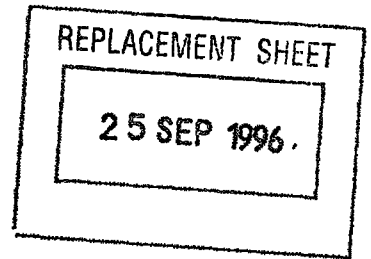
Here, when T_p is higher than the boiling point
 b of the ink which is in contact with the heat-acting
surface, a bubble begins to be created from a time
 $Tb0$ at which $T = Tb$ in the heat-acting portion filled
15 with the ink, and the volume thereof increases with
the lapse of time and reaches a maximum volume V_p at
a time t_p . When the electrical signal P is switched
off at the time t_f , the surface temperature T begins
to attenuate gradually and accordingly, the volume
20 V of the bubble decreases and the bubble disappears
at a time t_{B1} .

In order to ensure the discharge of ink
droplets to be effected efficiently and stably in an
ink jet recording apparatus, for example, in the
25 aforescribed bubble jet recording method, driving
conditions for film boiling such as a voltage, a
pulse width and a frequency at which electrical

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1 energy is supplied to the electro-thermal converting
member and further, control such as pre-discharging or
pre-heating for effecting stable practical printing,
or the recovery operation of the recording head are
5 programmed in advance in the ink jet recording
apparatus by hardware or software in accordance with
the characteristic of ink set for the ink jet
recording apparatus. Particularly, in a recording
apparatus of the type in which an ink tank storing
10 therein ink to be supplied to a recording head is
interchangeable for the apparatus, if use is made of
an ink cartridge storing therein ink of other kind
which does not match these various set conditions,
there will not be obtained an appropriate combination
15 of the characteristic of the ink and the driving
conditions and therefore, normal driving of the
recording head cannot be accomplished and recording
of high quality will become difficult to accomplish.
For this reason, usually, the form of the ink
20 cartridge interchangeable for the recording apparatus
is designed exclusively for each apparatus so that
the user may not misuse the ink cartridge.

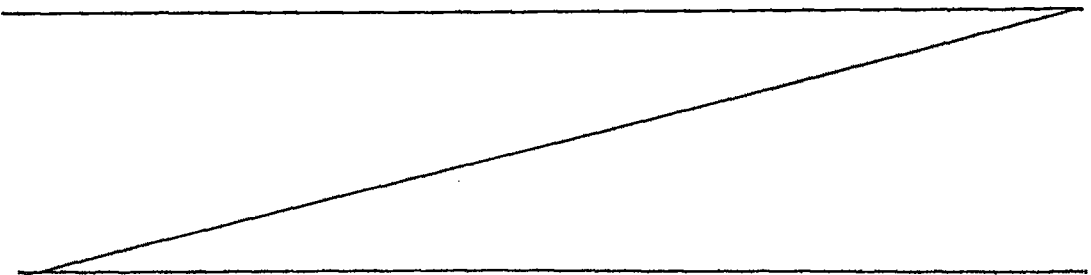
An example of the form of such an ink
cartridge is a box-like form. The ink cartridge is
25 designed such that by the operation of mounting the
ink cartridge on a cartridge mounting portion, a
hollow needle provided on the mounting portion is



1 thrust in the rubber plug of the cartridge so that ink
may be supplied from an ink containing portion in the
cartridge to an ink supply system through the hollow
needle.

5 However, the conventional ink jet recording
apparatus having such an interchangeable ink cartridge
only permits the use of ink fit for the discharge
conditions set in that apparatus and cannot select ink
of different discharge conditions and therefore, the
10 range of use of the ink jet recording apparatus is
limited and a wide range of use of the ink jet
recording apparatus having an excellent recording
characteristic has been difficult. Also, even if ink
having more excellent discharge and recording character-
15 istics is developed in the future, it will become
impossible to use such ink or obtain a satisfactory
state of use because the program in the apparatus is not
proper.

 The above-noted problems will hereinafter be
20 discussed specifically and in detail. Some examples of
the typical ink composition usable in an ink jet recording
apparatus are shown in Table 1 below.



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Table 1

Kinds of ink Component	①	②	③
Water [%]	50	50	80
DEG [%]	47	37	17
PEG [%]	0	10	0
Dyestuff [%]	3	3	3

The ink ① is an example of standard ink which exhibits a popular performance in both viscosity and solidification. On the other hand, the ink ② is ink in which the percentage of the component difficult to volatilize is increased relative to the ink ① and therefore which is characterized by a difficulty in clogging the discharge ports of the recording head. Thus, an ink jet recording apparatus using the ink ② does not require a mechanism for preventing the clogging of the discharge ports during the downtime of the ink jet recording head, or can be structurally simplified. However, since the ink ② has relatively high viscosity, it is necessary that discharge of the ink which does not contribute the recording, i.e., an operation called preliminary discharge, be sufficiently performed in advance in the early stage of each use. This may sometimes lead to a reduced

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1 throughput. Also, the ink (2) suffers from a disadvantage that the ink is ready to blur on the recording medium and a very high quality of printing cannot be provided. The ink (3) is ink characterized
5 in that the percentage of water content is increased relative to the ink (1) and the desiccation of the ink on the recording medium is quick and recording of high quality suffering much less from blur can be accomplished. Further, the ink (3) has a feature that
10 it can be driven at a relatively high frequency because it permits quick refilling of the nozzle after discharge. However, the ink (3) is ready to desiccate and therefore, the ink in the discharge ports of the recording head is ready to solidify as during the
15 downtime of the recording head. Therefore, it is necessary that the recovery operation such as pumping and the capping operation be performed frequently during the downtime of the recording head. Particularly, where the ink (3) is used for a recording head
20 of the bubble jet type in which heat energy is utilized as ink discharging energy, stable ink discharge cannot be accomplished unless the electrical energization time is made relatively short (e.g. 2-5 [μ sec]) and correspondingly the driving voltage
25 is made high. According, in the case of a recording head which can withstand such high driving stress, printing of high quality can be accomplished, but

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1 otherwise there will be obtained printing of low
quality which is bad in the accuracy of liquid droplet
shot.

Table 2 below specifically shows some examples
5 of the driving conditions for the recording head
relative to the inks in Table 1.

Table 2

Examples of appa- ratus	Kinds of ink Driving conditions	①	②	③
I	Voltage [V]	21	21	28
	Pulse width [μ s]	7	7	3
	Frequency [KHz]	4.5	4.0	6.0
	Number of prelimi- nary discharges (times)	50	128	50
II	Voltage [V]	21	19	21
	Pulse width [μ s]	7	8.5	7
	Frequency [KHz]	2	2	3
	Number of prelimi- nary discharges (times)	50	128	50

The apparatus example I is an apparatus using
silicon single crystal as the base material of the
recording head and carrying thereon a recording head
having a characteristic capable of withstanding
25 short pulse energization and high voltage driving
and responding to a high frequency. The apparatus
example II is an apparatus using glass as the base

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1 material of the recording head and carrying thereon a
recording head which is low in durability to short
pulse energization, high voltage driving and a high
frequency, but is very inexpensive.

5 For example, when the apparatus example I pro-
grammed with the use of the ink (1) having the
standard characteristic being taken into account is
used in a manner in which the frequency of use is
extremely low, it is desirable to use the ink (2)
10 which does not cause clogging. However, it is
necessary that the user change without fail the
substance of the driving program of the recording
head in which are set the conditions for the best
discharge to be accomplished when the ink (1) is used
15 to the substances matching the characteristic of the
ink (2), for example, the conditions such as the number
of preliminary discharges, the pre-heating state, the
driving frequency and the pulse width.

To increase the printing speed in the apparatus
20 example I, the ink (3) can be used, but even in that
case, as described previously, it is necessary that
the user change without fail the driving conditions of
the recording head in accordance with the character-
istic of the ink (3).

25 However, it is cumbersome and mistakable for
the user to change the driving conditions in accordance

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1 with the characteristic of the ink used, and damage is
liable to occur to the recording apparatus due to the
malfunctioning of the recording head. For example,
where use is made of a recording head of the type of
5 the apparatus example II, when the conditions for the
use of the ink (1) are to be changed to the driving
conditions for the use of the ink (3), the head driving
voltage is changed from 21V to 28V and the pulse width
is changed from 7 μ sec to 3 μ sec, whereby there is
10 provided good discharge of the ink (3). However, as
previously described, such driving conditions are not
suitable because they give high stress to the recording
head used in the apparatus example I and may therefore
extremely shorten the life of the recording head.

15 Accordingly, when the life of the recording head is
taken into consideration, for example, the driving
voltage must be changed to 21V and the pulse width
must be changed to the order of 7 μ sec and moreover,
the set frequency must be changed from 6 KHz to 3 KHz.

20 As described above, it is adequate to use ink
which takes into account the used state and the
purpose of use of the ink jet recording apparatus,
but it is difficult for an ordinary user to minutely
change the program in the ink jet recording apparatus
25 body such as the driving conditions and the preliminary
discharge conditions of the recording head with the
kind and driving characteristic of the recording head

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1 taken into account so that a change of the ink used
can be coped with. Even if such change is possible
at all, wrong setting may be effected and abnormal
printing or excessive stress may be given to the
5 recording head, and it will be difficult to ensure
the reliability of the recording apparatus.

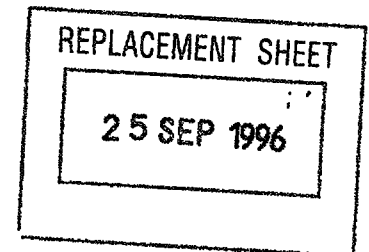
Now, when an ink cartridge interchangeable for
the apparatus is mounted in the apparatus body, it
is popular that the ink cartridge is held by a suitable
10 fastening means. Also, in the mounted state of the ink
cartridge, the interior of the ink tank and the ink
supply system on the apparatus body side are
communicated with each other by ink.

However, if the relation between the holding
15 position of the fastening means and the position in
which the communication is effected by ink is not
appropriate or especially there is a play in the
fastening means, the ink communication will not be
secured in spite of the ink tank being held by the
20 fastening means, and the ink supply system and the
ink tank will become spaced apart from each other.
If at this time, for example, the recovery operation
is performed, air may be introduced into the supply
system. If air is thus introduced into the supply
25 system, not only ink discharge will fail to be
properly effected, but also the recording head will
be damaged.

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1 On the other hand, when the ink cartridge is
to be interchanged, the user may inadvertently insert
his hand into the cartridge insertion port and have
the fingertip injured or stained with ink. In order
5 to prevent this, there has been provided a protective
device as shown, for example, in Figure 2 of the
accompanying drawings. In Figure 2, the reference
numeral 130 designates an ink tube connected to a
hollow needle 120 and supplying ink to the recording
10 head, the reference numeral 131 denotes a mounting
bed for fixedly supporting the hollow needle 120, and
the reference numeral 132 designates an insertion path
for directly the ink cartridge 104 to its mounted
position.

15 The reference numeral 133 denotes a protective
plate pivotable about a support shaft 134, the refer-
ence numeral 135 designates a torsion coil spring
mounted around the support shaft 134 and biasing the
protective plate 133 in the direction of arrow C, and
20 the reference numerals 136 and 137 denote locking
members for holding the protective plate 133 in an
insertion path closing position as shown and
restraining the movement thereof. That is, these
locking members 136 and 137 are formed symmetrically
25 with respect to each other, and have wedge portions
136A and 137A and locking grooves 136B and 137B at
opposed locations, and are both endowed with



1 resiliency, whereby they can be flexed in the direction
of arrow D. The reference numeral 140 designates
a rubber plug provided in the front face of the ink
cartridge 104, and the reference numerals 141 and 142
5 denote unlocking projection members (hereinafter
referred to as the unlocking members) provided on the
sides of the ink cartridge 104.

In the protective device for the ink cartridge
mounting portion which is so constructed, as long as
10 the ink cartridge 104 is not mounted, the protective
plate 133 is held in its shown position by the locking
members 136 and 137, and even if a finger tip or the
like is inserted into a cartridge guide or the like,
it will strike against the protective plate 133 and
15 will not reach the tip end of the hollow needle 120.
Also, if as shown in Figure 2, the ink cartridge 104
is inserted from the direction of arrow A along the
insertion path 132, the unlocking members 141 and
142 will slidably contact with the wedge portions
20 136A and 137A of the locking members 136 and 137,
respectively, and will push open these members in the
direction of arrow D.

Consequently, the opposite end portions of the
protective plate 133 are liberated from the locking
25 grooves 136B and 137B of these members and also, the
front face of the ink cartridge 104 bears against the
protective plate 133 and pushes it up in the direction

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1 of arrow B. Thereafter, the hollow needle 120 thrusts
into the rubber plug 140 of the ink cartridge 104,
whereby there can be brought about a mounted state in
which the supply of ink to the recording head is
5 possible. When the ink cartridge 104 is to be
removed, the ink cartridge 104 is pulled out rearwardly
from its mounted state, whereby the hollow needle 120
is pulled out from the rubber plug 140, and then the
protective plate 133 is pivoted in the direction of
10 arrow C by the spring force of the torsion coil spring
135 and returns to its vertical position and is
sandwiched between the locking members 136 and 137
and restores the state shown in Figure 2.

However, in the conventional ink jet recording
15 apparatus as described above, the locking members 136
and 137 are provided laterally symmetrically and
therefore, even when the user inserts the ink
cartridge 104 with its vertical direction or its
longitudinal direction mistaken, the locked state of
20 the protective plate 133 will be released by the
engagement between the unlocking members 141, 142
and the locking members 136, 137 and the ink cartridge
104 will be directed to its mounted position, and
this has led to the undesirable possibility that the
25 hollow needle 120 is damaged or the ink cartridge 104
itself is damaged and the supply of ink becomes
impossible. Also, an attempt to provide a special

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1 device discretely to prevent such an accident would
make the mounting device itself complicated in
structure and result in an increased cost.

Now, some of ink cartridges are in a form which
5 is provided with an ink containing portion and in
addition, a waste ink containing portion for containing
discharged ink, i.e., ink sucked during the recovery
operation performed to prevent the clogging of the ink
discharge ports of the recording head (hereinafter
10 referred to as the waste ink), and with such ink
cartridges, it is possible to scrap the waste ink
contained in the waste ink containing portion, by and
simultaneously with the interchange of the cartridge.

If in an ink jet recording apparatus of such
15 interchangeable ink cartridge type, the recording
operation is performed with no ink cartridge mounted
in the apparatus, recording will not be obtained
because ink supply does not take place. Also, if the
recovery operation is performed, waste ink discharged
20 from the waste ink system side will not be contained
in the ink cartridge but may be released into the
apparatus to thereby contaminate the surroundings, or
the released waste ink may contaminate electric
circuits to thereby cause an accident such as fire.
25 Accordingly, it is desirable to provide detecting
means for informing the user of the mounting of an
ink cartridge in the apparatus.

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1 An example of such detecting means is shown in
Figures 3 and 4 of the accompanying drawings. As shown
in Figure 3, a cartridge detecting flag 131 is
comprised of a rotatable flag shaft 131B supported on
5 the upper portion of an insertion port 121, a flag
plate 131C mounted on one end of the shaft, and a
cam portion 131A for rotating the flag shaft 131B, and
on the other hand, a lever member 132 pivotally moved
by the mounting of a cartridge 104 is provided inside
10 the insertion port 121. Thus, when the ink cartridge
104 is inserted into the insertion port 121 and is
surely mounted with a hollow needle 120 being inserted
into a tank, not shown, in the cartridge 104, the
projected portion 132A of the lever member 132 is
15 pressed by the fore end of the cartridge 104, whereby
the tip end portion 132B of the lever pivotally moves
the flag plate 131C through the cam portion 131A and
keeps it in a light intercepting position for a
detecting sensor 124 as shown.

20 Figure 4 shows the details of the detecting
sensor 124 for detecting both of the home position
and the cartridge. The detecting sensor 124 is of the
transmission type and is provided with an optical path
135 between a light emitting element 133 and a light
25 receiving element 134, and is designed such that the
optical path 135 is shielded from light by a home
position detecting flag 130, the flag plate 131C of

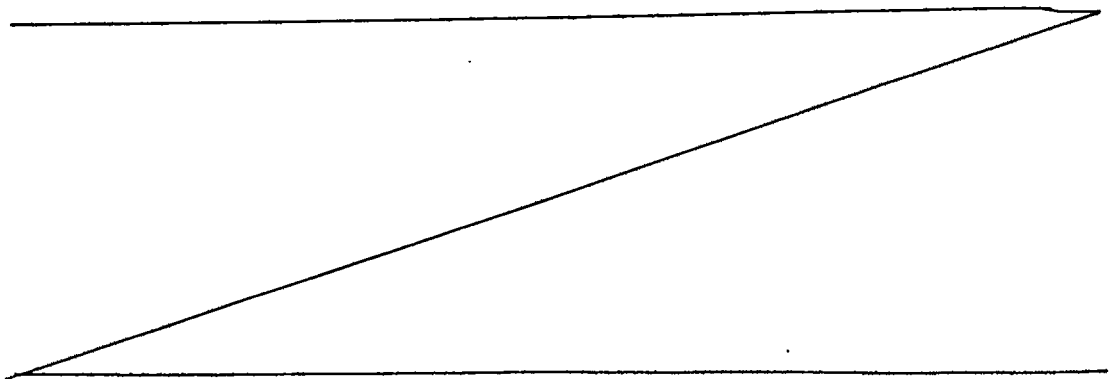
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1 the ink cartridge detecting flag 131, etc. Accordingly,
when the ink cartridge 104 is mounted, the detecting
sensor 124 detects the flag plate 131C when a carriage
102 has been directed to a detecting position, whereby
5 the mounting of the cartridge is confirmed.

However, in the conventional ink jet recording
apparatus as described above, the home position
sensor is used also as the cartridge detecting sensor
and the number of detecting means is correspondingly
10 decreased, but the information the user wants to
recognize about the ink cartridge 104 is not only the
mounting thereof, but also the information regarding
the color and characteristic of the ink contained in
the ink cartridge 104 as described previously and
15 the remaining amount of ink, and to enable all of such
information to be obtained, the number of flags must
be increased or the number of detecting means
themselves must be increased, and this will result in
complicated structure, which in turn will result in an
20 increased cost.

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SUMMARY OF THE INVENTION

1 So, it is an object of the present invention
to eliminate such problems peculiar to the prior art
and to provide an ink cartridge to which is imparted
5 information for controlling the driving conditions
of a recording head on the basis of ink used.

It is also an object of the present invention
to provide an ink jet recording apparatus of high
performance and high reliability in which an ink jet
10 recording head used changes its driving conditions
so as to fit thereto.

It is a further object of the present
invention to provide a construction of such
correlation that the mounting of an ink cartridge
15 into an apparatus can be reliably accomplished, and
to ensure ink supply, information reading, etc. to
be reliably effected.

It is another object of the present invention
to provide an ink cartridge which is simple in
20 structure and can prevent malfunctioning during the
mounting of the cartridge, and an ink jet recording
apparatus into which such ink cartridge can be
mounted.

It is still another object of the present
25 invention to provide an ink jet recording apparatus
in which a minimum number of detecting means enables
the user to recognize various kinds of information

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1 regarding an ink cartridge, and to provide such ink
cartridge.

5 It is yet still another object of the present
invention to provide an ink cartridge which is
interchangeably provided for an ink jet recording
apparatus provided with a recording head for causing
the discharge of ink to thereby effect the recording
of images and which contains said ink therein and
supplies said ink in response to the discharge of
said ink, characterized by the provision of a medium
10 provided with information for controlling the
driving conditions of said recording head.

15 It is also an object of the present invention
to provide an ink jet recording apparatus which
permits the removable mounting therein of an ink
tank cartridge forming a supply source of ink for a
recording head for discharging said ink to a
recording medium to thereby effect recording,
characterized by the provision of:

20 communication means for effecting the
communication between said ink tank and the supplied
ink;

25 reading means for reading the information
regarding said ink tank cartridge itself from an
information presenting member provided on said ink
tank cartridge to present said information; and

holding means for holding said ink tank

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1 cartridge;

5 a position in which said ink communication is effected, a position in which said information is read and a position in which said ink tank cartridge is held being disposed in the named order in the direction of mounting of said ink tank cartridge.

10 It is a further object of the present invention to provide an ink tank cartridge forming a supply source of ink for a recording head for discharging said ink to a recording medium to thereby effect recording, characterized by the provision of:

15 an information presenting member provided to present the information regarding the ink tank cartridge itself;

a communication member for effecting the communication of the supplied ink with an apparatus body; and

20 a held member for being held by said apparatus body;

25 said communication member, said information presenting member and said held member being disposed so that the communication of said supplied ink, the reading of said information and said holding may be effected in the named order with the mounting operation of said ink tank cartridge.

It is still a further object of the present

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1 invention to provide an ink jet recording apparatus
characterized by the provision of:

an ink tank cartridge which forms a supply
source of ink for a recording head for discharging
said ink toward a recording medium to thereby effect
5 recording and which is provided with a member for
presenting inherent information regarding said ink
tank cartridge itself and second information
differing from said inherent information and is
removably mountable in an apparatus body;

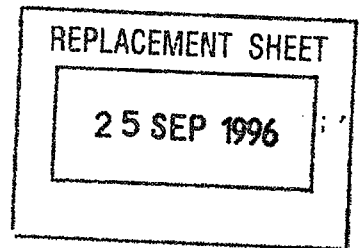
10 communication means for effecting the
communication between said ink tank cartridge and
the supplied ink;

reading means for reading said inherent
information and said second information; and

15 holding means for holding said ink tank
cartridge;

a position in which said ink communication is
effected, a position in which said second
information is read, a position in which said
20 inherent information is read and a position in which
said ink tank cartridge is held being disposed in
the named order in the direction of mounting of said
ink tank cartridge.

25 It is another object of the present invention
to provide an ink tank cartridge for an ink jet
recording apparatus which forms an ink supply source



1 for a recording head for discharging ink and which
is removably mountable in the apparatus body,
characterized by the provision of an inherent
information presenting member for presenting
5 inherent information regarding the ink tank
cartridge itself, and a second information
presenting member provided forwardly of said
inherent information presenting member with respect
to the direction of mounting for presenting second
10 information differing from said inherent
information.

It is still another object of the present
invention to provide an ink cartridge which is
mountable on a mounting portion along the insertion
15 path of an ink jet recording apparatus having an
openable-closable plate openably and closably held
in the insertion path to said mounting portion, and
locking members for restraining said openable-
closable plate from the opposite sides of said
20 insertion path to inhibit the opening movement
thereof and which contains therein ink to be
supplied to a recording head and in which unlocking
members engageable with said locking members to
thereby release the restraint of said locking member
25 during the mounting of said ink cartridge are
projectedly provided on opposite sides,
characterized in that said unlocking members are

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1 provided asymmetrically with respect to the
direction of insertion into said insertion path.

It is yet still another object of the present invention to provide an ink jet recording apparatus
5 which is provided with an openable-closable plate
provided in an insertion path for directing to a
mounting portion an ink cartridge containing therein
ink to be supplied to a recording head and openably
and closably held, and locking members for
10 restraining said openable-closable plate from the
opposite sides of said insertion path to inhibit the
opening movement thereof and in which the restraint
of said locking members can be released by unlocking
members projectedly provided on the opposite sides
15 of said ink cartridge during the insertion of said
ink cartridge into said insertion path,
characterized in that said unlocking members and
said locking members are disposed asymmetrically
with respect to the direction of insertion of said
20 ink cartridge.

It is another object of the present invention
to provide an ink jet recording apparatus in which
is removably mounted an ink cartridge containing
therein ink to be supplied to a recording head for
25 discharging the ink to thereby effect recording,
characterized by the provision of:

a flag member provided on said ink cartridge

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24

and adapted to be protruded toward a path along which a carriage is moved only when said ink cartridge is mounted on a mounting portion; and

a photosensor provided on said carriage and capable of being shielded from light by said flag member.

It is still another object of the present invention to provide an ink cartridge which is removably mounted on the fixed mounting portion of an ink jet recording apparatus for supplying discharged ink to a recording head carried on a movable carriage, characterized by the provision of a flag member capable of being protruded and contained, and means for protruding said flag member toward a path along which said carriage is moved only when said ink cartridge is mounted on said mounting portion, the light interception of a photosensor provided on said carriage being possible by said flag member.

By providing on an ink cartridge a medium including information for driving an ink jet head, the driving conditions of the ink jet head matching the composition of ink can be automatically set by an ink jet recording apparatus itself, and this leads to the possibility of providing an ink jet recording head which is simple to operate and high in reliability.

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1 Also, there can be provided an ink cartridge
which can be prevented from being erroneously
inserted by the user and which has information for
properly controlling the driving of a recording -
5 head.

 Further, in a position wherein an ink
cartridge is held in an apparatus body, the
communication between an ink supply system and ink
is effected prior thereto and therefore, the ink
10 communication state can be secured near the held
position of the ink cartridge. In addition, prior
to the holding, the information regarding the ink
cartridge is readable and therefore, the
impossibility of reading or misjudgment does not
15 occur near the held position. Furthermore, the ink
communication is effected prior to reading and
therefore, even if the recording operation is
immediately started in response to reading, there
will occur no inconvenience such as the introduction
20 of air into the ink supply system, and even if
conversely, the ink cartridge is pulled out during
the recording operation, this can be detected before
the ink communication is cut off and therefore,
there will occur no similar inconvenience if the
25 operation is discontinued.

 Also, according to the present invention, in
the position wherein the ink cartridge is held in

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26

1 the apparatus body, the communication between the
ink supply system and ink is effected prior thereto
and therefore, the ink communication state can be
secured near the held position of the ink cartridge.
5 Further, the inherent information regarding the ink
cartridge becomes readable near the held position,
and information differing from said information is
read in a predetermined range from the ink
communication position to the vicinity of the held
10 position and therefore, if design is made such that
a warning is given in response to the reading of
this information, the unsatisfactory holding of the
ink cartridge can be detected to obviate the falling
off thereof.

15 Furthermore, the horizontal positions of the
unlocking members provided on the ink cartridge side
and the horizontal positions of the locking members
provided correspondingly to them are made
asymmetrical with respect to the direction of
insertion, i.e., different from each other with
20 respect to the vertical direction or the direction
of insertion, and therefore, even if the ink
cartridge is inserted into the mounting portion with
the vertical direction or the longitudinal direction
thereof being mistaken, the locking members and the
25 unlocking members will not come into engagement with
each other and the locked state will not be released

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1 and thus, the ink cartridge will be prevented from
being mounted by mistake and accordingly, any damage
attributable to wrong mounting can be prevented.

Also, according to the present invention, the
5 flag member capable of being protruded and contained
which is provided on the ink cartridge is protruded
from the cartridge toward the path along which the
carriage is moved when the ink cartridge is mounted
on the mounting portion and therefore, the mounting
10 of the ink cartridge can be detected by the
photosensor carried on the carriage, and by
variously changing the form of the flag member and
characterizing each ink cartridge, the information
for a plurality of ink cartridges can be
15 individually judged by a combination thereof with
the moved position of the carriage.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a characteristic graph showing
20 the relation between an applied pulse and the growth
of a bubble.

Figure 2 is a perspective view showing the
construction of an ink cartridge mounting mechanism
according to the prior art.

25 Figure 3 shows the construction of an ink
cartridge detecting device according to the prior
art.

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1 Figure 4 illustrates a photosensor for the
detecting device of Figure 3.

 Figure 5 is a schematic perspective view
showing an embodiment of the ink cartridge according
5 to the present invention.

 Figure 6 is a block diagram showing a
construction for controlling the driving of a
recording head by the information of the ink
cartridge.

10 Figure 7 is a flow chart showing an example
of the sequence until printing is accomplished by
the information of the ink cartridge.

 Figure 8 is a schematic perspective view
showing another embodiment of the ink cartridge
15 according to the present invention.

 Figures 9 to 15 are schematic perspective
views showing further embodiments.

 Figure 16 is a schematic perspective view
showing the installed position of a medium carried
20 on an ink cartridge.

 Figure 17 is a schematic view showing an
example of the ink jet recording apparatus.

 Figure 18 is a perspective view showing an
ink jet recording apparatus according to an
embodiment of the present invention with the top
25 cover thereof removed.

 Figures 19A and 19B are a perspective view

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1 and a fragmentary cross-sectional view,
respectively, showing an example of the construction
of the ink cartridge mounting portion of the
apparatus according to the present invention.

5 Figure 20 is a cross-sectional view showing
an example of the construction of an ink cartridge
according to an embodiment of the present invention.

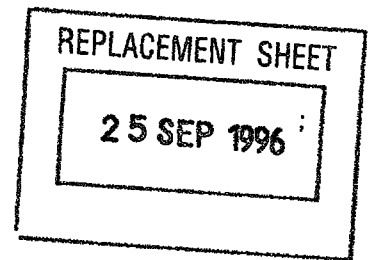
Figure 21 is a perspective view for
illustrating each portion for effecting the mutual
coupling between the ink cartridge and the body
10 side.

Figure 22 illustrates the relation in the
coupling position of each portion concerned in
coupling in the present embodiment relative to the
insertion of the ink cartridge.
15

Figures 23A - 23E illustrate inconveniences
which occur when the coupling position relation as
in the present embodiment is not adopted.

Figures 24A and 24B are a fragmentary
enlarged view and a coupling position relation
20 illustration, respectively, showing an improved
embodiment of the ink cartridge of Figures 21 and
22.

Figures 25A and 25B are block diagrams
showing a control system for the construction shown
25 in Figure 24 and a flow chart showing an example of
the operation thereof, respectively.



1 Figure 26 is a perspective view showing an
example of the construction of an ink cartridge
mounting mechanism according to the present
invention.

5 Figures 27A and 27B illustrate the normal
cartridge mounting operation by the embodiment of
Figure 26.

Figures 27C and 27D illustrate a wrong
mounting operation.

10 Figure 28 is a perspective view showing the
construction according to another embodiment of the
present invention.

Figures 29A and 29B illustrate still another
embodiment of the present invention.

15 Figures 30A and 30B illustrate the
construction of the ink cartridge according to the
present invention before and after the cartridge is
mounted.

20 Figures 31A - 31C are perspective views
showing the three kinds of forms of the flag member
in the ink cartridge according to the present
invention.

25 Figures 32A and 32B illustrate the operation
of another embodiment of the ink cartridge according
to the present invention in a state in which ink is
present and a state in which ink is absent,
respectively.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

Some embodiments of the present invention will hereinafter be described in detail with reference to the drawings.

[Embodiment 1]

Figure 5 is a partly broken-away perspective view showing an ink cartridge 51 removably mountable with respect to an ink jet recording apparatus according to the present invention, and a portion of a connecting device 52 connected to the ink cartridge 51 and provided with a supply portion for supplying ink to the ink jet recording apparatus and a supply receiving portion for receiving waste ink from the ink jet recording apparatus, the connecting device 52 being provided on the ink jet recording apparatus side.

In Figure 5, the reference numeral 12 designates the housing of the ink cartridge 51 which is usually made by plastic molding in accordance with the shape or construction of the cartridge containing portion of the ink jet recording apparatus body.

The reference numeral 13 denotes a hermetically sealed type ink container for containing ink therein. In the present embodiment, the ink container 13 uses a flexible ink bag in which ink is enclosed. The reference numeral 15

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1 designates an ink supply portion formed of an
elastic material such as silicone rubber. This ink
supply portion is connected to the ink bag through
an ink conducting tube 15a, and when the ink
5 cartridge 51 and the ink jet recording apparatus are
connected together, the ink supply portion provides
a portion into which a hollow ink needle 16
installed in the connecting device 52 of the ink jet
recording apparatus is inserted to thereby supply
10 the ink in the ink bag into the ink jet recording
apparatus.

Any ink forcibly discharged from an ink jet
recording head by the filling of the recording head
with ink or by the recovery operation or the like of
the recording head passes through waste ink
15 collecting tubes 16a and 16b installed in the ink
jet recording apparatus body and is fed into a waste
ink reservoir 18 through a hole 17 formed in the
housing of the ink cartridge. The reference numeral
19 designates a medium having information indicative
20 of the kind of the ink in the ink cartridge. The
medium used in the present embodiment is a resistor
(having a predetermined resistance value selected
from among 0 to $\infty\Omega$). The reference characters 19a
and 19b denote terminals provided on the ink
25 cartridge side to electrically connect the medium to
the ink jet recording apparatus body. When the ink

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1 cartridge is completely connected to the ink jet
recording apparatus body, these terminals 19a and
19b are electrically connected to pin terminals 20a
and 20b prepared in the ink jet recording apparatus
5 body. These pin terminals are electrically
connected to a control circuit in the ink jet
recording apparatus body, which control circuit can
electrically freely read the information of these
elements.

10 Figure 6 is a block diagram showing the
manner in which the ink cartridge 51 shown in Figure
5 is connected to the ink jet recording apparatus
53. By the ink cartridge 51 being mounted in the
ink jet recording apparatus 53, the medium 19
15 carried on the ink cartridge is connected to the
interface 54 of the apparatus 53 side, whereby the
information of the medium 19 is transmitted. On the
basis of this information, control as will be
described later, for example, the table of ROM 56
20 including a conversion table, is selected, and on
the basis thereof, the driving of a recording head
59 is controlled by a head driving control device
61.

25 Figure 7 shows a series of operation
sequences when the power source switch of the ink
jet recording apparatus body is closed in a state in
which the ink cartridge 51 is mounted with respect

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1 to the ink jet recording apparatus 53 shown in
Figures 5 and 6 and the terminals 19a and 19b of the
medium 19 of the ink cartridge 51 are electrically
connected to the pin terminals 20a and 20b of the
5 apparatus side and the ink supply system is
connected to the apparatus body.

At a step S101, a power source switch is
closed. At a step S102, whether the ink cartridge
is mounted with respect to the apparatus is judged.
10 If the ink cartridge is not mounted, a warning lamp
is turned on at a step S103. If the ink cartridge
is judged to be mounted, at a step S104, the
resistance value of the medium carried on the ink
cartridge is read. At a step S105, in conformity
15 with the read resistance value, data is read out
from a data table. At a step S106, the data is
judged, and if the data is absent, the warning lamp
is turned on at a step S107. If the data is
present, at a step S108, the data is transferred to
a driving RAM. Thus, at a step S109, the recording
20 head is driven in accordance with a predetermined
table, and at a step S110, whether printing is
possible or whether a printing signal is present is
judged, and if printing is possible by the printing
signal, printing is effected at a step S111. If
25 printing is not possible, return is made to the step
S109, where processing is effected to make the

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1 recording head capable of printing. Of course, the
detection of the presence or absence of the ink
cartridge may be effected by detecting the medium
carried on the ink cartridge.

5 Table 3 below shows an example of the
conversion table of the resistance values of the
resistor on the ink cartridge and the ink jet
driving conditions, etc. for those resistance
values.

Table 3

Resistance value	Voltage	Pulse width	Frequency	Number of preliminary discharges
[k Ω]	[V]	[μ s]	[KHz]	[times]
0	0	0	0	0
0.5	21	7	3	128
1	21	7	4	128
5	28	3	3	128
10	28	3	4	50
100	28	3	6	50
200	28	2.5	6	50
∞	0	0	0	0

20 Resistance value vs. head driving conditions
conversion table recorded in the ink jet
recording apparatus body.

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1 This conversion table is pre-recorded in the
control ROM in the ink jet recording apparatus.
After the presence of the ink cartridge is
confirmed, the information on the ink cartridge is
5 read as the resistance value.

Where for example, the kind of the ink jet
recording apparatus 53 is the apparatus example I in
Table 2 and the kind of the ink is the ink ② in
Table 1, if the resistance value of the resistor on
10 the cartridge corresponding thereto is 1 k Ω , the
information that the driving voltage is 21 V, that
the pulse width is 7 μ sec, that the driving
frequency is 4 KHz and that the number of
preliminary discharges is 128 times is read from the
15 conversion table recorded in the ROM 56 which is
shown in Table 3, by the CPU 55, and then is
transferred as the data during the driving of the
ink jet recording head to a particular area of the
RAM 56. Likewise, if the resistance value
20 corresponding to the ink ③ is 100 k Ω , the
conditions that the driving voltage is 28 V, the
pulse width is 3 μ sec, the driving frequency is 6
KHz and the number of preliminary discharges is 50
times are read from the conversion table.

25 When the recording head 59 is actually driven
to effect printing, the CPU 55 again indicates the
aforementioned data from said determined area of the

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1 RAM to a reading head controller 58. Of course, the
table differs from apparatus to apparatus, and for
the ink ③, in the apparatus example II, the driving
voltage is 21 V, the pulse width is 7 μ sec, the
5 driving frequency is 3 KHz and the number of
preliminary discharges is 50 times, and further, if
the clog preventing mechanism is a very simple
device and the ink ③ is unsuitable, if the data on
the conversion table in that apparatus is made to
10 have a particular value (in this example, 0) for
identification, the ink jet recording apparatus will
judge that setting is impossible, and can produce an
alarm. Thus, any ink which is difficult to
discharge when used in a recording head having a
15 predetermined characteristic can be automatically
discriminated.

Further, by sufficiently securing the
capacity of the conversion table, many expected
kinds of driving conditions are input to the
conversion table, whereby there can be realized an
20 ink jet recording apparatus which can cope with
excellent ink in the future. In the aforescribed
embodiment, description has been made with respect
to an example in which reading is effected from the
conversion table and the driving voltage, the pulse
25 width, the driving frequency and the number of
preliminary discharges are all made variable, but it

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1 is apparent that it is also possible to form in the
apparatus a circuit in which more simply, for
example, only the driving voltage, only the pulse
width, or only the driving frequency, or a possible
5 combination thereof is set by the resistance value
of the resistor. Also, the information designated
by the medium can include, in addition to these, the
conditions of the pre-heating in which the recording
head is pre-heated to improve the characteristic of
10 the ink or the preliminary discharge in which
discharge not concerned in recording is effected to
improve the recording characteristic, such ink
discharge conditions that optimum discharge can be
obtained during recording, the ink discharge
15 conditions when recording is effected by the use of
inks of plural colors, or the discharge recovery
conditions of the recording head which correspond to
the ink used.

The discharge recovery conditions are
20 performed when the discharge state is deteriorated
before predetermined recording is terminated, and
include, for example, a series of operations of
moving the recording head to a position opposed to a
cap member, thereafter causing the cap to bear
25 against the discharge port surface, driving a pump
for recovery to thereby forcibly discharge the ink
from the discharge port, opening the cap, thereafter

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1 effecting idle suction for discharging the ink in
the cap, and cleaning the discharge port surface of
the recording head by a blade, or one of these
operations or a combination of two or more of these
5 operations. That is, the discharge recovery
conditions show the selection of these operations
and a condition for which these operations are
performed under what degree of load, and optimum
conditions are set in conformity with the
10 characteristic of the ink. For example, for ink
which is low in viscosity and easy to dry, it is
necessary to set the discharge recovery operation at
high frequency, and for ink which is high in
viscosity and difficult to dry, the frequency of the
15 discharge recovery operation can be set low. Here,
the frequency includes not only the frequency of the
recording operation, but also the operation load or
the like of the recovery pump in the recovery
operation. Also, the pre-heating conditions are
20 necessary for bringing about such ink conditions
that optimum recording can be accomplished during
recording in conformity with the characteristic of
the ink used. For example, as regards ink of high
viscosity, it is preferable to heat such ink at a
25 somewhat high temperature to reduce the load of the
ink discharge conditions during the recording by the
recording head, and adjust the viscosity of the ink.

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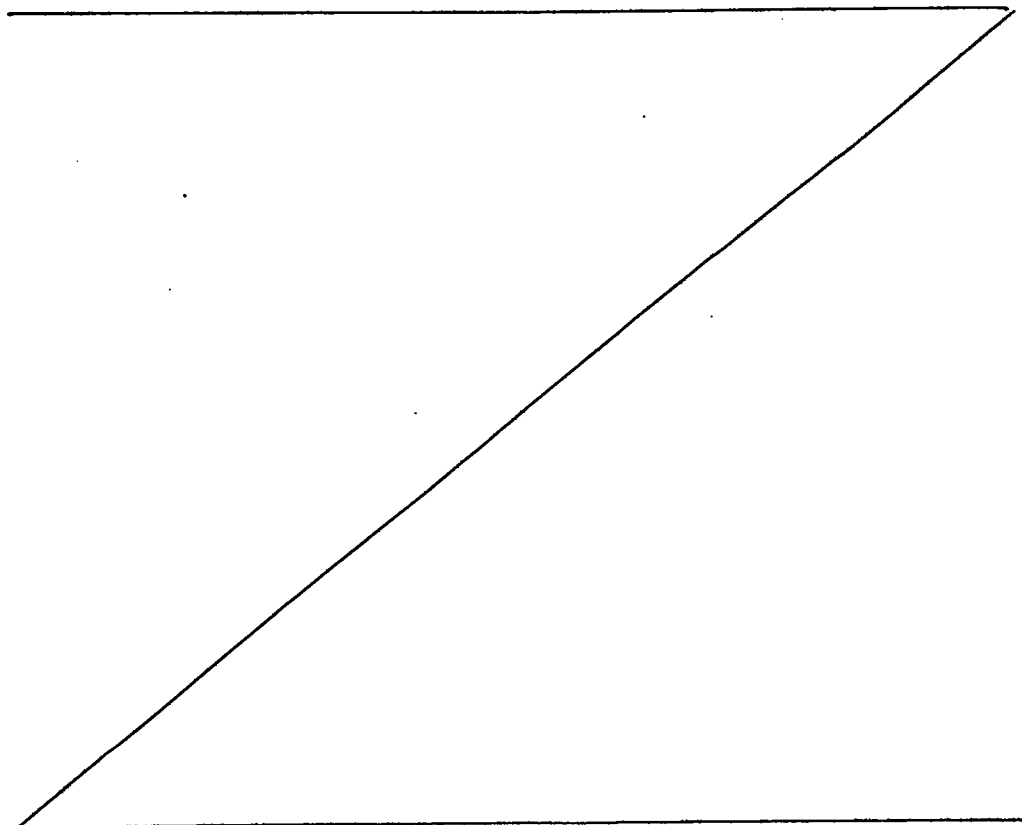
1 By these various conditions being also
included in the conversion table of the body side,
more excellent recording can be accomplished more
easily as compared with a case where discharge
5 conforming to the characteristic of ink is effected
under only the discharge conditions.

As regards the form in which the resistor as
the medium is carried on the ink cartridge, such
resistor may be provided at a predetermined location
10 on the front face of the ink cartridge in which a
collecting portion is provided, but alternatively,
may be provided on the upper surface of the ink
cartridge as shown in Figure 8.

15

20

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1 In this case, as regards the resistance value
of the resistor, a resistor of different resistance
value may be carried between the terminals of the
cartridge side which are connected to the contacts of
5 the apparatus side, or the expanse of the resistor can
be changed, whereby the resistor may assume one of
various resistance values. As a method of changing the
resistance value of the resistor at this time, it is
possible to utilize a logo type or the like of a
10 predetermined shape. Also, the set resistance value
may be such a value that the conversion table set on the
body side as previously described can be properly read
out.

As a method of carrying this resistor on the
15 ink cartridge, mention may be made of a method of forming
the resistor by printing so that it may directly assume
a predetermined resistance value relative to the upper
surface of the cartridge, or a method of sticking a
label printed with a resistor so that it may assume a
20 predetermined resistance value.

For the mounting with respect to the apparatus
of a cartridge provided with such a resistor having a
predetermined resistance value, design is made such
that the terminal of the resistor and the terminal of
25 the body side scratch each other. This is because in
some cases, stable reading of the resistance value
cannot be accomplished even if the terminals are

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1 connected together with their surfaces oxidized and a
film remaining formed thereon, and such instability can
be eliminated by mounting the cartridge in such a
manner that the oxidized film is scraped off.

5 In the foregoing, a resistor has been described
as an example of the resistor carried on the cartridge,
but it is also possible to use a capacitor, a diode, a
coil, a battery or the like for the same purpose.

Figure 9 shows an embodiment of the afore-
10 described ink cartridge in which the information medium
is made removably mountable. In Figure 9, the reference
numeral 28 designates a chip provided with a resistor
which is an information medium. By the chip 28 being
combined with the mating portion of the ink cartridge,
15 this ink cartridge becomes entirely identical in
appearances and function to the ink cartridge shown in
Figure 5. Accordingly, in the manufacture of the ink
cartridge of the present invention, it is unnecessary
to pre-assemble and prepare the housing 12 of the ink
20 cartridge corresponding to the kind of the ink and the
element 19, and it will become easy to prevent the
mixing of products if the chip 28 is mounted when the
ink cartridge is filled with the ink, and efficient
production becomes possible with a result that an
25 inexpensive and highly reliable ink cartridge is realized.

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1 [Embodiment 2]

2 In Embodiment 1, a simple element such as a
3 resistor has been shown as the information medium, but
4 in the present invention, a semiconductor can be
5 employed as another example of the information medium.
6 Figure 10 shows an embodiment of the present invention
7 which is provided with an electrically erasable read-only
8 semiconductor memory array as the information medium
9 in the ink cartridge. The reference numeral 21 denotes
10 the ink cartridge body. The reference numeral 22
11 designates a semiconductor memory array. Here, the
12 semiconductor memory array is an ROM (read-only memory),
13 an EEPROM (electrically erasable rewritable read-only
14 memory), a battery back-up RAM or the like. The
15 reference numeral 23 denotes a substrate attached
16 accurately to the housing portion of the ink cartridge.
17 This substrate has a terminal portion 26 for fixing
18 the memory array thereto and electrically connecting
19 the memory array to a connector prepared in an ink jet
20 recording apparatus 24. As shown in Figure 10, when
21 the ink cartridge body is inserted into the ink
22 cartridge receiving portion 27 of the ink jet recording
23 apparatus 24, the connector 25 and the terminal portion
24 26 are electrically connected together. At this time,
25 an ink reservoir and a waste ink reservoir are likewise
26 connected to the connecting device of the ink jet
27 recording apparatus.

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1 The series of operation sequences when in this
state, the power source switch of the ink jet recording
apparatus body is closed are similar to those shown in
Figure 7. In the present embodiment, the memory array
5 provided on the ink cartridge permits more information
to be recorded thereon than the information medium
shown in Embodiment 1 (memory arrays of 1 or more (K
byte) as the lowest capacity are now commercially
available) and therefore, the ink jet driving conditions,
10 the discharge recovery conditions, the pre-heating
conditions, etc. are directly written therein as in
the conversion table carried on the apparatus body in
Embodiment 1. Accordingly, the CPU quickly transfers
the information such as the ink jet driving conditions
15 as the data during the driving of the ink jet recording
head from the memory array to a particular area of the
RAM after the closing of the power source switch. When
the recording head is to be driven, the driving may be
effected in a manner similar to that described with
20 respect to Embodiment 1.

A feature of the present embodiment is that as
previously described, the information such as the
driving conditions, etc. matching the ink in the ink
cartridge is recorded in the memory of the ink cartridge
25 for each kind of the ink jet recording head and therefore
a conversion table need not be prepared on the ink jet
recording apparatus body. Accordingly, it is unnecessary

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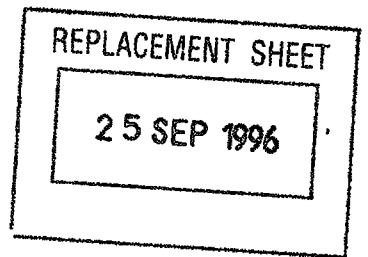
1 to prepare a number of conversion tables in advance.
That is, in the present embodiment, even if new ink
is prepared in the future, only the ROM data of the
ink cartridge can be changed and therefore, the present
5 embodiment is high in expansibility.

Figure 11 shows an example of the ink cartridge
in which the removably mountable information medium
adopts the memory array as described in connection
with Figure 10. In Figure 11, the reference numeral
10 30 designates a semiconductor memory array such as
ROM, EEPROM or a battery back-up RAM. The semiconductor
memory array 30 has on the housing 31 thereof a terminal
33 for electrically connecting the memory array to the
connector 32 of the ink cartridge. The reference
15 numeral 34 denotes a terminal for electrically connecting
the ink jet recording apparatus body to the memory
array. Accordingly, again in the present embodiment,
it is apparent that an effect similar to that of the
embodiment shown in Figure 9 is obtained.

20

[Embodiment 3]

Figure 12 shows another embodiment of the
present invention in which the information such as the
ink jet recording head driving conditions are recorded
25 in a memory on the ink cartridge in parallelism to
the direction of insertion of the ink cartridge into
the ink jet recording apparatus. The reference numeral



1 35 designates a magnetic tape on which the information
such as the ink jet driving conditions is recorded at
35a in parallelism to the direction of insertion of
the ink cartridge by variations in magnetization polarity,
5 density, etc. Also, in order to prevent unsatisfactory
reading of the information caused by a change in the
insertion speed, exclusive tracks in which timing
information is written at predetermined intervals are
set at 35b in parallelism to the track in which the
10 aforementioned information is written.

As shown in Figure 12, the information such as
the ink jet head driving conditions recorded on the
magnetic tape is successively read by a reading head
36 when the ink cartridge is inserted into the ink jet
15 recording head body. After this information is
transferred to the RAM area in the ink jet recording
apparatus body, the ink jet recording head can be
driven on the basis of this information in the same
manner as in the embodiment shown in Figure 10.

20

[Embodiment 4]

Figure 13 shows another embodiment in which
the method of recording information on the ink cartridge
in the embodiment shown in Figure 12 is changed. In the
25 present embodiment, the information such as the ink jet
driving conditions uses a bar code 37 stucked to the
housing portion of the ink cartridge, in place of the

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1 magnetic tape shown in the previous embodiment. Again
in this case, as in the previous embodiment, the
information such as the recording head driving conditions
is successively read by a reading head 38 when the ink
5 cartridge is inserted into the ink cartridge receiving
portion 27 of the ink jet recording apparatus. In the
present embodiment, a bar code need only be printed as
the recording medium and therefore, the medium can be
manufactured relatively easily and an inexpensive ink
10 cartridge can be provided.

[Embodiment 5]

Figure 14 shows another embodiment in which the
method of recording information on the ink cartridge in
15 the embodiment shown in Figure 13 is changed. In
Figure 14, the reference numeral 39 designates an ink
cartridge, and the reference numeral 40 denotes a
three-dimensional information pattern disposed on the
housing of the ink cartridge. The information pattern
20 40 is molded integrally with the housing of the ink
cartridge. The reference numeral 41 designates a
three-dimensional information pattern for timing
information. As shown in Figure 14, the information
such as the ink jet recording head driving conditions
25 recorded on the three-dimensional information pattern
is successively read by a reading cam switch 42 when
the ink cartridge is inserted into the ink cartridge

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1 receiving portion of the ink jet recording apparatus.
After this information is transferred to the RAM area
in the ink jet recording apparatus body, the ink jet
recording head can be driven on the basis of this
5 information in the same manner as in the embodiment
shown in Figure 10.

[Embodiment 6]

Figure 15 shows another embodiment in which the
10 method of recording information on the ink cartridge
in the embodiment shown in Figure 14 is changed. In
Figure 15, the reference numeral designates an ink
cartridge, and the reference numeral 41 denotes a
three-dimensional information pattern disposed on the
15 housing of the ink cartridge 40. The information pattern
41 is molded integrally with the housing of the ink
cartridge. The reference numeral 42 designates a
three-dimensional information pattern for timing
information. In the embodiment shown in Figure 15,
20 the information such as the ink jet head driving
conditions so recorded in the three-dimensional
information pattern is successively read by the
photoelectric switch 43 of the ink jet recording head
body when the ink cartridge is inserted into the ink
25 jet recording apparatus. After this information is
transferred to the RAM area in the ink jet recording
apparatus body, the ink jet recording head can be

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1 driven on the basis of this information.

5 The medium for transmitting the information by the
aforedescribed various systems, as shown in Figure
16, may preferably be disposed, for example, above the
ink connecting portion between the ink cartridge and
the recording apparatus with respect to the direction
of gravity. That is, it is preferable that as shown
in the surfaces 44-48 on the cartridge in Figure 16,
the information medium or the information delivery
10 portion between the information medium and the ink jet
recording apparatus body be positioned above the level
line of a cap 15 which is the ink connecting portion
between the ink cartridge and the ink jet recording
apparatus.

15 By the information medium or the information
delivery portion between the information medium and
the ink jet recording head being so provided above
the ink connecting portion with respect to the direction
of gravity, the ink flows downwardly of the cartridge
20 along the direction of gravity even if it leaks from
the ink connecting portion and therefore, the medium
can be prevented from being wetted by the ink. Thus,
adverse effects such as electrical leak, the corrosion
of the terminal portion and the unsatisfactory operation
25 of the sensor caused by slight leakage of the ink during
the mounting or dismounting of the ink cartridge can be
minimized.

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1 The ink cartridge 154 of the present invention
can also be applied to an ink cartridge for supplying
ink to the ink imparting portion 153 of an apparatus
of the type in which as shown in Figure 17, when an
5 ink retaining member 152 passes through the ink
imparting portion, a hole or recess 156 formed in the
ink retaining member 152 is filled with ink and when
the ink reaches the surface of the hole or recess 156
in the ink retaining member 152 filled with ink or the
10 surface of a recording head 151, a desired voltage is
applied to the recording head 151 to thereby discharge
the ink and form an image on a recording medium 157
disposed in opposed relationship with the recording
head 151 and moved on a platen.

15 In this case, as in each of the aforescribed
embodiments, control can be effected such that the
various kinds of information given to the cartridge
154 are transmitted by the interface 159 between the
ink imparting portion 153 and the cartridge and a
20 processing table based on the information is selected
to thereby effect predetermined driving of the head 151.

[Embodiment 7]

25 The ink cartridge carrying thereon an information
medium in the form as previously described has a
construction as shown, for example, in Figure 19, and
can be applied to an ink jet recording apparatus which

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1 is shown with its cover removed.

In Figure 18, the reference numeral 201 designates a recording head in the form of a chip, and the reference numeral 202 denotes a carriage carrying the recording head 201 thereon and enabling the movement of its own for the scanning by the recording head 201. On the carriage 202, as will be described later, there are provided a support member for removably carrying the recording head 201 thereon, and a cover member (indicated by dot-and-dash line) forming a part of the recording head 201 and protecting a substrate printed with a head driving circuit or the like.

The recording head 201 has 64 discharge openings disposed in the front end portion thereof, and an ink liquid path communicating with each of these discharge openings is provided. Further, behind the region in which the ink liquid paths are disposed, there is provided a common liquid chamber for supplying ink to these liquid paths. In the ink liquid paths corresponding to 64 discharge ports, there are provided electro-thermal conversion elements generating discharge energy available to discharge the ink liquid from these discharge ports and electrode wiring for supplying electric power to the electro-thermal conversion elements.

These electro-thermal conversion elements and electrode wiring are formed on a substrate formed of

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1 silicon or the like by the film-forming technique, and
partition walls, a top plate, etc. formed of resin or
a glass material are layered on this substrate, whereby
said discharge openings, said ink liquid paths and
5 said common liquid chamber are constructed. Further
rearwardly of said construction in the recording
head 201, a driving circuit for driving the electro-
thermal conversion elements on the basis of a recording
signal is provided in the form of a printed substrate.

10 In the carriage 202, rearwardly of the above-
described recording head 201, there is disposed a
connector substrate 212 through a connector 209. On
the connector substrate 212, there are disposed the
connector 209 for connection to the recording head 201
15 and a connector for connection to a flexible cable from
the control circuit of the apparatus body. Also, a
capacitor, a resistor, etc. are mounted on the connector
substrate 212, and by these, the drop of the power
source voltage supplied through the flexible cable and
20 the mixing of noise with a signal are compensated for.
Further, the connector substrate 212, as will be
described later, is supported on a slide member so that
it may slide with the opening-closing movement of the
cover member and the connector 209 may be connected
25 to the terminal of the recording head 201.

The carriage 202 is slidably and pivotably
engaged with a guide shaft 203 through an engagement

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1 portion 262a, and the guide shaft 203 is provided over
an area longer than the width of recording paper so as
to be orthogonal to the direction in which a recording
medium such as recording paper is conveyed. Also, the
5 carriage 202 is connected to a portion of a belt, not
shown, extended in parallelism to the guide shaft 203,
and by this belt being driven by a carriage motor, not
shown, the movement of the carriage 202 along the guide
shaft 203, i.e., the scanning movement of the recording
10 head 201, becomes possible. Also, the carriage 202
and the recording head 201 obtain the force for
pivotally moving about the guide shaft 203 from their
own gravity, and with this force as a biasing force,
they bias a paper keep plate 208 to be described
15 through a slide member provided on the carriage 202 for
sliding on the paper keep plate. Thereby, the recording
head 201 can keep a predetermined spacing between it
and the recording paper used in conformity with the
thickness of the recording paper.

20 The recording paper 206 fed from a paper
supply cassette, not shown, or fed manually is supplied
to the apparatus body through a paper supply port
comprised of an upper paper guide 207a and a lower
paper guide 207b. The paper keep plate 208 having a
25 curvature is continuous to the extension of the upper
paper guide 207a. The paper keep plate 208 is
disposed so as to press the recording paper against a

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1 paper feeding roller 205, and is formed of such a
material that the frictional force created between the
paper keep plate and the recording paper during the
pressing is smaller than the frictional force created
5 between the paper feeding roller 205 and the recording
paper. Also, the lower paper guide 207b extends to
the region in which the paper feeding roller 205 is
disposed parallel to the paper keep plate 208.

Thus, the recording paper 206 fed from the
10 paper supply port is conveyed by one line each upwardly
in the apparatus with the rotation of the paper feeding
roller. At this time, the recording paper 206 slides
on a plate-like platen 207 while the spacing between
it and the recording head 201 is regulated to a
15 predetermined magnitude by the paper keep plate 208 and
the platen 207.

The recording head 201, with its scanning
movement, discharges ink droplets to the recording area
of the recording paper 206 opposed thereto to thereby
20 effect recording of one line, and by this recording
and the conveyance of the recording paper for said
one line, recording of each one line is sequentially
effected, whereby characters, images or the like are
formed. The recording paper 206 on which recording
25 has been effected, with the conveyance thereof, is
discharged onto a paper discharge tray, not shown, by
paper discharge rollers 204 and spurs 240A and 240B

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1 provided above the recording paper conveyance path.
Five pairs of such spurs 240A and 240B are provided
correspondingly to the paper discharge rollers 204,
and a spur cleaner is interposed between each pair of
5 spurs. A member for supporting these spurs and spur
cleaners is not shown in Figure 18. The spurs 240A
are designed to impart a pressure force to the paper
discharge rollers 204 with the recording paper
interposed therebetween, and the spurs 240B are designed
10 to regulate the recording paper conveyance path between
them and the platen 207. The paper discharge rollers
204 are rotatively driven so as to be greater in
peripheral speed than the paper feeding roller 205,
whereby the recording paper 206 in the portion thereof
15 constituting the recording area is pulled upwardly and
thus, the recording paper 206 can be prevented from
floating up from the platen 207.

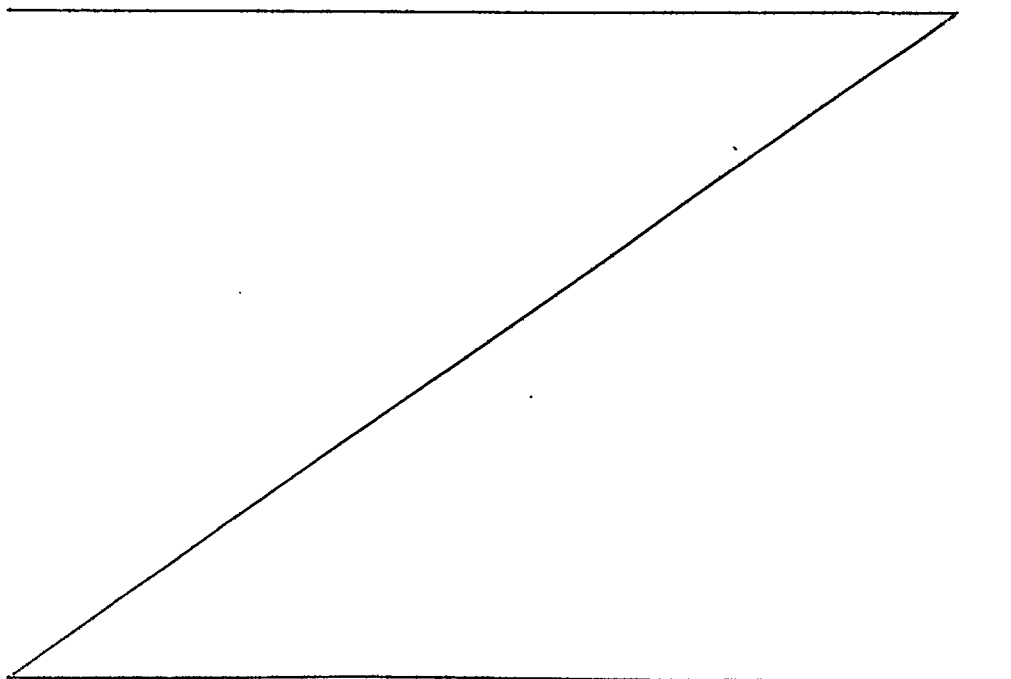
Near the home position in the area continuous
to the scanning area of the recording head 201, there
20 are provided a series of constructions for the discharge
recovery process. That is, there are provided a blade
226 for removing water drops, dust, etc. on the discharge
port surface in which the discharge ports are disposed
by the wiping movement thereof, an absorbing portion
25 225 for removing water drops, etc. on the discharge
port surface chiefly by absorbing them, and a cap 213
for effecting the capping for the hermetic sealing of

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1 the discharge port surface, idle discharge and ink
absorption. These members are designed to be movable
back and forth relative to the moving area of the
recording head 201 while being supported as a unit by
5 a moving support member 214, and performs their
respective operations at appropriate timing. Also,
the ink absorption in the cap 213 is effected by a
pump 224 communicating with the cap 213 through the
hollow portion of the moving support member 214 and
10 a tube. During the capping by the cap 213, a hole
formed in a cap arm 217 mounted on a side of a holding
member for the cap 213 and a projected portion provided
on the carriage 202 are engaged with each other, whereby
the recording head 201 is precluded from rotating
15 rearwardly to thereby ensure the capping of the
discharge port surface by the cap 213.

20

25



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1 The rotation of the paper feeding roller 205,
and the paper discharge rollers 204, and the operations
in the discharge recovering mechanism, i.e., the back
and forth movement of the cap 213, the blade 226 and
5 the absorbing member 225 as a unit and the absorbing
operation by the pump 224, are performed by the
utilization of the rotative driving force of a feed
motor 221. That is, the rotative driving force of the
feed motor 221 mounted on a portion of the apparatus
10 body frame is first transmitted to a transmission
switching gear train 219. In this gear train 219, the
selection and switching of each gear is effected by the
movement of a selection gear (not shown) operatively
associated with the movement of the carriage 202, i.e.,
15 the scanning movement by the recording head 201, the
movement to the home position or the discharge recovery
device and the stoppage at these positions. Thereby,
the rotation of each gear in the gear train 219 is
transmitted to the paper feeding roller 205 and the
20 paper discharge rollers 204 through an intermediate feed
gear 220, and transmitted to the cap 213, etc. finally
through a cam 216, and further transmitted to the pump
224 through a pump gear 222 and a pump cam 223.

 The supply of ink to the recording head 201 is
25 effected from an ink cartridge 227 mounted in the
recording apparatus body, through a flexible tube
capable of following the movement of the carriage 202.

1 Also, the moved position of the carriage 202 is
detected by counting the number of steps of the
carriage motor with the position of engagement between
a home position sensor 211 provided on the carriage
5 202 and a home position detecting flag provided near
the end of the movement area of the carriage 202 as
the reference.

Description will now be made of the construction
of the ink cartridge 227 according to the present
10 embodiment and the construction of the mounting portion
of the body side on which the ink cartridge is mounted.

Figures 19A and 19B show an example of the
construction of the mounting portion of the body side.

First, in Figure 19A, the reference numeral 302
15 designates a cartridge inserting portion for receiving
the insertion of the ink cartridge 227. The reference
numeral 304 denotes a contact holder for holding leaf
spring-like contacts 306A and 306B as means for reading
the information provided on the ink cartridge 227.

20 The contact holder 304 is combined with the inserting
portion 302 by a latch portion 308 being engaged with
a hole 310 in the inserting portion 302. The reference
numeral 312 designates a connector for connecting the
contacts 306A and 306B to a body control unit.

25 The reference numeral 314 denotes a hollow
needle member which enters the interior of a containing
bag for ink to be supplied which is contained in the ink

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1 cartridge 227. The hollow needle member 314 is formed
with an ink conducting aperture 316 in the tip end
portion thereof. An ink supply tube is mounted on the
other end of the needle 314, and the tube is connected
5 to a common liquid chamber portion in a head chip 110
provided on the recording head 201. Means for detecting
the amount of remaining ink can be provided intermediately
of this ink supply system.

The reference numeral 318 denotes a waste ink
10 pipe for directing waste ink to an ink absorbing member
which enters the ink cartridge 227 and is contained
therein. The waste ink is ink discharged during the
ink refreshing process, for example, in the ink supply
system or the common liquid chamber, or ink discharged
15 during the recovery process.

The reference numeral 320 designates clicks as
a fastening means for the ink cartridge 227. One click
320 is provided on each side of the inserting portion
302. These clicks 320, as shown in Figure 19B, receive
20 the insertion of the cartridge 227 by an engagement
portion 322 being resiliently flexed with the engagement
thereof with a side of the cartridge 227 during the
insertion of the cartridge 227, and hold the cartridge
227 in that position by the engagement portion 322
25 restoring its original shape when a recess 332 in the
cartridge 227 reaches the clicks.

Figure 20 shows an example of the construction

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1 of the ink cartridge 227 according to the present
embodiment.

In Figure 20, the reference numeral 340 denotes
an ink bag containing therein ink to be supplied. .

5 The ink bag 340 is provided with a plug 342 made, for
example, of rubber. The needle 314 is inserted into
this plug 342 and further enters the interior of the ink
bag, whereby ink communication is accomplished. The
reference numeral 344 designates an ink absorbing member
10 for receiving the above mentioned waste ink. The
aforedescribed medium for transmitting the characteristic
of the ink in the cartridge is attached to a portion of a
side or the upper surface of the ink cartridge 227.

Figure 21 illustrates each portion for coupling
15 the ink cartridge 227 to the body side. In Figure 21,
the reference numeral 346 denotes a wiring resistance
pattern provided on the upper surface of the ink cartridge
227, and the control unit of the apparatus body can
detect the presence or absence of the mounted ink
20 cartridge in conformity with the conduction/non-
conduction between the contacts 306A - 306B through
the wiring resistance pattern 346. Also, by this wiring
resistance pattern being made into a resistance pattern
having a resistance value determined in conformity with
25 the color or density or the like of the ink containing
this pattern, the control unit of the apparatus body can
read the information thereof.

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1 In the present embodiment, the location and
dimensions of each coupling portion are determined so
that an inserted position (1) in which the needle 314
penetrates through the plug 342 with the insertion of
5 the ink cartridge 227 and the aperture 316 comes to the
interior of the ink bag 340, whereby ink communication
is accomplished, a position (2) in which the contacts
306A and 306B are connected to the wiring resistance
pattern 346 and a position (3) in which the clicks 320
10 are engaged with recesses 332, whereby the ink cartridge
227 is held may lie in the named order in the direction
of insertion. That is, design is made such that when
the operation inserts the cartridge 227, the needle 314
first enters the interior of the ink bag 340 and when
15 the cartridge is further inserted, the contacts 306A and
306B are then connected to the resistance pattern 346
and only when the cartridge is still further inserted,
the clicks 320 come into engagement with the recesses
332. In the case of the present embodiment, the ink
20 cartridge 227 contains the waste ink also therein and
therefore, it is desirable that in the position (1),
the waste ink pipe 318 be also positioned in the ink
cartridge 227.

 The above-described positional relation is
25 shown in Figure 22. In Figure 22, (4) indicates a
position in which the ink cartridge 227 finally strikes
in the direction of insertion, and the range from (3)

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1 to (4) is a range in which the cartridge 227 is movable
in its held position due to the back-lash of the clicks
320 and recesses 332, or a range in which the clicks 320
come into engagement with the recesses 332 and the
5 cartridge 227 is further inserted until it strikes
against the innermost part of the inserting position
302.

If such positional relation is not assumed,
there will occur inconveniences as shown in Figure 23.

10 That is, in the relation shown in Figure 23A,
even if cartridge holding is done, the information
regarding the cartridge cannot be read through the
contacts 306A and 306B and therefore, in some cases,
the control unit of the apparatus body may judge that
15 the cartridge is not yet inserted. In the relation
shown in Figure 23B, contact connection is effected
prior to ink communication and therefore, the control
unit of the apparatus body may judge that the cartridge
has been mounted, and may start a predetermined operation,
20 whereby air may be introduced from the needle 314 into
the ink supply system. This also holds true of the
relation shown in Figure 23C and moreover, if the
operation discontinues the inserting operation by the
confirmation of a click sound, ink communication will
25 not be provided at all.

Also in the relations shown in Figures 23D and
23E, in spite of cartridge holding being done, there is

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1 a case where the needle 314 is out in that range or
contact connection becomes unstable.

In contrast, according to the relation as shown
in Figure 22, ink communication, contact connection and
5 cartridge holding take place in the named order during
the insertion of the cartridge and therefore, the
operator only need confirm cartridge holding simply
by a click sound or the like. Also, even if the control
unit of the apparatus body immediately starts its
10 operation in response to contact connection, there will
not occur the inconvenience that air is introduced into
the ink supply system, and even if conversely, the
cartridge 227 is pulled out during the operation of the
control unit of the apparatus body, the control unit of
15 the apparatus body will detect it before ink communication
is cut off and therefore, a similar inconvenience will
not occur if the operation is discontinued.

Figure 24A shows a further improvement in the
above-described construction. In the example shown
20 there, the wiring resistance pattern is divided into
two, and the pattern lying forwardly with respect to
the direction of insertion of the cartridge is a pattern
346A for short-circuiting the contacts 306A-306B, and
the pattern lying rearwardly is a resistance pattern
25 346B having a resistance value determined in conformity
with the color, density, etc. of the ink.

Figure 24B shows the relation among a range

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1 within which ink communication is done in such a
construction, a range within which the contacts 306A
and 306B are in contact with the pattern 346A, a range
within which the contacts 306A and 306B are in contact
5 only with the pattern 346B, and a range within which the
cartridge is held.

In Figure 24B, (1) indicates a limit position in
which ink communication is done as described above, (3)
indicates a limit position in which the cartridge 227 is
10 held, and (4) indicates the innermost position in which
the cartridge 227 strikes. Also, (2A) indicates a limit
position on this side with respect to the direction of
insertion in which the contacts 306A and 306B are in
contact with the pattern 346A and are short-circuited,
15 and (2B) indicates a limit position on this side with
respect to the direction of insertion in which the
contacts 306A and 306B are off the pattern 346A and in
contact only with the pattern 346B and the resistance
value of this pattern is read. Here, it is desirable
20 that the position (2B) be the position (3) or a position
near it, and in the present example, a position near
the position (3) in the direction of insertion of the
cartridge in which particularly the engagement between
the clicks 320 and the recesses 332 is released and the
25 cartridge 27 is ready to slip out.

The relation among the various positions is as
shown, and an effect similar to that in the case of

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1 can be started at suitable timing during the closing of
the power source switch of the apparatus or during the
interchange of the ink cartridge 227, and in addition,
during the recording operation.

5 When this procedure is started, the resistance
value is first read at a step S1. If at this step, the
resistance value is infinity, it means a case where the
cartridge 227 is not mounted and therefore, advance is
made to a step S3, where the operation of each portion
10 is maintained in its stopped state, and at a step S5,
the operator is noticed to promote to insert the cartridge
227.

On the other hand, if the resistance value is "0",
it means that the cartridge 227 is ready to slip out and
15 therefore, advance is made to a step S7, where the
operation of each portion is stopped, whereafter at
a step S9, the operator is noticed to promote the
operation for the cartridge 227 to be surely held.

Further, if the resistance value is a predetermined
20 value, it means that the cartridge 227 is already surely
held and therefore, the information (the color or the
like of the ink) regarding the cartridge corresponding
to that resistance value is recognized and a setting
process corresponding thereto is carried out (a step S11).

25 That is, when the operator has inserted the
cartridge 227 but the clicks 320 have not come into the
recesses 332, or when the engagement therebetween has be

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1 released for some reason or other, the cartridge
holding is not complete and therefore the cartridge is
liable to slip out. In such a case, the contacts 306A
and 306B are connected to the pattern 346A, whereby the
5 control unit 400 of the apparatus body becomes unable to
read the inherent information of the cartridge 227 and
therefore, the control unit 400 of the apparatus body
can recognize such a situation and switch off the
operation of the apparatus, thereby noticing the
10 operator to promote to surely insert the cartridge 227.
Thus, the operator can be noticed of such a danger that
the cartridge 227 will slip out of the apparatus.

If the positional relation as described above can
be basically kept with regard to the reading position for
15 the information regarding the supplied ink communication
and the cartridge and the cartridge holding position, it
is of course possible that the cartridge and the
inserting portion therefor adopt suitable constructions.
For example, the cartridge holding need not always
20 resort to the clicks and recesses. Further, the reading
of the information regarding the ink cartridge need not
always be electrical, but may be, for example, optical.
Furthermore, in the above-described embodiment, the
waste ink is also introduced into the cartridge, but the
25 cartridge may also be of the type which effects ink
supply alone.

By adopting such a construction, reliable reading

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1 of the information can be accomplished in the cartridge
carrying thereon the information medium as previously
described, and the driving of the recording head best
suited for the ink used can be accomplished. -

5

[Embodiment 8]

Figure 26 shows another example of the ink
cartridge mounting mechanism according to the present
invention. In Figure 26, the reference numeral 304
10 designates an example of the ink cartridge according to
the present invention, and the reference numerals 341
and 342 denotes unlocking members projectedly provided
on the left and right side walls of the ink cartridge
304. The reference numerals 336 and 337 designate
15 locking members according to the present invention which
are provided along the left and right sides of an
insertion path 332. In the present embodiment, the left
and right locking members 336 and 337 differ in shape
from each other, as shown.

20 In the case of the present embodiment, the
unlocking members 341 and 342 and the locking members
336 and 337 are all disposed at the same level above
the bottom surface of the insertion path 332, but the
unlocking members 341 and 342 differ in their projected
25 position in the direction of insertion. In this case,
it is desirable in preventing the error of manufacture
and malfunctioning that the amount of deviation between

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1 the unlocking members be 5 mm or more.

Thus, when the ink cartridge 304 is further inserted from the state shown in Figure 25, the locking member 342 may reach the end of the wedge portion 337A of the locking member 337 in a state in which the unlocking member 341 has reached the end of the wedge portion 336A of the locking member 336. The reference characters 336B and 337B designate locking grooves in the respective locking members, the reference character 336C denotes an escape portion, and the reference characters 336D and 337D designate returning wedge portions provided to return a protective plate 333 smoothly from its pushed-up position to its locked position as shown.

Reference is now had to Figures 27A-27D to describe the cartridge mounting operation in the ink cartridge mounting mechanism constructed as described above. First, when the ink cartridge 304 is mounted in a normal posture, as shown in Figure 27A, the unlocking members 341 and 342 provided on both sides of the ink cartridge 304 slidably contact with the wedge portion 336A of the locking member 336 and the wedge portion 337A of the locking member 337, respectively, and pivotally move the locking members 336 and 337 in opposite directions as shown in Figure 27B to thereby liberate the protective plate 333 from the restraint by the locking grooves 336B and 337B, and rotate the

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1 protective plate 333 in the direction of arrow B
against the spring force of a spring 335 as shown in
Figure 26, whereby the ink cartridge 304 can be
directed to its mounted position.

5 However, when the ink cartridge 304 is mounted
upside down by mistake as shown, for example, in Figure
27C, the unlocking members 341 and 342 pivotally move
the locking members 336 and 337 as shown in Figure 27D and
thus, the protective plate 333 is not liberated from
10 these locking members. Also, even if the locking members
336 pivotally moves at all, the unlocking member 342
will be stopped in the escape portion 336C and the front
face of the ink cartridge will bear against the
protective plate 333. Consequently, the inserting
15 movement of the ink cartridge 304 will be precluded by
the protective plate 333 and the ink cartridge 304 will
not be directed to its mounted position. Although not
shown, when the ink cartridge 304 is about to be mounted
with its front and rear reversed, the unlocking members
20 are likewise absent and therefore the locking members 336
and 337 are not operated. Thereby the reliability of the
cartridge mounting is ensured and thus, the transmission
of the information from the information medium carried
on the cartridge can also be reliably accomplished.

25

[Embodiment 9]

Figure 28 shows still another embodiment of

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1 the present invention. In the ink cartridge 304
according to this embodiment, the unlocking members 341
and 342 provided on both sides thereof are made to
differ from each other in the level from the insertion
5 path 332. Again in the present embodiment, it is
desirable for the same reason as set forth in the
previous embodiment that the amount of the deviation
between the unlocking members be 5 mm or more. Thus,
the locking members 336 and 337 are also disposed so
10 as to keep levels corresponding to the unlocking
members 341 and 342.

In the ink cartridge mounting mechanism
constructed as described above, even if the ink
cartridge 304 is inserted upside down, the left and
15 right unlocking members 341 and 342 will not come into
engagement with the locking members 336 and 337, and if
the ink cartridge is inserted with its front and rear
reversed, the unlocking members are not present on the
first half of the cartridge, whereby the locked state of
20 the protective plate 333 is not released and thus, wrong
mounting is prevented.

Figures 29A and 29B show an ink cartridge
according to yet still another embodiment of the present
invention. The present embodiment is such that the
25 locations of the unlocking members are changed for each
ink cartridge and for example, ink cartridges containing
therein inks which differ in the characteristics thereof

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1 such as color, etc. can be correctly mounted on their
corresponding mounting portions. That is, the ink
cartridge 304A shown in Figure 29A and the ink
cartridge 304B shown in Figure 29B are made to differ
5 in the locations of unlocking members 341 and 342 in the
direction of height and the amounts of horizontal
deviation thereof differ from each other as indicated
by D1 and D2.

So, assuming that for example, red ink is
10 contained in the ink cartridge 304A and black ink is
contained in the ink cartridge 304B, although not shown,
locking members provided on the mounting portion of a
red ink supply system and the mounting portion of a black
ink supply system are made to correspond to the levels of
15 the unlocking members 341 and 342, whereby even if a
wrong attempt is made to mount an ink cartridge of
a different color, the mounting thereof can be precluded
and at the same time, the mounting of the individual ink
cartridges 304A and 304B themselves in a wrong posture
20 can be prevented. By wrong mounting being thus
prevented, the reliable transmission of information
can be accomplished in the cartridges of the aforescribed
construction each having as information medium and
optimum driving of the recording head matching the ink
25 used can be accomplished.

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1 [Embodiment 10]

Figures 30A and 30B show another embodiment of the ink cartridge according to the present invention. In these figures, the reference numeral 401 designates an ink cartridge having therein an ink containing
5 portion, not shown, the reference numeral 402 denotes a shutter kept slidable along an opening 401A in the upper surface of the cartridge 401, the reference character 402A designates a shutter projection projected upwardly
10 from the shutter 402, and the reference numeral 403 denotes a coil spring interposed between the shutter 402 and a spring receiving wall 401B. By this coil spring 403, the shutter 402 is biased leftwardly along the opening 401A and the shutter projection 402A is caused
15 to bear against the end edge of the opening 401A to thereby keep the opening 401A closed.

The reference numeral 404 designates a flag member pivotable about a support shaft 405 and formed, for example, of a material capable of intercepting
20 infrared light. The support shaft 405 is journaled to the wall portion of the cartridge 401. The reference numeral 406 denotes a torsion coil spring provided around the support shaft 405 and having one end thereof restrained by the flag member 404 and the other end secured
25 to the wall portion of the cartridge 401. The torsion coil spring 406 biases the flag member 404 clockwise about the shaft 405 to thereby bias the same toward

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1 the back side of the shutter 402. On the other hand,
the reference character 422A designates a stopper
portion projectedly provided from a cartridge guide
422 toward a cartridge insertion path 426. When the
5 ink cartridge 401 is inserted from right to left as
viewed in Figure 30A, the shutter projection 402A bears
against the stopper portion 422A, and with a further
inserting operation thereafter, it serves to open the
shutter 402 against the spring force of the spring 403.

10 The reference numeral 424 denotes a light detecting
sensor of the transmission type endowed, for example,
with the infrared light detecting function. The sensor
424 is carried on a carriage. When the ink cartridge 401
is inserted from the state of Figure 30A along the
15 cartridge insertion path 426, the shutter 402 is opened
by the stopper portion 422A as previously described, and
in the completely mounted state of the ink cartridge 401
shown in Figure 30B, the shutter 402 is fully opened and
at the same time, the flag member 404 is cocked up by
20 the spring force of the torsion coil spring 406 and bears
against the stopper portion 422A, and is kept in a
posture for intercepting the optical path of the
detecting sensor 424. The end portion 402B of the
shutter 402 which is projectedly provided along the
25 direction of the opening therein serves to suppress
the cocking-up of the flag member 404 when the ink
cartridge 401 does not assume its completely mounted

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1 position as shown in Figure 30B, but assumes an
incompletely mounted position, and as long as the flag
member 404 is not cocked up, said end portion 402B is
not detected by the detecting sensor 424 and thus, the
5 incomplete insertion of the ink cartridge 401 can be
prevented. Accordingly, in this case, it is preferable
to keep the gap between the flag member 404 and the
shutter 402 as small as possible, and by doing so, the
timing at which the flag member 404 is cocked up, i.e.,
10 the timing at which the ink cartridge 401 is completely
mounted, can be made more accurate.

Also, when the ink cartridge 401 is to be
removed from the recording apparatus, the ink cartridge
401 is drawn out rightwardly from the state of Figure
15 30B, whereby the flag member 404 is pushed by the
stopper portion 402A and is rotated counterclockwise
and also the shutter 402 is moved by the spring force
of the coil spring 403 in a direction to close the
opening 401A, and in the completely drawn out state of
20 the cartridge, the flag member 404 is housed under the
shutter 402.

In the ink cartridge thus constructed, the flag
member for detecting the mounting of the cartridge which
is provided in the cartridge itself is housed in the
25 interior thereof before the cartridge is mounted and
thus, does not spoil the external appearance of the
cartridge and the cartridge is easy to handle, and on

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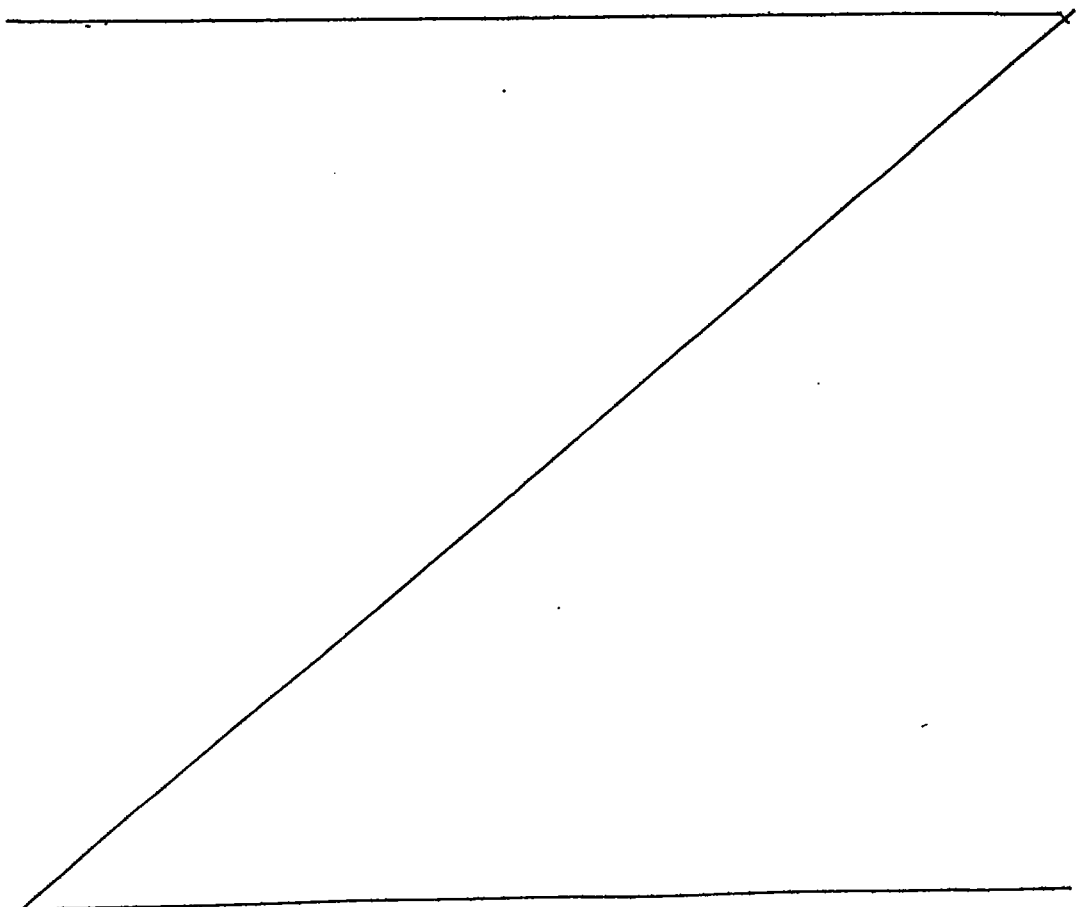
1 the other hand, it is only required on the recording
apparatus side to dispose a hole for cocking up and down
the flag member and a stopper portion provided in the
cartridge guide and moreover, as will be described
5 later, by a simple construction, various kinds of
information regarding the ink cartridge can be provided
to the user with high reliability.

Such a construction enables the cartridge to
be reliably mounted with respect to the apparatus and
10 therefore, for example, in the case of a cartridge
carrying an information medium thereon, the corresponding
information is reliably transmitted.

15

20

25



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1 Figures 31A-31C shows another embodiment of
the ink cartridge according to the present invention.
In these figures, only a flange member 404 is shown,
and the reference characters 404A, 404B and 404C designate
5 the light intercepting portions thereof. By the light
intercepting portions 404A, 404B and 404C being so changed
in accordance with the direction along the support shaft
405 thereof, i.e., the direction of movement of the
carriage, the detecting position by the detecting sensor
10 shown in Figures 30A and 30B can be changed, and different
information regarding the ink cartridge 401 (in the
case of the present embodiment, three kinds of information)
can be obtained due to the difference in the detecting
position. This is an example of other form of the afore-
15 described information medium. Accordingly, the flange
member 404 which differs in the position of the light
intercepting portion as described above from cartridge
to cartridge containing ink therein is used so as to
show the kind, the characteristic or the like of the
20 ink contained in the cartridge 401, and the number of
the kinds of the information is not limited to three
as described above.

The amount of information which can be handled
differs depending on the resolving power during the
25 carriage scanning and the detection width of the detecting
sensor, but where design is made such that detection
of a width of 20 mm is done, for example, by scanning

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1 for 2 mm each, a flag member in which the light inter-
cepting portion is changed in position at a unit of
2 mm is provided in each cartridge, whereby ten kinds
of information can be obtained. If an attempt is made
5 to obtain such information by the conventional system,
ten independent flags will become necessary and moreover,
such flags will have to be arranged at intervals of
2 mm on the recording apparatus side, and this will
unavoidably lead to an increased number of parts as
10 well as the complication, bulkiness and increased cost
of the apparatus, whereas by constructing the cartridge
as shown in the present embodiment, it becomes possible
to save the space by a minimum number of parts and yet
provide numerous kinds of information regarding the
15 ink cartridge.

Figures 32A and 32B show still another embodiment
of the present invention and a construction for transmit-
ting information indicative of the presence or absence
of ink. The present embodiment is one in which for
20 an ink bag 430 in the cartridge 401, there is provided
a flag for informing the user that the amount of ink
remaining in the ink bag has become, for example, a
predetermined amount or less. The reference numeral
440 designates that flag member, and in the present
25 embodiment, in the end portion of that side of the flag
member 440 on which a support shaft 405 is provided,
there is formed a contact portion 440A protruded

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1 substantially in the form of a semicircle, and such
a contact portion 440A may always keep contact with
the surface of the ink bag 430 even in the completely
mounted state of the ink cartridge 401 as shown in Figures
5 32A and 32B and the state of the ink cartridge before
mounted, although not shown.

The reference numeral 441 denotes longitudinal
slots formed in two wall portions of the ink cartridge
401 which are parallel to the plane of the drawing sheet,
10 and the support shaft 405 of the flag member 440 is
fitted in these slots 441 and supported for vertical
movement and rotational movement. Also, in the case
of the present embodiment, a torsion coil spring 406
mounted around the support shaft 405 has a spring force
15 for biasing the flag member 440 clockwise and biasing
the support shaft 405 itself downwardly along the slots
441, and biases the contact portion 440A of the flag
member 440 toward the ink bag 430. ,

According to the ink cartridge 401 thus constructed,
20 before the cartridge 401 is mounted at a predetermined
mounting position along an insertion path 426, the flag
member 440 is housed under the shutter 402 in the same
manner as described previously in connection with Figure
30A, but when the cartridge is surely mounted at the
25 predetermined mounting position, the flag member 440
rises in the manner as shown in Figure 32A or 32B. Thus,
simultaneously with the rising of the flag member, the

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1 contact portion 440A of the flag member 440 is biased
toward the surface of the ink bag 430 by the spring
force of the torsion coil spring 406.

So, in the ink cartridge 401 thus provided with
5 the ink bag 430 as ink containing means, when ink is
sufficiently stocked in the ink bag 430, the entire
flag member 440 rises at a high position as shown in
Figure 32A and thus, the light intercepting portion
440B thereof is kept at a height for intercepting the
10 optical path 435 of a detecting sensor 424, and when
the carriage has been directed to the position of the
cartridge 440, the presence of ink is detected by the
detecting sensor 424 carried on the carriage. Also,
when the ink becomes exhausted, the flag member 440
15 is kept in a low position as shown in Figure 32B even
if it rises, whereby the flag member 440 does not inter-
cept the optical path 435 of the detecting sensor 424,
and the ink is judged to be absent.

As is apparent from the foregoing description,
20 according to the present invention, a medium including
the information for driving the ink jet head is provided
on the ink cartridge, whereby the ink jet recording
apparatus itself can automatically set the driving
conditions of the ink jet head matching the composition
25 of ink and therefore, there can be provided an ink jet
recording apparatus which is simple to operate and high
in reliability.

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1 Also, there can be provided an ink cartridge
which can be prevented from being erroneously inserted
by the user and which has information for properly
controlling the driving of the recording head.

5 Also, as described above, according to the present
invention, in the position wherein an ink tank in the
form of a cartridge forming an ink supply source is
held in the apparatus body, the ink communication with
the ink supply system is done prior thereto and therefore,
10 the ink communication state can be secured near the
held position of the ink tank. Also, the information
regarding the ink tank is readable prior to the holding
of the ink tank and therefore, impossibility of reading
or misjudgment does not occur near the held position.
15 Further, the ink communication is done prior to reading
and therefore, even if the recording operation is
immediately started in response to reading, there will
not occur the inconvenience that air is introduced into
the ink supply system, and even if conversely, the ink
20 tank is pulled out during the recording operation, it
can be detected before the ink communication is cut
off and therefore, no similar inconvenience will occur
if the operation is discontinued.

 Further, as described above, according to the
25 present invention, in the position wherein an ink tank
in the form of a cartridge forming an ink supply source
is held in the apparatus body, the ink communication

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1 with the ink supply system is done prior thereto and
therefore, the ink communication state can be secured
near the held position of the ink tank. Also, the
inherent information regarding the ink tank becomes
5 readable near the held position, and information differing
from said information is read in a predetermined range
from the ink communication position to the vicinity
of the held position and therefore, if design is made
such that a warning is given in response to the reading
10 of the said information, the unsatisfactory holding
of the ink tank can be detected to obviate the shipping
out thereof.

Furthermore, as has hitherto been described,
according to the present invention, unlocking members
15 projected from the opposite sides of the ink cartridge
and locking members provided on both sides of the inser-
tion path for the ink cartridge and unlockable by the
respective unlocking members are provided asymmetrically
with respect to the direction of insertion of the ink
20 cartridge and therefore, even if a wrong attempt is
made to insert the ink cartridge with its vertical direc-
tion or its longitudinal direction being mistaken, the
ink cartridge can be prevented from being erroneously
mounted and accordingly, damage to the ink cartridge
25 by the hollow needle or damage to the hollow needle
which would make the supply of ink impossible can be
eliminated.

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1 Further, any special expensive device is not
required for the prevention of such erroneous mounting,
but it is only required to simply change the installed
positions of the locking members and the unlocking members.

5 Furthermore, even where a plurality of kinds of inks
are used, erroneous mounting can be prevented for the
respective ink cartridges.

Also, as has hitherto been described, according
to the ink jet recording apparatus of the present inven-
10 tion and the ink cartridge therefor, a transmission
type photosensor shielded from light by a flag member
existing in the movement path of the carriage is provided
on the carriage and a flag member adapted to protrude
toward the movement path of the carriage only in the
15 mounted state of the ink cartridge is provided on the
ink cartridge, and the transmission type photosensor
is shielded from light by the flag member provided on
the ink cartridge, whereby the mounting of the ink
cartridge may be detected and therefore, not only the
20 mounting of the ink cartridge is detected by a small
number of parts and simple structure, but also the form
of the flag member is made different for each ink cartridge,
whereby many kinds of information such as the kind,
characteristic, etc. of ink can be classificatorily
25 recognized by the user and in addition, the quantity
of remaining ink can be detected.

The present invention brings about an excellent

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1 effect particularly in a recording head and a recording
apparatus of the bubble jet type which has been put
forward by Canon, Inc., among the ink jet recording
systems.

5 As regards the typical construction and principle
of this system, a construction is preferable which uses
the basic principle disclosed, for example, in U.S.
Patents Nos. 4,723,129 and 4,740,796. This system is
applicable to both of the so-called on-demand type and
10 the so-called continuous type, and particularly in the
case of the on-demand type, the present invention is
effective because at least one driving signal correspond-
ing to recording information and providing a rapid
temperature rise exceeding nuclear boiling is applied
15 to an electro-thermal converting member disposed cor-
respondingly to a sheet or a liquid path in which liquid
(ink) is retained, thereby causing the electro-thermal
converting member to generate heat energy and causing
film boiling on the heat-acting surface of a recording
20 head with a result that a bubble in the liquid (ink)
can be formed correspondingly at one to one to said
driving signal. By the growth and contraction of the
bubble, the liquid (ink) is discharged through a discharge
port to thereby form at least one droplet. If this
25 driving signal is made into a pulse shape, the growth
and contraction of the bubble take place appropriately
on the spot and therefore, discharge of the liquid (ink)

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1 which is particularly excellent in responsiveness can
be accomplished, and this is more preferable. The
driving signal of such pulse shape may suitably be one
as described in U.S. Patents Nos. 4,463,359 and 4,345,262.

5 The adoption of the conditions described in U.S. Patent
No. 4,313,124 which is an invention relating to the
temperature rise rate of said heat-acting surface would
lead to the possibility of accomplishing more excellent
recording.

10 As regards the construction of the recording
head, besides the construction as disclosed in the
aforementioned patents which comprises a combination
of discharge ports, liquid paths and electro-thermal
converting members (a straight liquid flow path or a
15 perpendicular liquid flow path), the constructions using
U.S. Patents Nos. 4,558,333 and 4,459,600 which disclose
constructions in which the heat-acting portion is disposed
in a bent area are also covered by the present invention.
In addition, the present invention is effective for
20 a construction based on Japanese Laid-Open Patent Applica-
tion No. 59-123670 which discloses a construction in
which a slit common to a plurality of electro-thermal
converting members is the discharge portion of the
electrothermal converting members, or a construction
25 based on Japanese Laid-Open Patent Application No. 59-
138461 which discloses a construction in which an opening
for absorbing the pressure wave of heat energy corresponds

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1 to the discharge portion.

Further, the recording head of the full line type having a length corresponding to the width of the largest recording medium on which the recording apparatus
5 can effect recording may be of a construction as disclosed in the above-mentioned publications wherein that length is satisfied by a combination of a plurality of recording heads, or of a construction as a single recording head formed as a unit, and the present invention can display
10 the above-described effect more effectively.

In addition, the present invention is also effective in a case where use is made of a recording head of the interchangeable chip type which is adapted to be mounted on an apparatus body to thereby make the
15 electrical connection to the apparatus body or the supply of ink from the apparatus body possible, or a recording head of the cartridge type provided integrally on the recording head itself.

Also, the addition of recovery means, preliminary
20 auxiliary means, etc. for the recording head provided as the construction of the recording apparatus of the present invention can more stabilize the effect of the present invention and is therefore preferable. Specifically mentioning these, they are capping means, cleaning
25 means and pressurizing or suction means for the recording head, an electro-thermal converting member or a heating element discrete therefrom or pre-heating means comprising

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1 a combination of these, and it is also effective for
accomplishing stable recording to carry out the preliminary
discharge mode in which discharge not concerned in
recording is effected.

5 Further, the recording mode of the recording
apparatus is not limited to a recording mode using only
the main color such as black, but may use a recording
head constructed as a unit or a combination of a plurality
of recording heads, and the present invention is very
10 effective for an apparatus provided with a plurality
of different colors or at least one of full colors
provided by mixed colors.

The above embodiments of the present invention
have been described as using liquid ink, but the present
15 invention also permits the use of ink which is in the
solid phase at room temperature or ink which becomes
softened at room temperature. In the above-described
ink jet recording apparatus, it is popular to regulate
the temperature of ink itself within a range from 30°C
20 to 70°C and effect temperature control so that the
viscosity of the ink may be within a stable discharge
range and therefore, use can be made of ink which assumes
the liquid phase when the recording signal used is
imparted. In addition, the temperature rise by heat
25 energy is positively used as the energy for the change
of ink from its solid phase to its liquid phase to thereby
prevent said temperature rise, or ink which solidifies

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1 when left as it is used for the purpose of preventing
the evaporation of the ink, and at any rate, the use
of ink having a nature that is liquefied only by heat
energy, such as ink which is liquefied by the imparting
5 of heat energy conforming to the recording signal and
is discharged in the form of liquid or ink which already
begins to solidify at a point of time whereat it reaches
the recording medium is also applicable to the present
invention. In such a case, the ink may assume the form
10 as described in Japanese Laid-Open Patent Application
No. 54-56847 or Japanese Laid-Open Patent Application
No. 60-71260 wherein the ink is retained as liquid or
solid in recesses or through-holes in a porous sheet
and is opposed to an electro-thermal converting member.
15 In the present invention, what is most effective for
each ink mentioned above is what executes the above-
described film boiling system.



REPLACEMENT SHEET

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Claims 1 to 9 for the Divisional Application relating to the
European Patent Application No. 90 114 982.3-2304

5

1. An ink cartridge mountable on a mounting portion
along an insertion path (332) of an ink jet recording
apparatus having an openably-closable plate (333) openably
and closably held in said insertion path (322) to said
10 mounting portion, and locking members (336, 337) for
restraining said openable-closable plate from both sides of
said insertion path (322) to thereby inhibit the opening
movement thereof, said ink cartridge containing therein ink
to be supplied to a recording head and having projectedly
15 provided on the opposite sides thereof unlocking members
(341, 342) engageable with said locking members (336, 337)
during the mounting of said ink cartridge to release the
restraint of said locking members (336, 337), said ink
cartridge being characterized in that said unlocking members
20 (341, 342) are provided asymmetrically with respect to the
direction of insertion into said insertion path (332).

2. An ink cartridge according to Claim 1, characterized
in that said ink jet recording apparatus has mounting
25 portions and insertion paths corresponding to ink cartridges
individually containing a plurality of different kinds of
inks therein, and said unlocking members (341, 342) provided
on said ink cartridges are asymmetrical with respect to the
direction of insertion into said insertion path at positions
30 different for respective corresponding ones of said mounting
portions.

3. An ink cartridge removably mounted on a fixed
mounting portion of an ink jet recording apparatus and
35 supplying discharged ink to a recording head carried on a
movable carriage, characterized by a flag member (404)

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capable of being protruded and contained; and means (406) for protruding said flag member toward a path along which said carriage is moved only when said ink cartridge is mounted on said mounting portion; a photosensor (424) provided on said carriage being capable of being shielded from light by said flag member.

4. An ink cartridge according to Claim 3, characterized in that said photosensor (424) is a sensor for detecting infrared light, and said flag member (404) is formed of a material capable of intercepting said infrared light.

5. An ink cartridge according to Claim 4, characterized in that the position in which said flag member (404) shields said photosensor (424) from light is made different along the direction of movement of said carriage to thereby make the detecting position of said photosensor (424), for said flag member (404) different, and different information is obtained for each ink cartridge mounted.

20

6. An ink cartridge according to Claim 4, characterized by an ink bag (430) containing said ink therein and wherein the level of the position in which said flag member (404) shield said photosensor (424) from light is varied in conformity with the quantity of the ink in said ink bag (430) to thereby detect the presence or absence of said ink.

7. An ink jet recording apparatus comprising an ink cartridge according to Claim 1, characterized in that the locations at which said unlocking members and said locking members are disposed are asymmetrical with respect to the direction of insertion of said ink cartridge.

8. An ink jet recording apparatus according to Claim 7, characterized in that a plurality of ink cartridges are provided so as to individually contain different kinds of

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inks therein, said plurality of ink cartridges are mountable on corresponding mounting portions, respectively, and said unlocking members (341, 342) and said locking members (336, 337) are asymmetrical with respect to the direction of
5 insertion of said ink cartridges at positions different for respective corresponding ones of said mounting portions.

9. An ink jet recording apparatus in which an ink cartridge (401) containing therein ink to be supplied to a
10 recording head for discharging the ink to thereby effect recording is removable mounted, characterized by a flag member (404) provided on said ink cartridge and adapted to be protruded toward a path along which a carriage is moved only when said ink cartridge is mounted on a mounting portion; and
15 a photosensor (424) provided on said carriage and capable of being shielded from light by said flag member (404).

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INK JET RECORDING APPARATUS AND
INK CARTRIDGE FOR THE APPARATUS

1 ABSTRACT OF THE DISCLOSURE

An ink cartridge interchangeably provided
for an ink jet recording apparatus provided with a
recording head for causing the discharge of ink to
5 thereby effect the recording of an image, and contain-
ing the ink therein and effecting the supply of the
ink in conformity with the discharge of the ink is
characterized by the provision of a medium provided
with information for controlling the driving conditions
10 of the recording head.

FIGURE 6

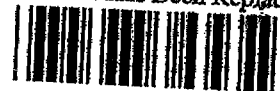
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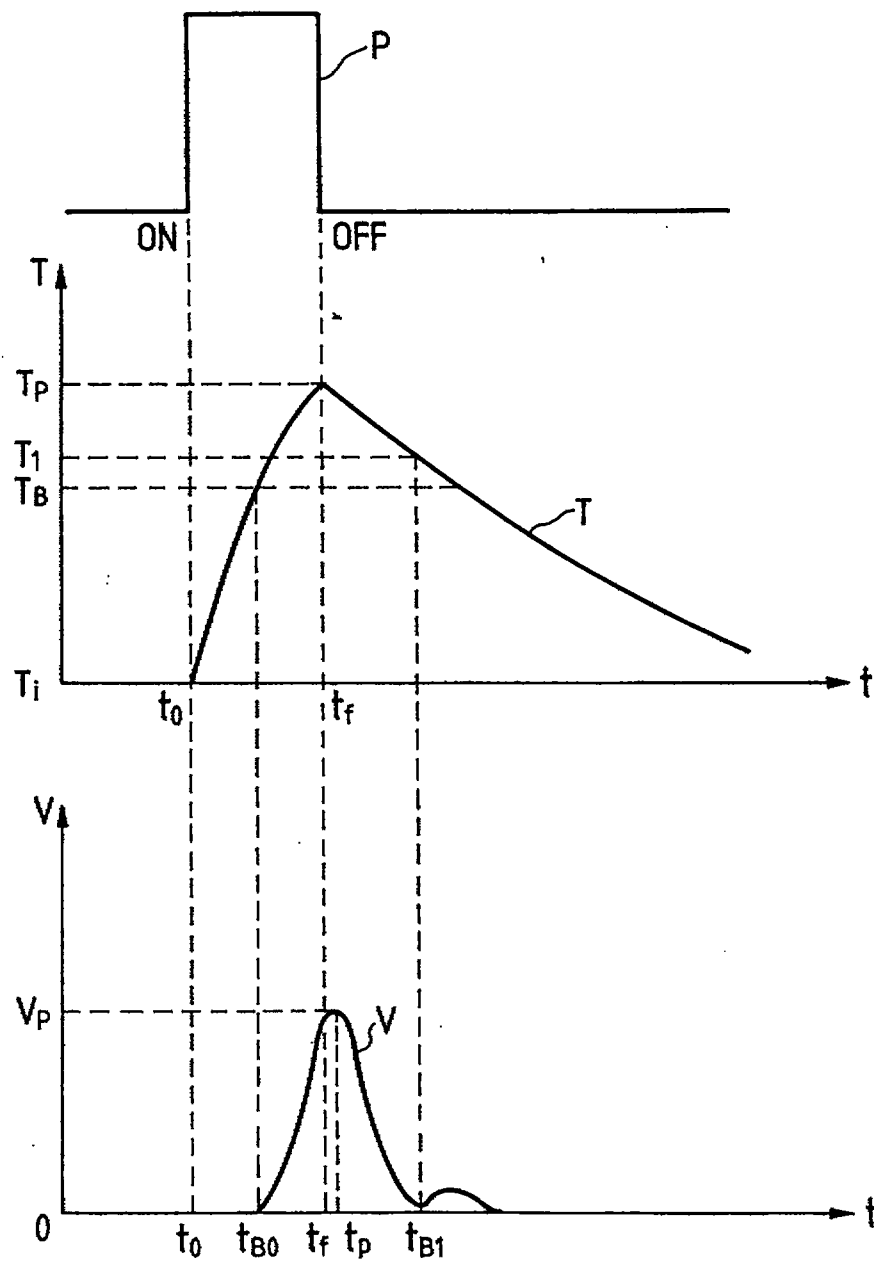
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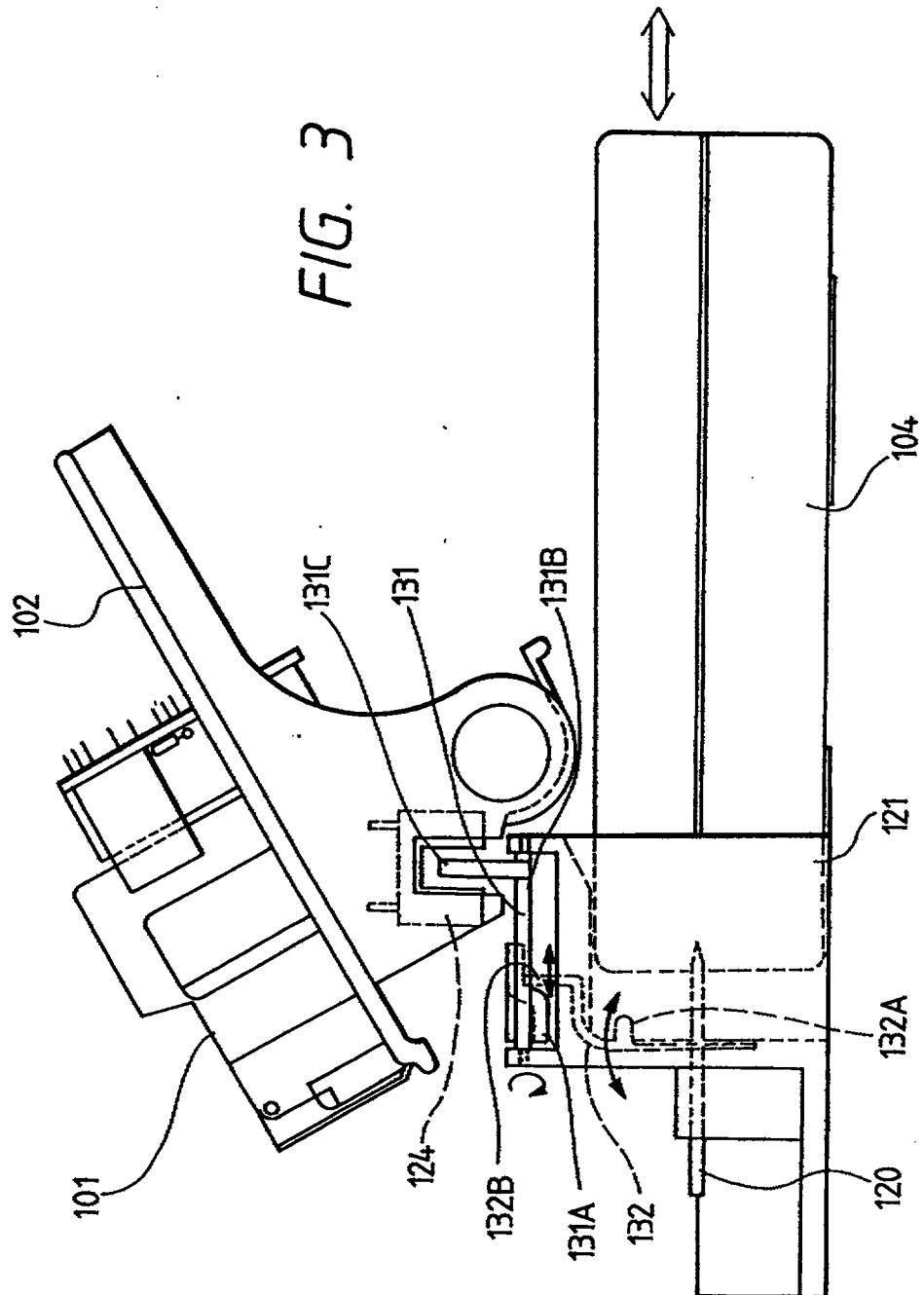
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FIG. 1



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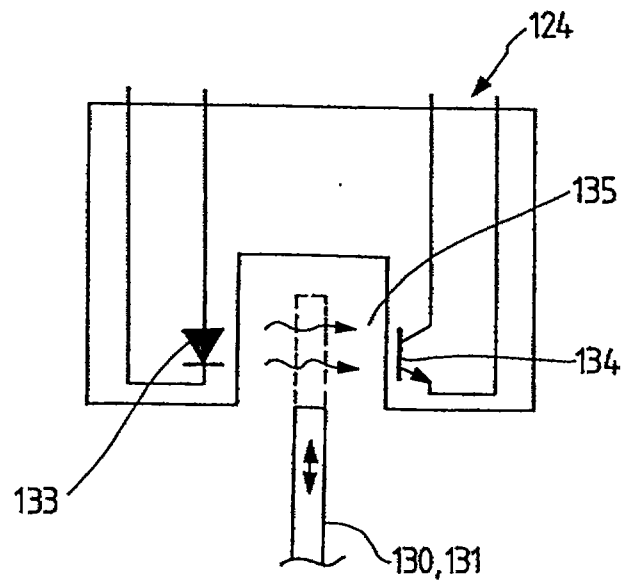
FIG. 3



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FIG. 4



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FIG. 5

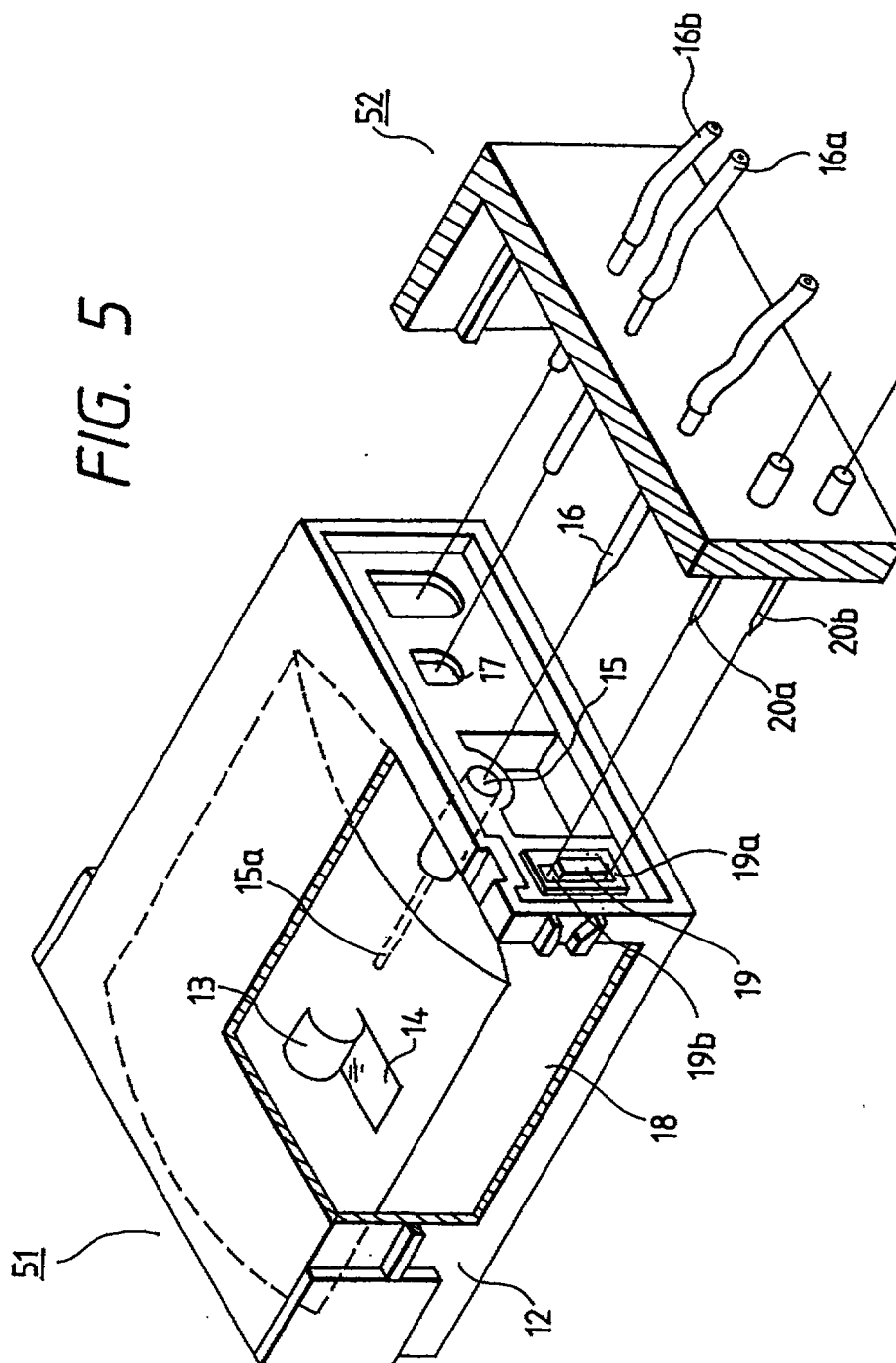
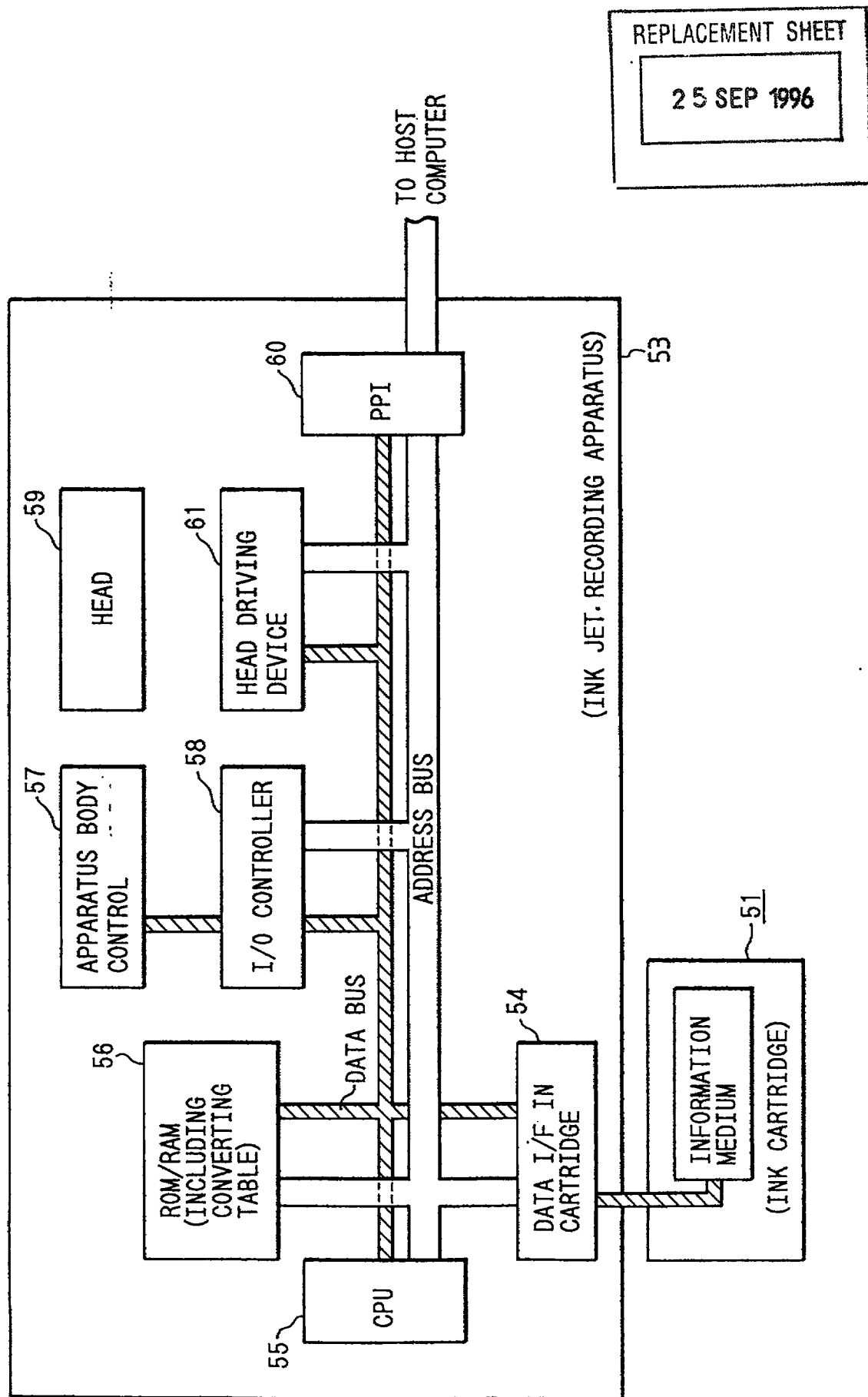


FIG. 6



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FIG. 7

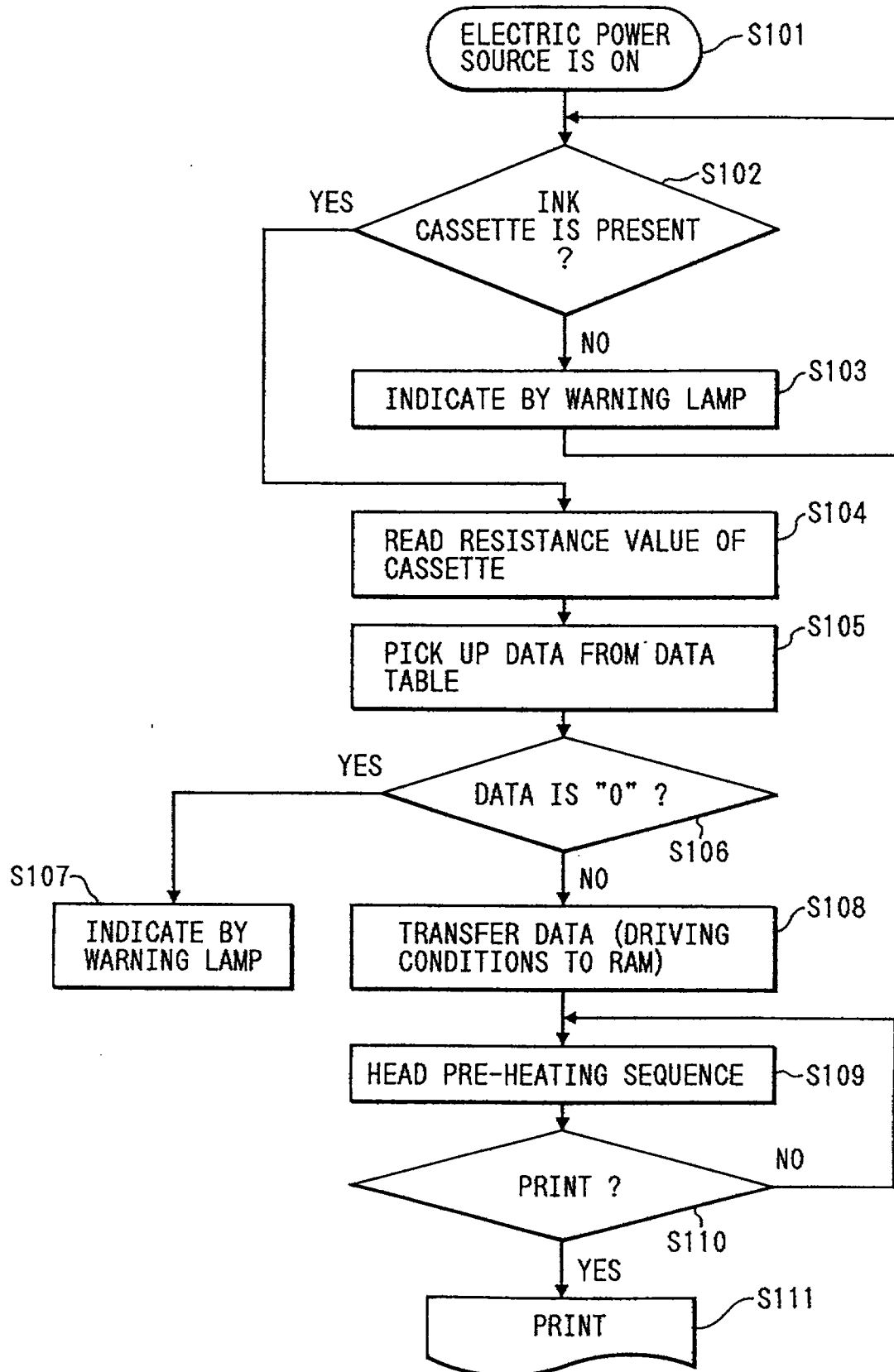


FIG. 8

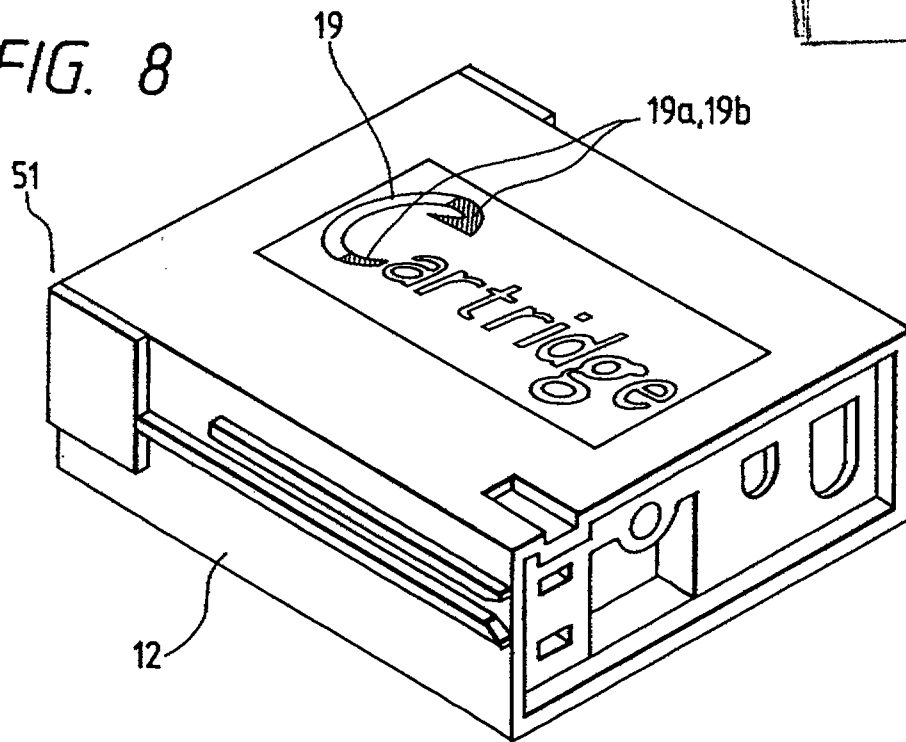
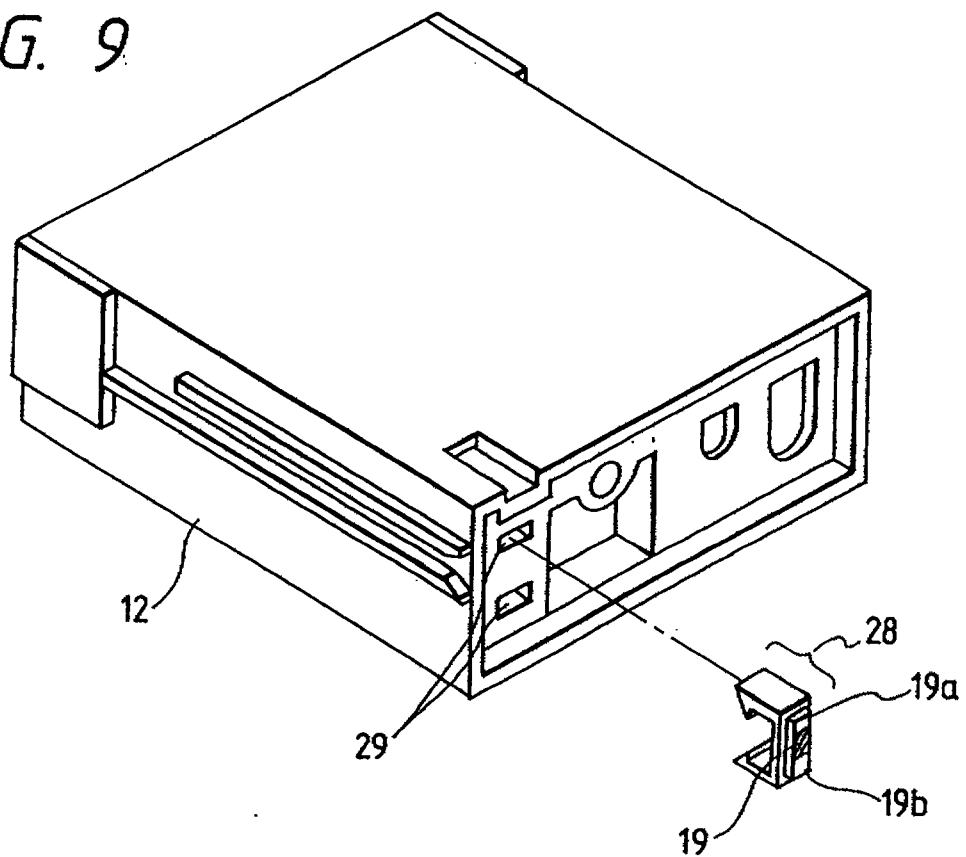


FIG. 9



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FIG. 10

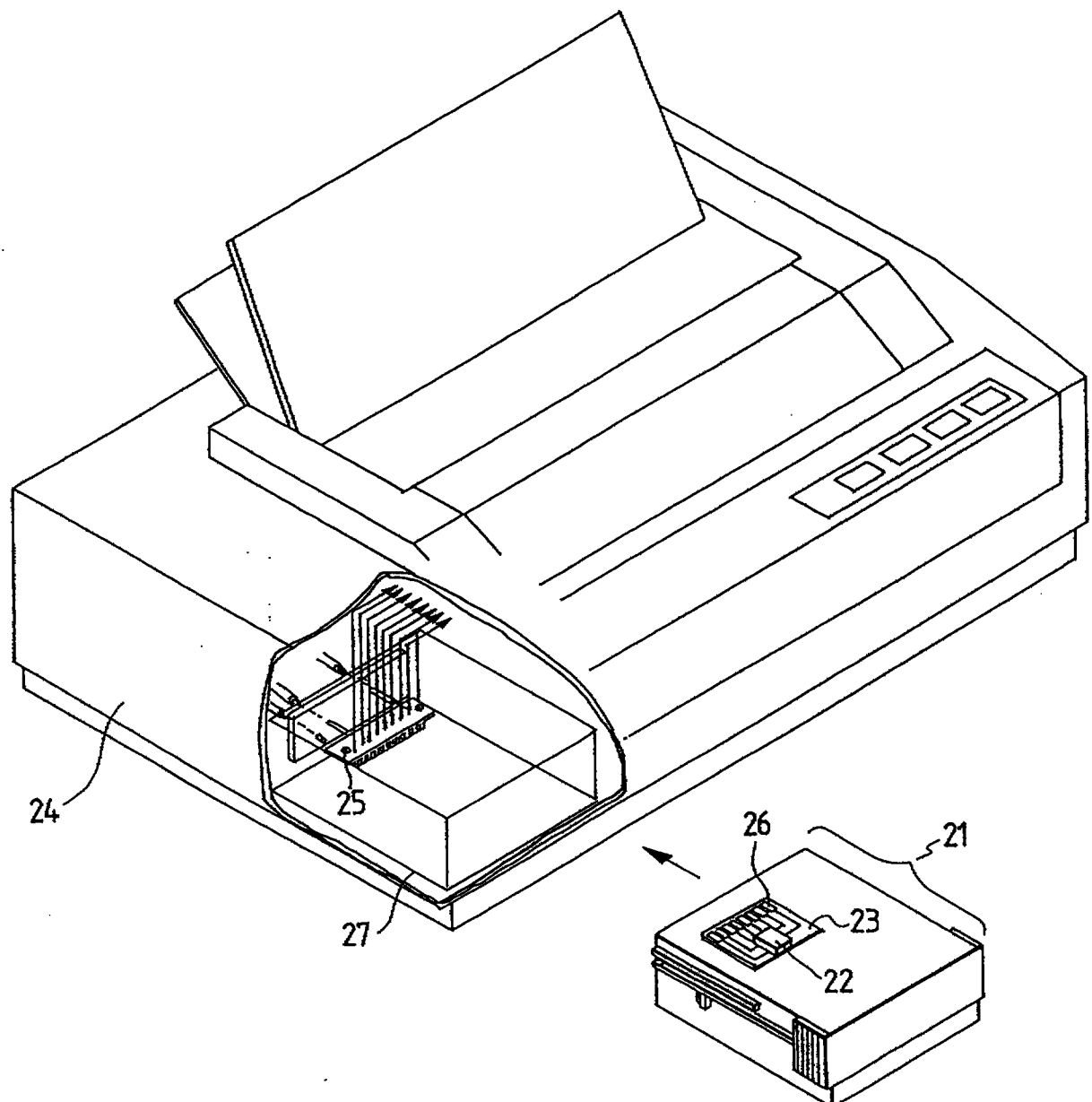
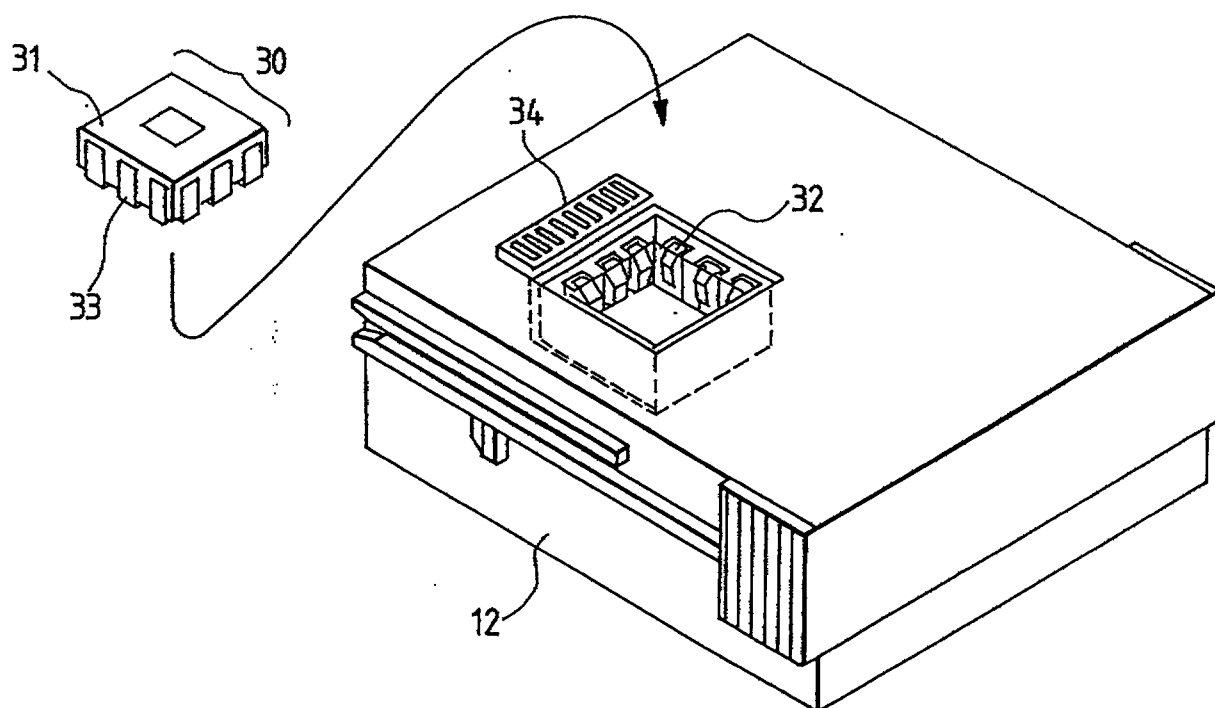
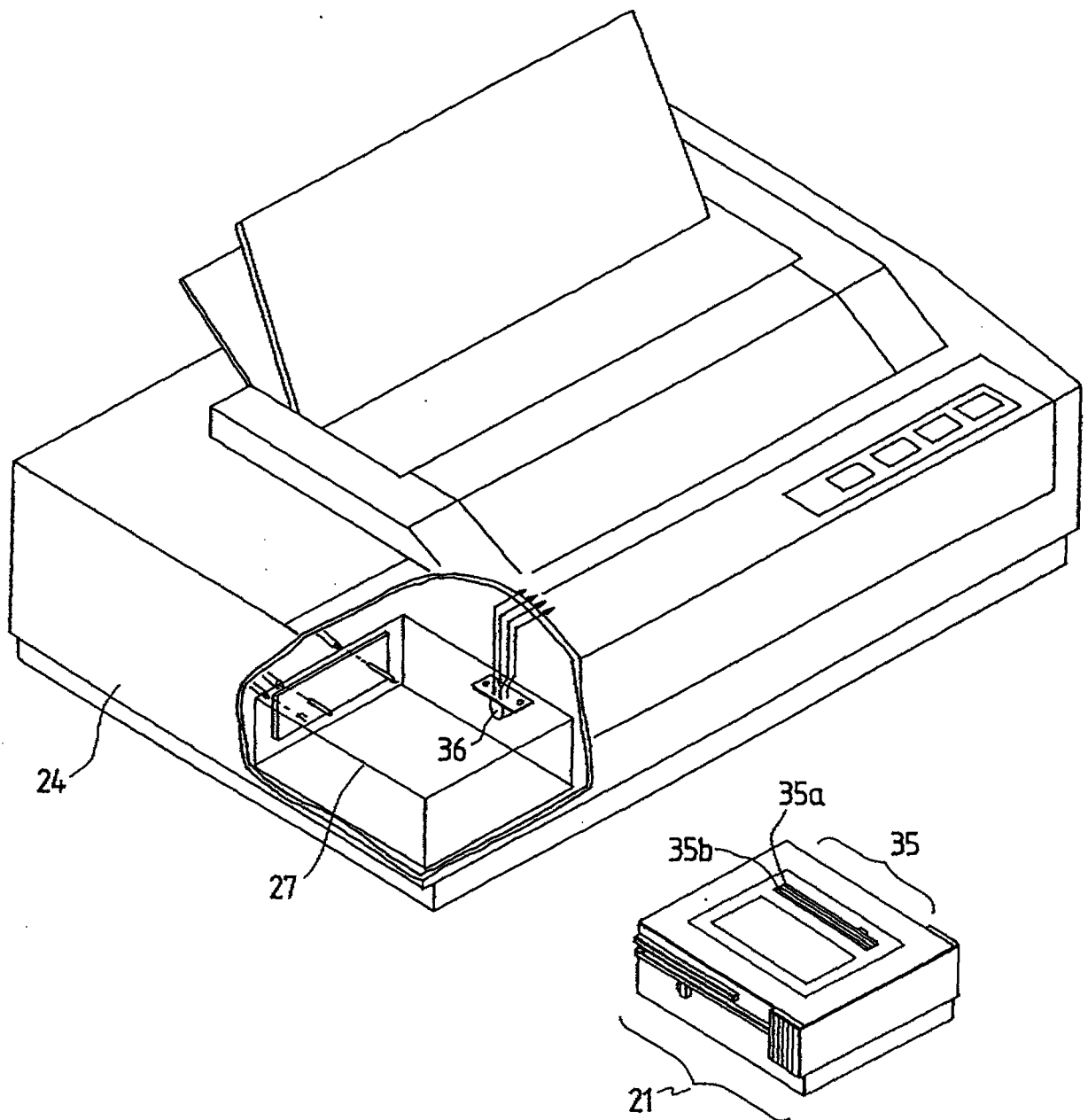


FIG. 11



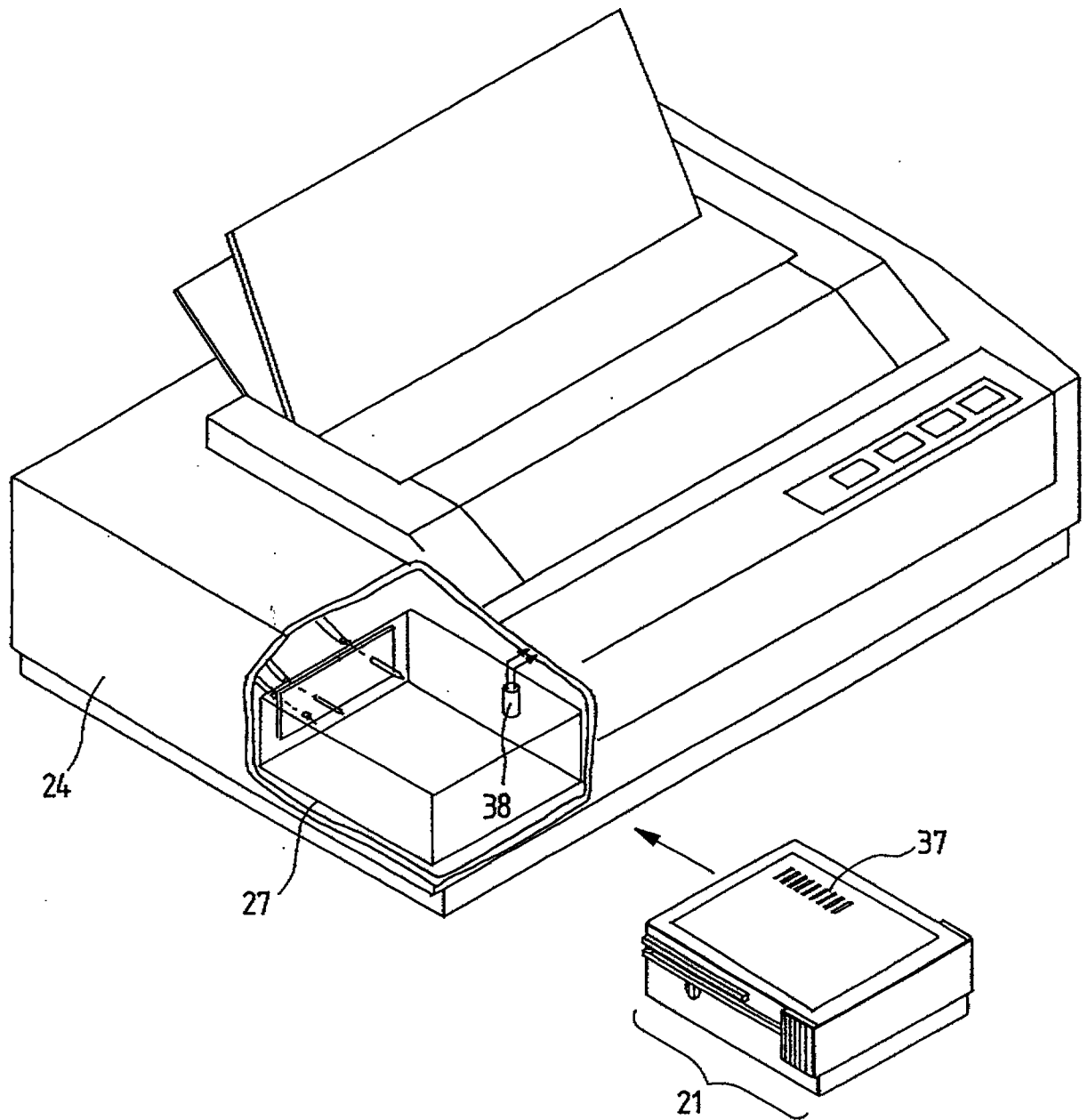
25 SEP 1996

FIG. 12



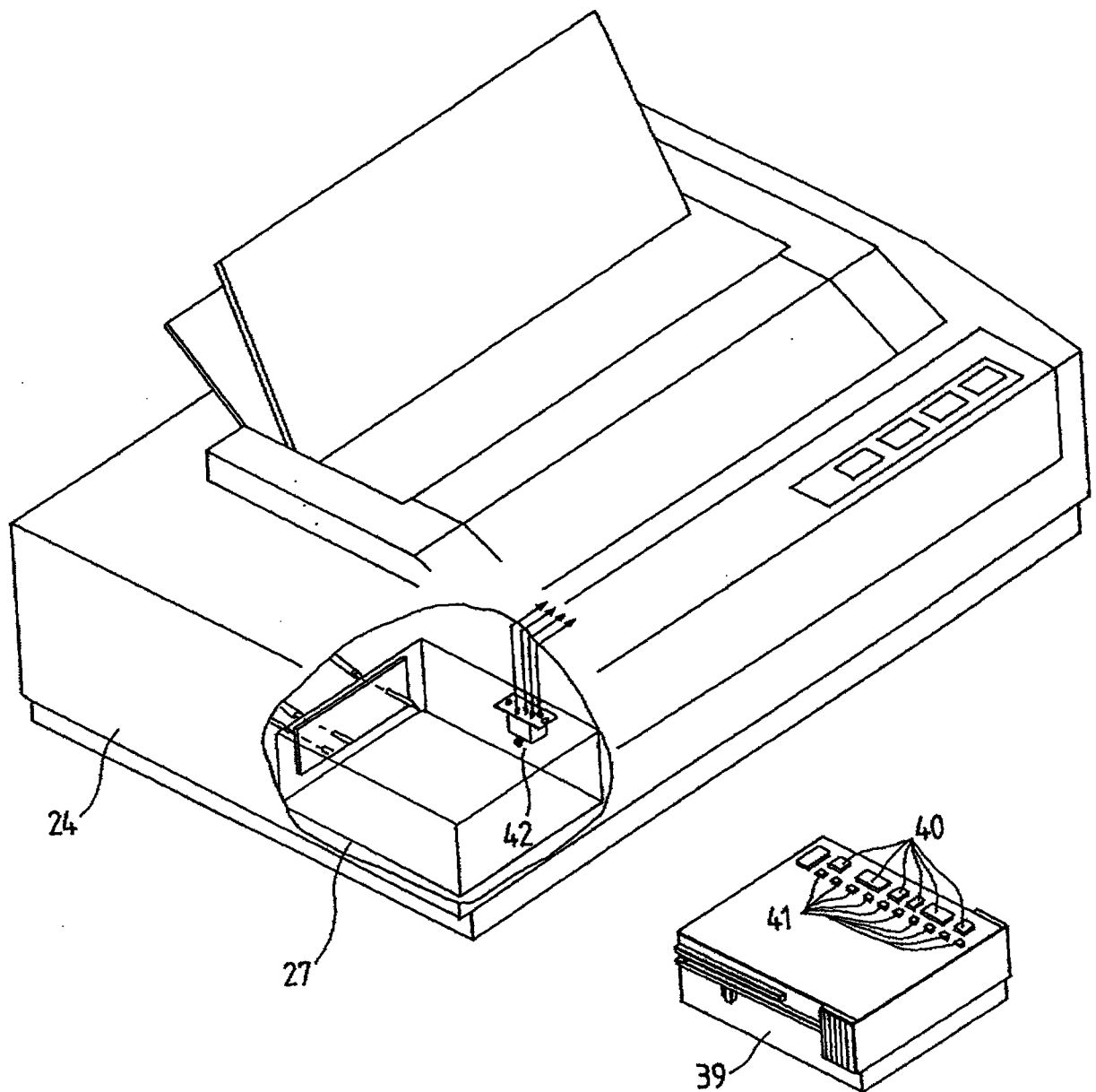
25 SEP 1996

FIG. 13



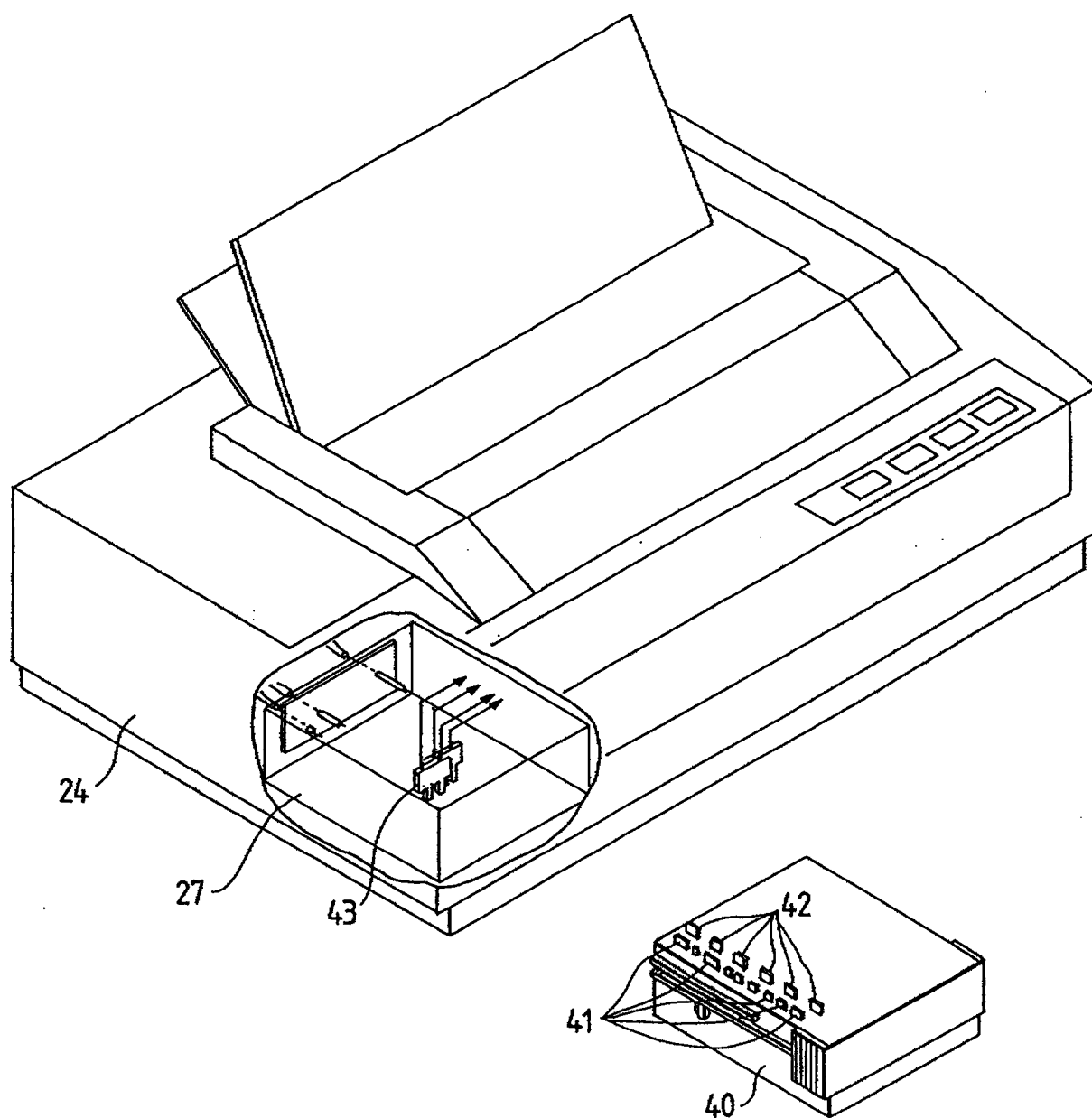
25 SEP 1996

FIG. 14



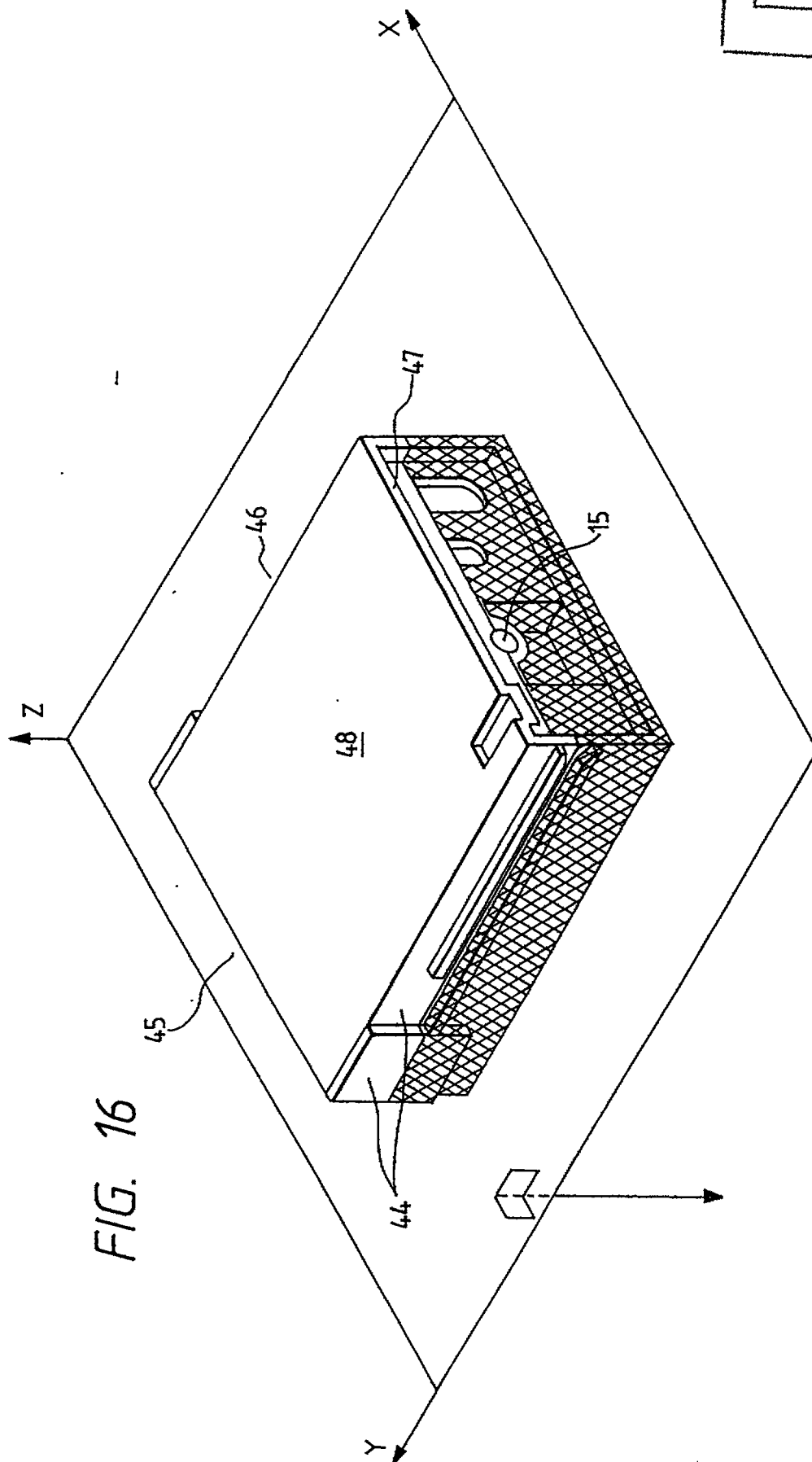
25 SEP 1996

FIG. 15



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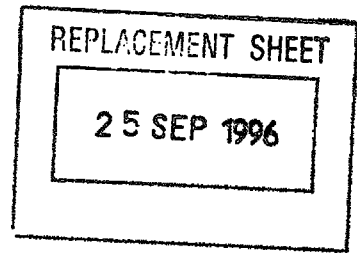
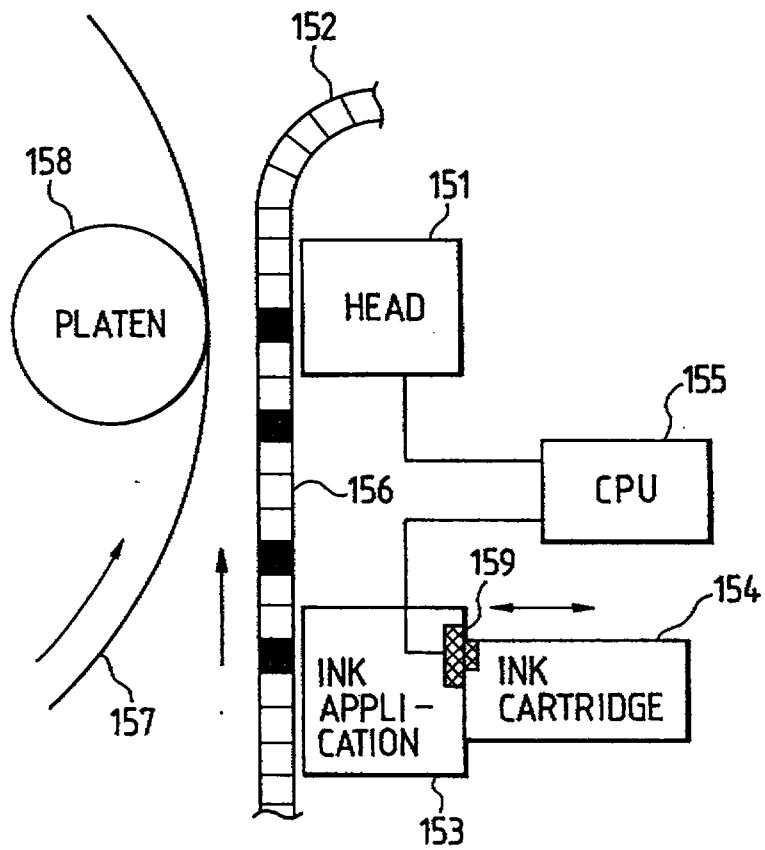


FIG. 17





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FIG. 19A

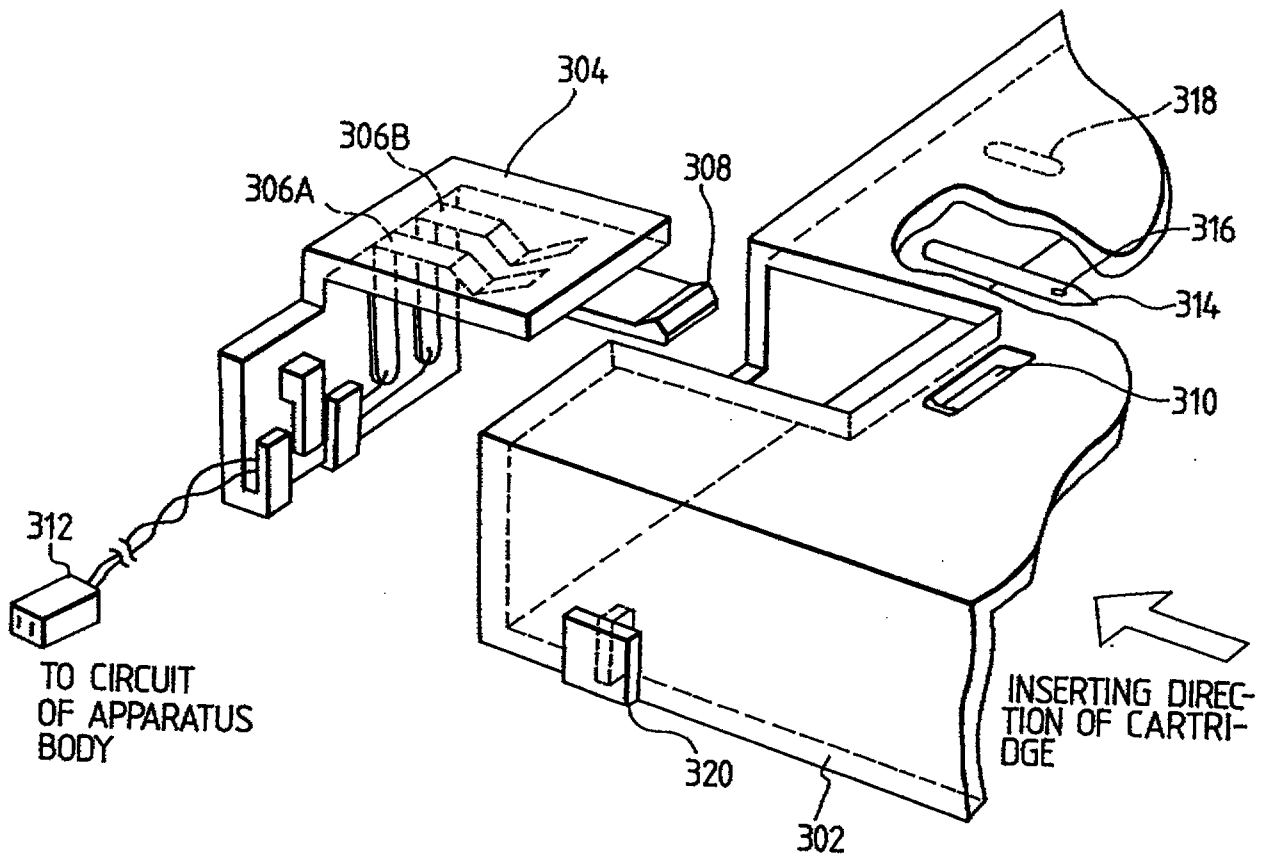
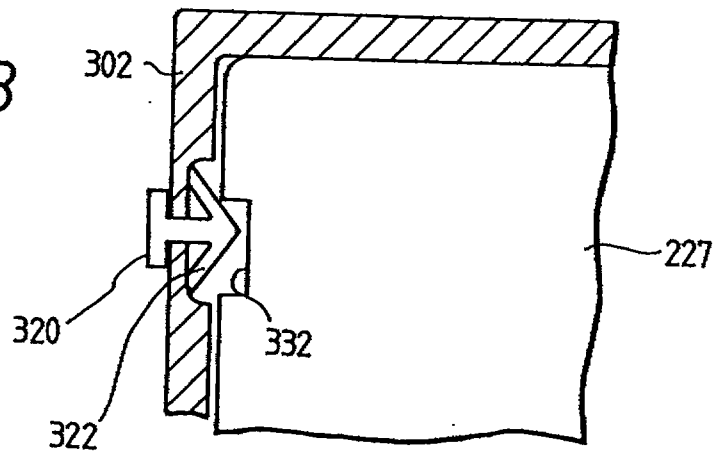


FIG. 19B



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FIG. 20

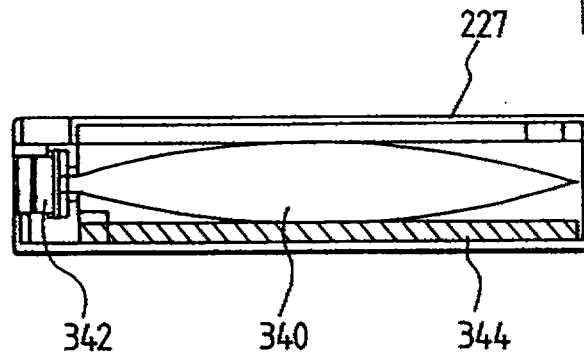
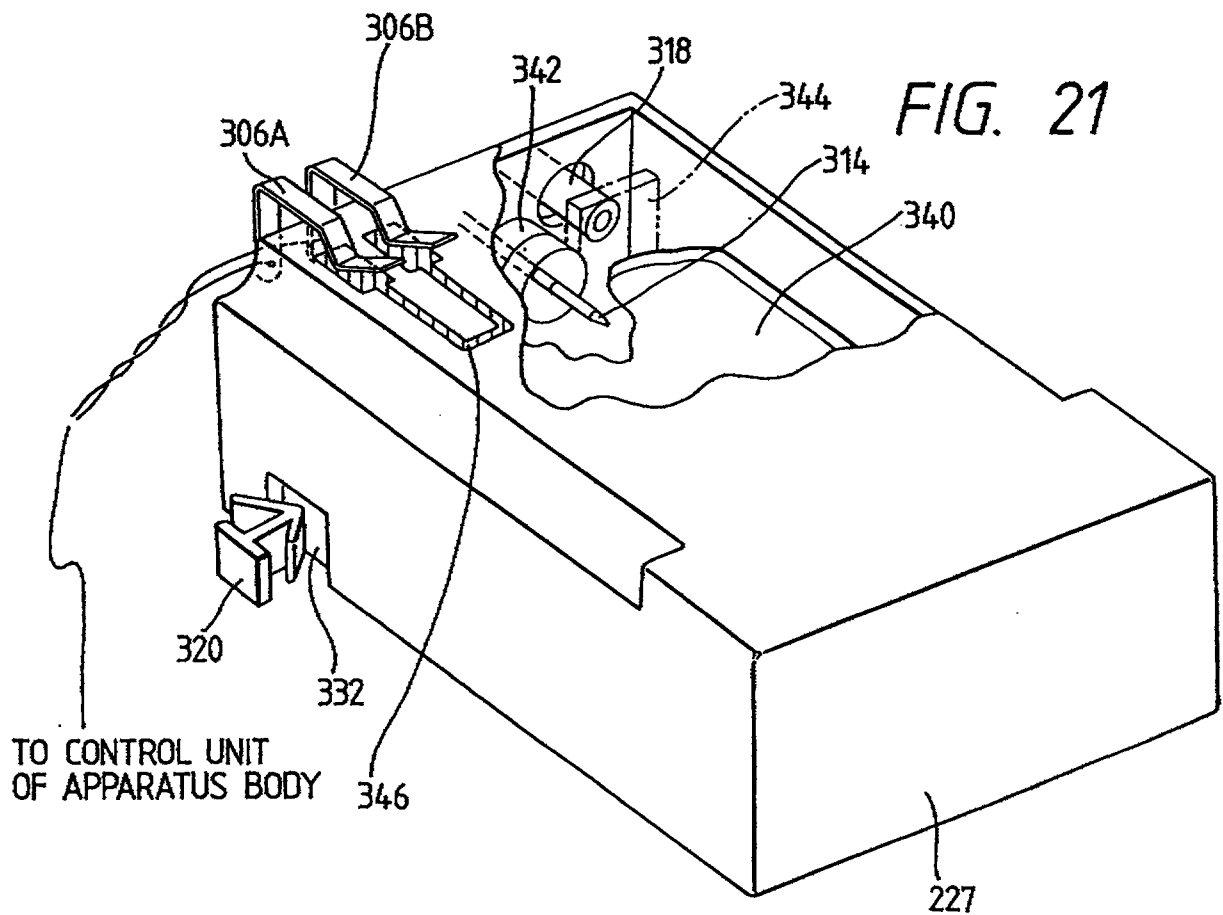


FIG. 22

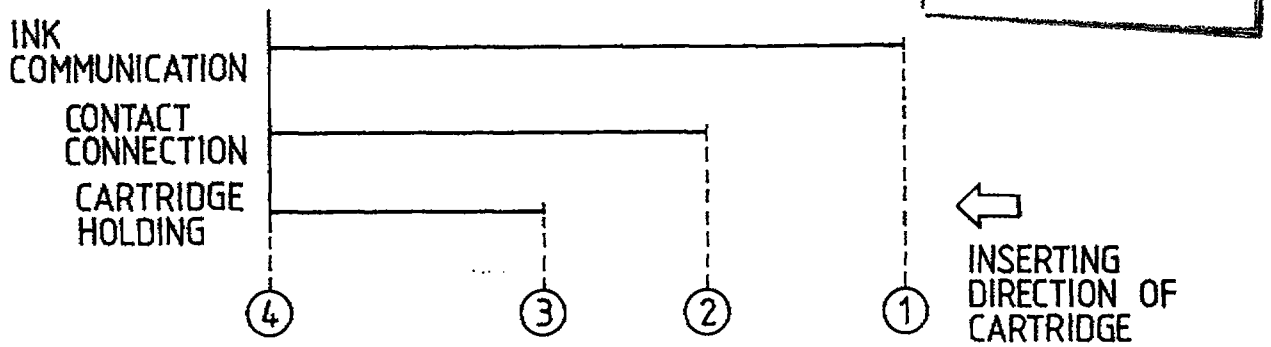


FIG. 23A

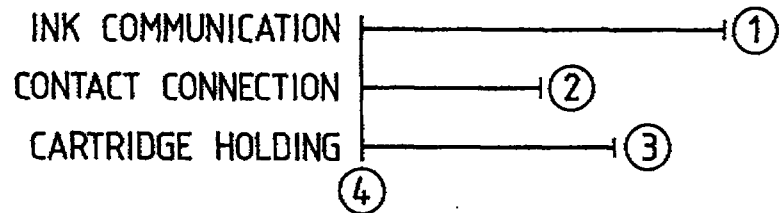


FIG. 23B

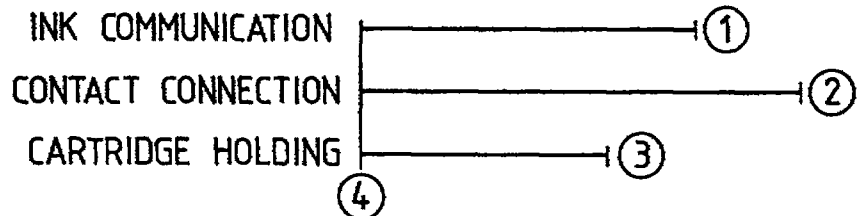


FIG. 23C

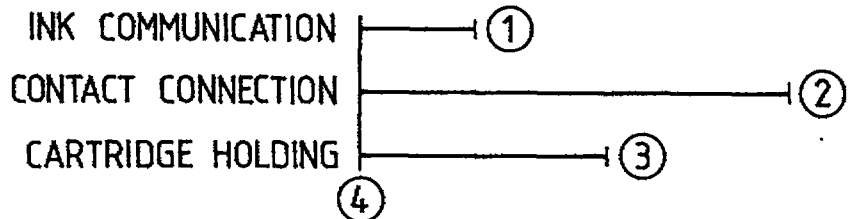


FIG. 23D

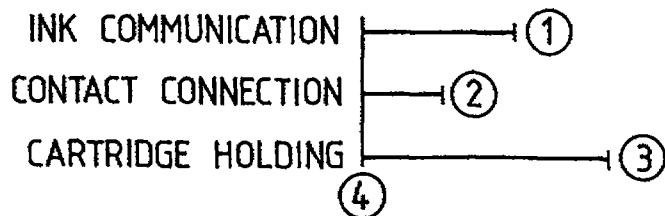
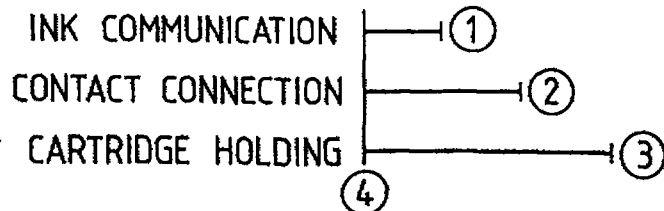


FIG. 23E



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FIG. 24A

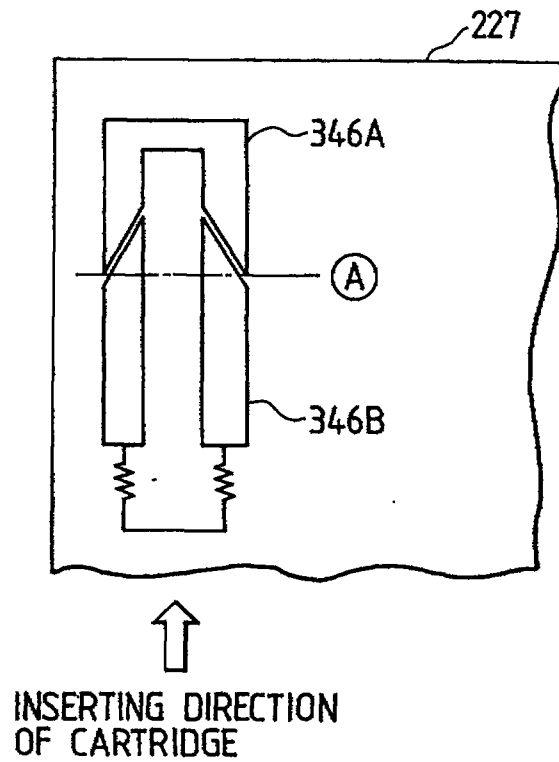
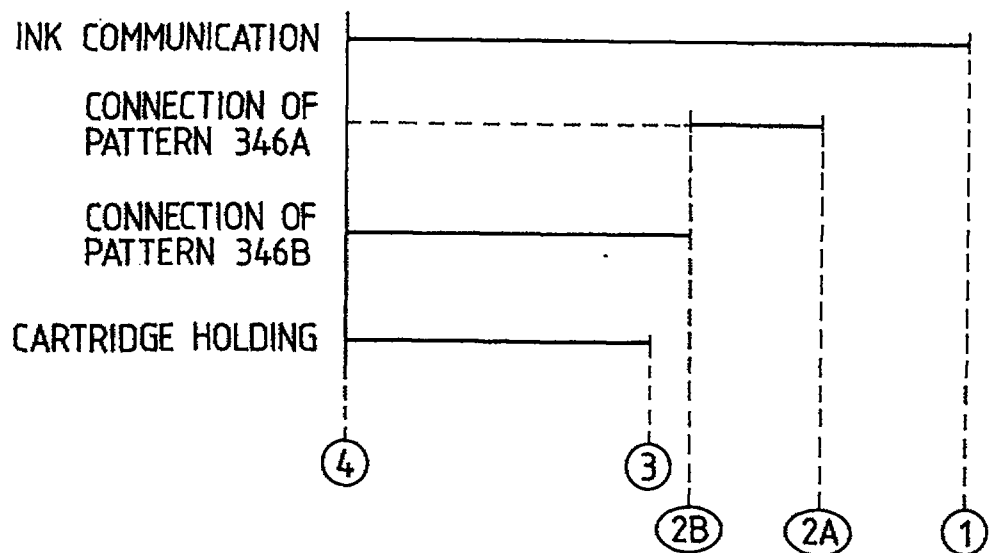


FIG. 24B



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FIG. 25A

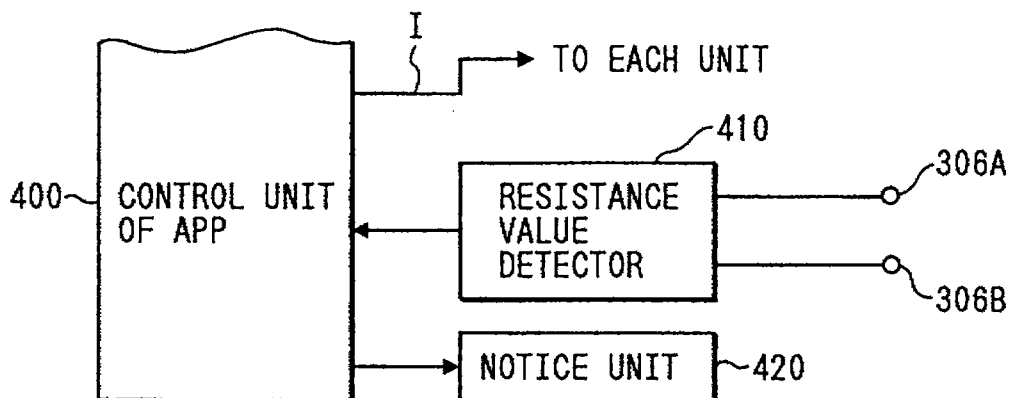
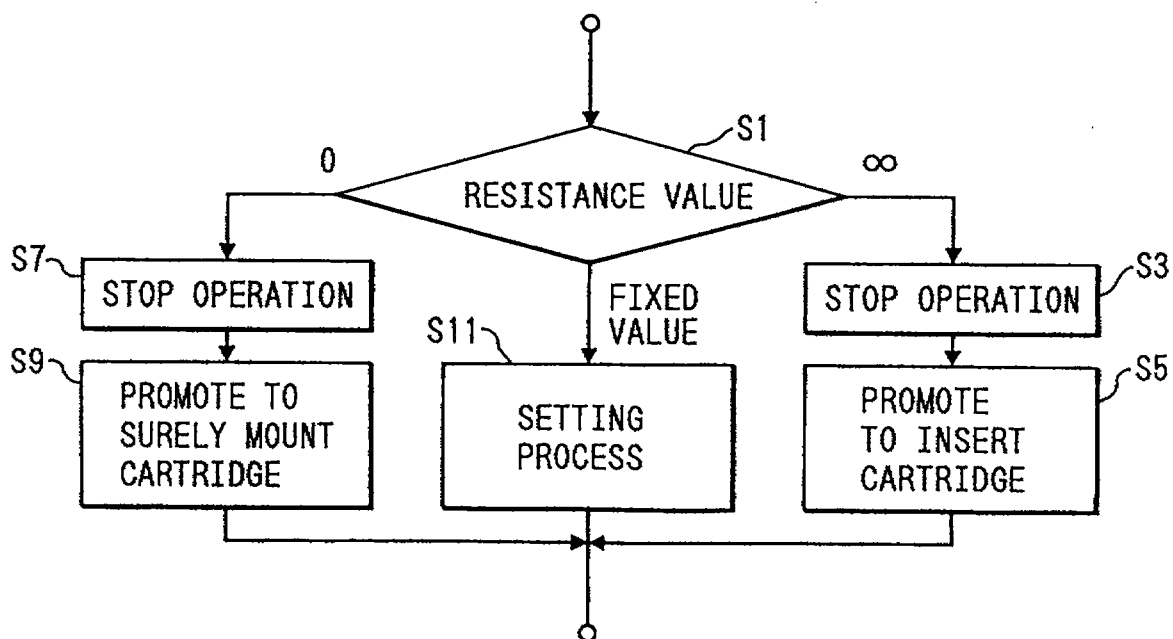
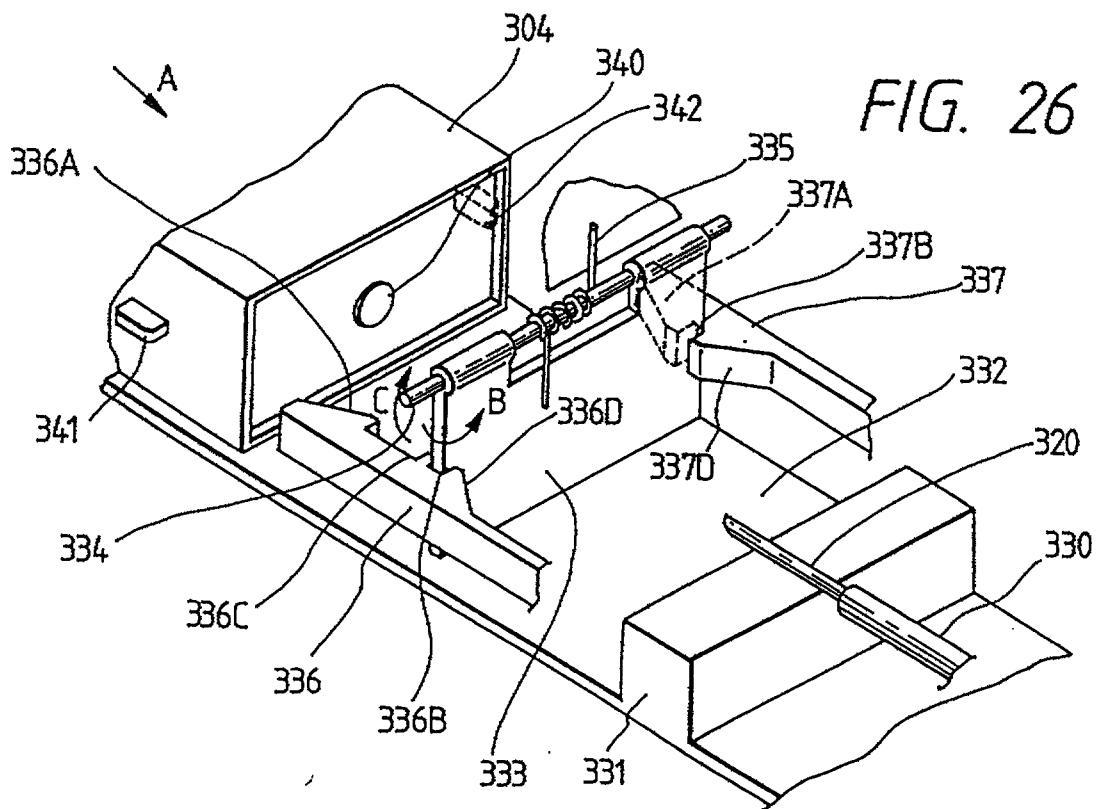


FIG. 25B



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FIG. 27A

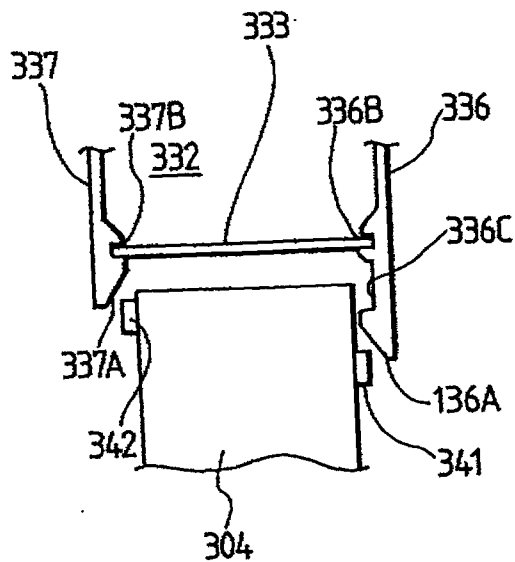


FIG. 27B

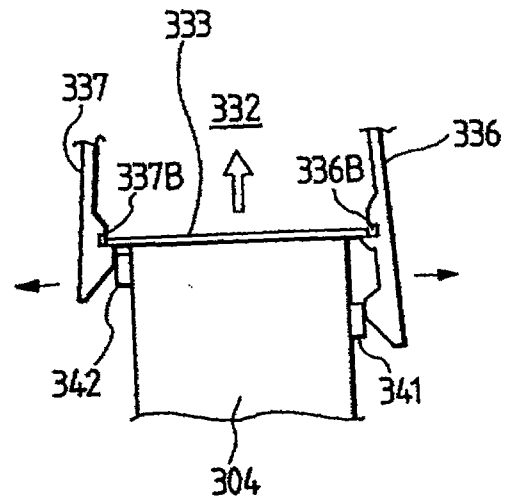


FIG. 27C

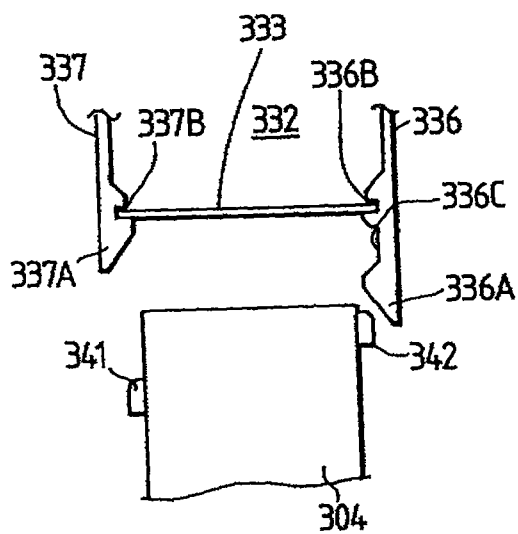
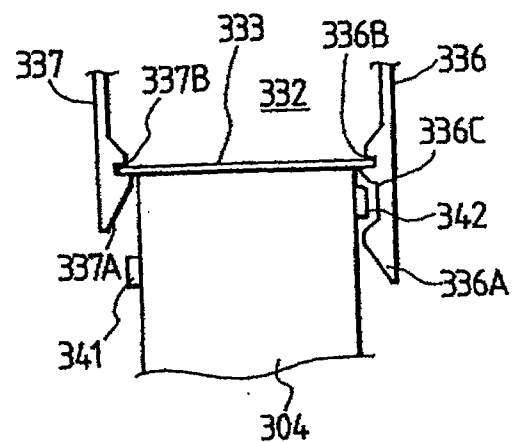


FIG. 27D



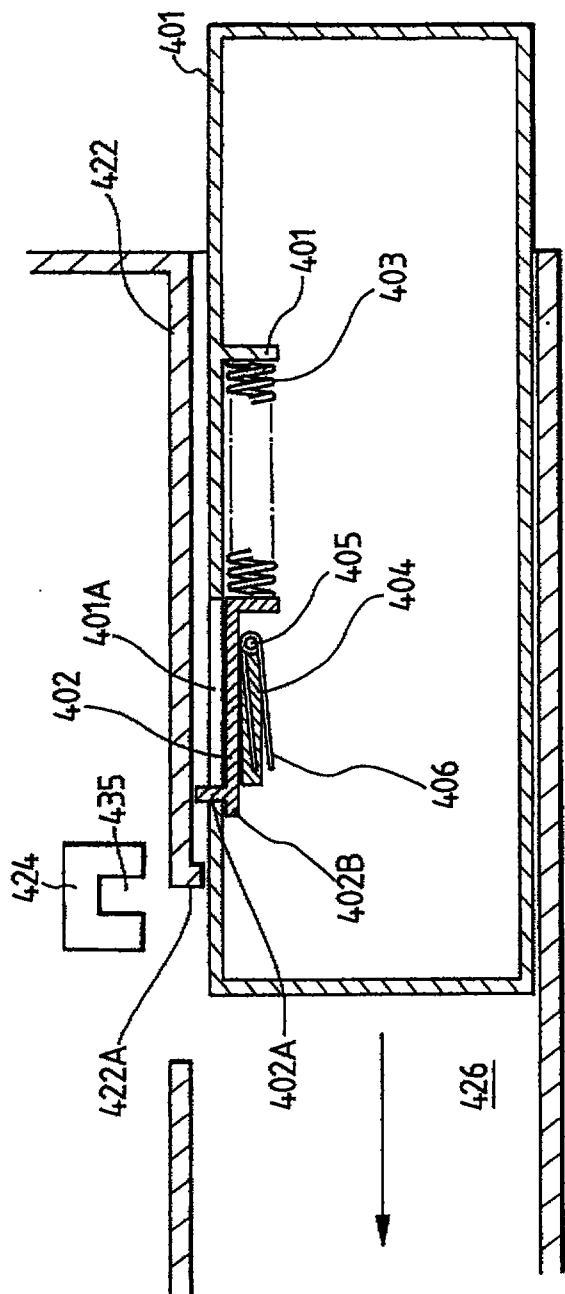


FIG. 30A

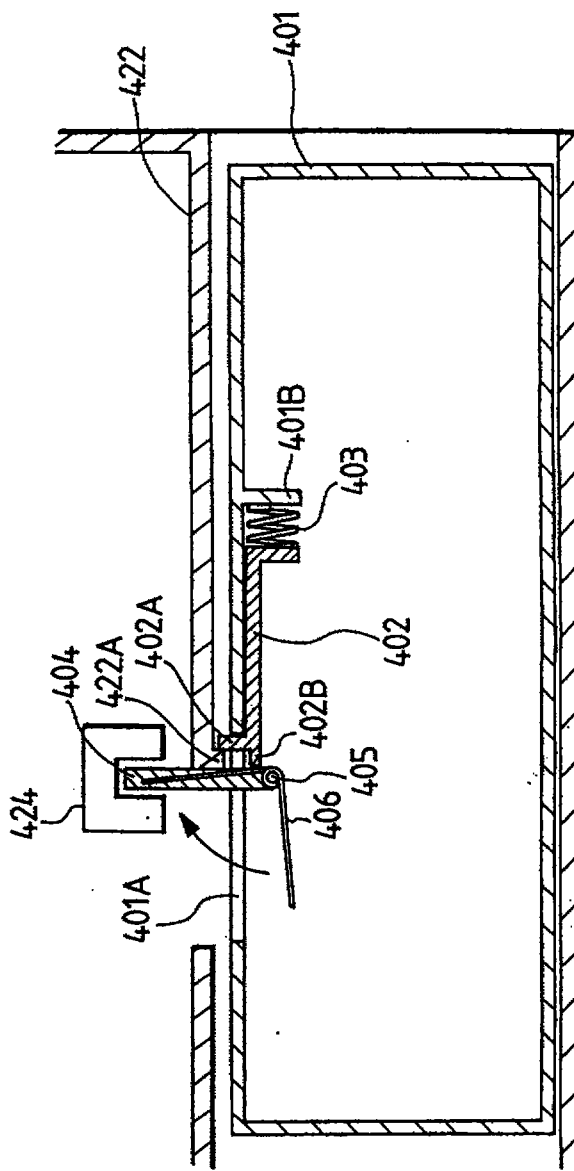


FIG. 30B



FIG. 31A

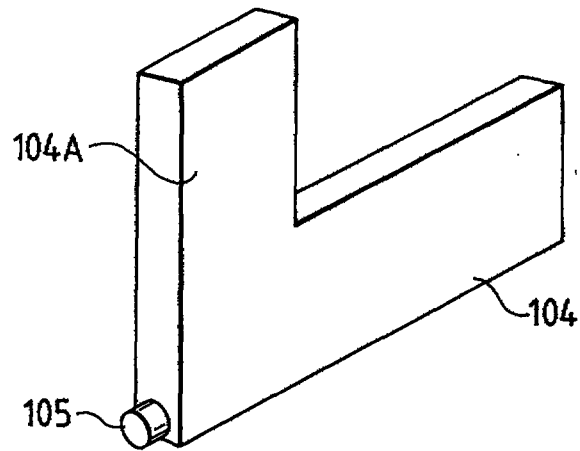


FIG. 31B

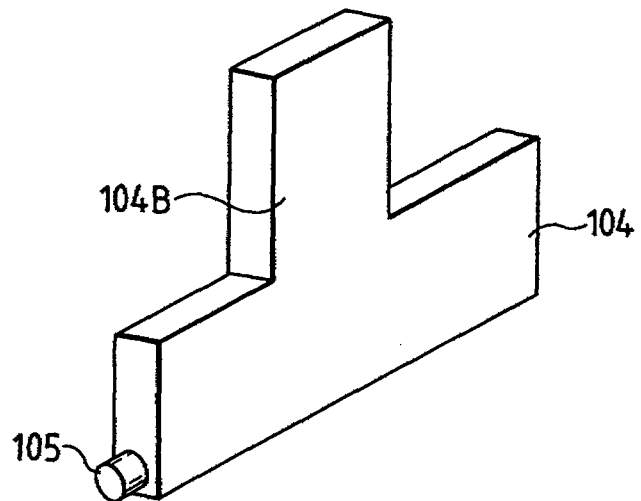
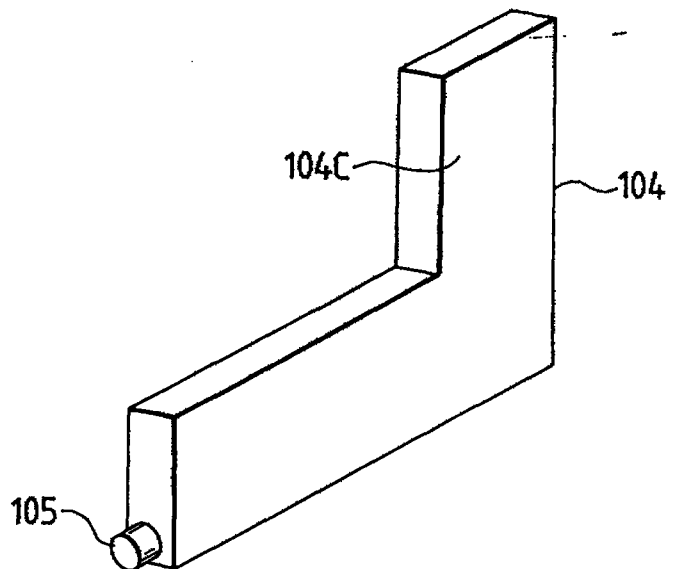
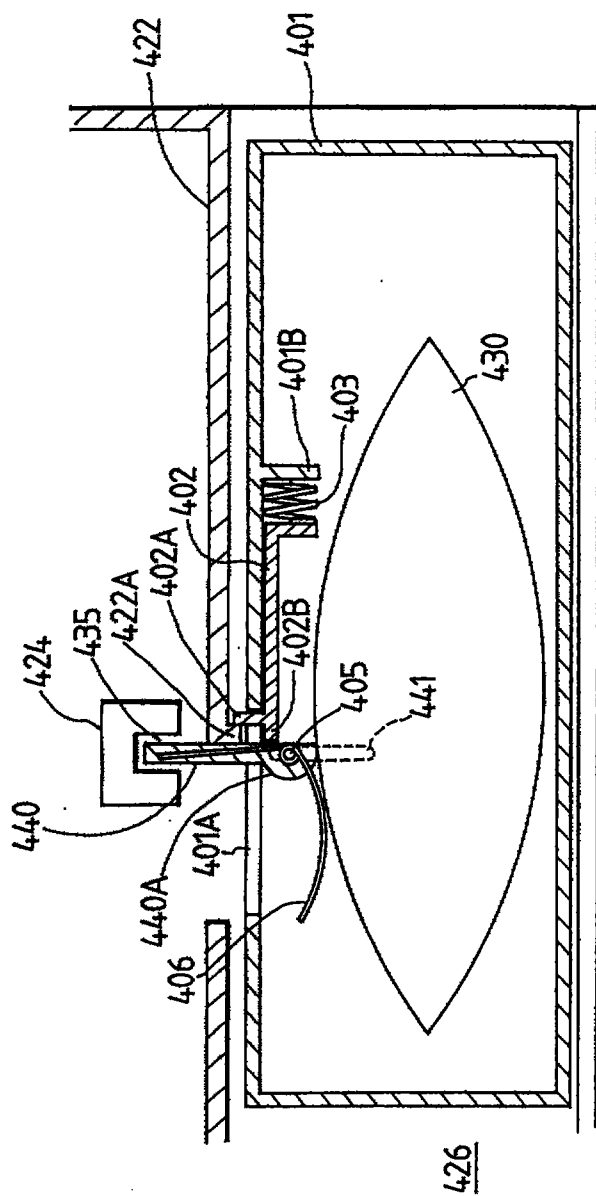
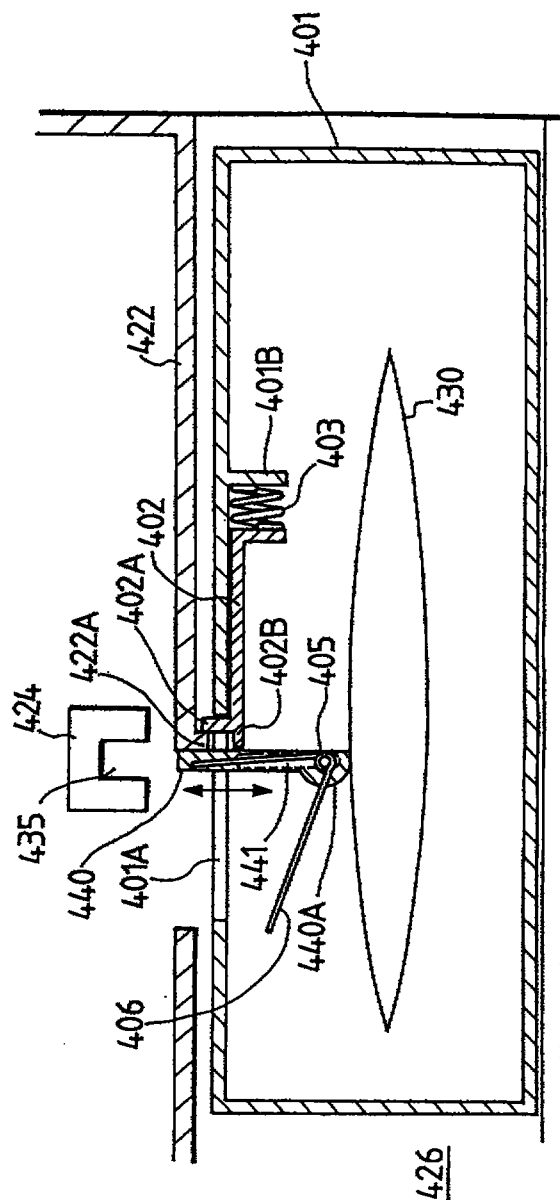


FIG. 31C





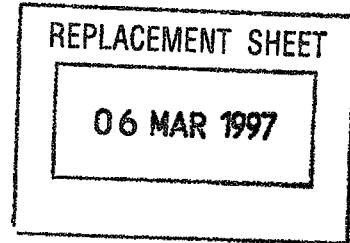


Figure 21 is obtained, but in the present embodiment, a more excellent effect is obtained by performing the following operation.

Figure 25A diagrammatically shows the essential portions of a control circuit according to the present embodiment. In Figure 25A, the reference numeral 400 designates the control unit of the apparatus body which may be in the form of a microcomputer having a CPU for effecting the process of Figure 25B and other control of the entire apparatus, an ROM storing therein a program or the like corresponding to the process procedure, and an RAM for working. The reference numeral 410 denotes a detector for detecting the resistance value between the contacts 306A and 306B. When said resistance value is "0", the detector 410 indicates that the contacts are short-circuited by the pattern 346A, and when said resistance value is infinity, it indicates that the ink cartridge 227 is not yet mounted, and when said resistance value is a predetermined value, it indicates that the ink cartridge 227 is properly held. The reference numeral 420 designates a display device for a message or the like, or output means of sound or the like, or a notice unit which may comprise a combination thereof. The letter I denotes an operation stopping signal for each portion.

Figure 25B shows an example of the operation procedure of the present embodiment and this procedure

AUSTRALIAN PATENT OFFICE
SEARCH REPORTApplication No.
SG 9603138-0

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

An ink jet cartridge (304) containing ink therein is interchangeably provided for an ink jet printer. The printer has an openably-closable plate (333) in the insertion path of the cartridge (304). The plate (333) is held on both sides by locking members (336, 337). The cartridge (304) carries unlocking members (341, 342) which engage with the locking members (336, 337) during mounting of the cartridge (304), to release them and allow the plate (333) to open. Both the locking members (336, 337) and the locking members (341, 342) are arranged asymmetrically with respect to the direction of insertion so as to ensure correct orientation of the cartridge (304) upon insertion.

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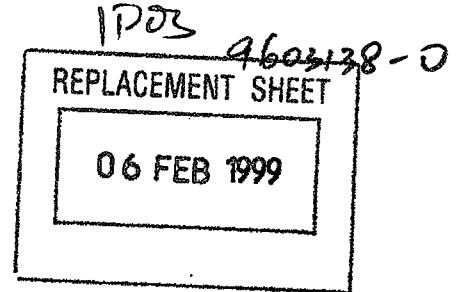
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Claims :

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1. An ink cartridge mountable on a mounting portion along an insertion path (332) of an ink jet recording apparatus, said ink cartridge containing therein ink to be supplied to a recording head and having projectedly provided on opposite sides thereof unlocking members (341, 342) engageable with locking members (336, 337) of said ink jet recording apparatus during the mounting of said ink cartridge to release the restraint of said locking members (336, 337), characterized in that

the locations of the opposite projections of said unlocking members (341, 342) differ from each other in the direction of insertion into said insertion path (332) or in a direction perpendicular.

2. An ink cartridge according to Claim 1, characterized in that the different locations of the projections of said unlocking members (341, 342) correspond to a kind of ink contained in said ink cartridge.

3. An ink jet recording apparatus comprising a mounting portion along an insertion path (332) for mounting an ink cartridge, said insertion path (332) having an openable-closable plate (333) openably and closably-held in said insertion path (332) to said mounting portion, and locking members (336, 337) for restraining said openable-closable plate (333) from opposite sides of said insertion path (332) to thereby inhibit the opening movement thereof, said locking members being engageable with unlocking members (341, 342), projectedly provided on opposite sides of said ink cartridge, during the mounting of said ink cartridge to thereby release the restraint of said locking members (336, 337), characterized in that



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the locations of said opposite locking members (341, 342) differ in the direction of insertion into said insertion path (332) or in a direction perpendicular to said direction of insertion.

4. An ink jet recording apparatus according to Claim 3, characterized in that a plurality of mounting portions are provided for ink cartridges containing different kinds of inks therein, and that the locations of said locking members (336, 337) of said plurality of mounting portions differ according to respective corresponding ones of said ink cartridges.

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ABSTRACT

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INK JET RECORDING APPARATUS AND INK CARTRIDGE FOR THE APPARATUS

An ink jet cartridge (304) containing ink therein is interchangeable provided for an ink jet printer. The printer has an openably-closable plate (333) in the insertion path of the cartridge (304). The plate (333) is held on both sides by locking members (336,337). The cartridge (304) carries unlocking members (341,342) which engage with the locking members (336,337) during mounting of the cartridge (304), to release them and allow the plate (333) to open. Both the locking members (336,337) and the unlocking members (341,342) are arranged asymmetrically with the respect to the direction of insertion so as to ensure correct orientation of the cartridge (304) upon insertion.

Figure 26