

- 1 -

- 1 An Ink Tank Unit, an Ink Jet Cartridge Having
 Said Ink Tank Unit and an Ink Jet Apparatus
 Having Said Ink Jet Cartridge

5 BACKGROUND OF THE INVENTION

Field of the Invention

 The present invention relates to an ink tank
unit for storing the ink to be supplied to a recording
head unit for the recording by discharging the ink, an
10 ink jet cartridge having said unit, and as ink jet
apparatus which performs the recording with said
cartridge mounted thereon.

Related Background Art

 Recording apparatuses which have the features of
15 printer, copying machine, facsimile etc., or are useful
as the output device for the complex electronic
equipment including a computer or a word processor, or
the work station, are configured to record the image
into the recording medium such as paper or plastic thin
20 plate, based on image information. Such recording
apparatuses can be classified into the ink jet system,
the wire dot system, the thermal system and the laser
beam system, depending on the recording method.

 A recording apparatus of the ink jet system (an
25 ink jet recording apparatus) performs the recording by
discharging the ink from recording means (recording
head) onto the recording medium, having the following

1 advantages. The recording means can be made compact,
high definition image can be recorded at high speed,
the ordinary paper can be used for the recording
without any special treatments, the running cost is
5 low, the noise is small owing to the non-impact method,
and the color image is easily recorded by using color
inks. In particular, a line-type recording apparatus
using recording means of the line-type in which a number
of discharge ports are arranged in a direction of sheet
10 width allows the higher speed recording.

Specifically, recording means (recording head)
of the ink jet system of discharging the ink by the
use of heat energy can be easily fabricated with an
arrangement of liquid channels (discharge ports) at high
15 density by forming electrothermal converters, electrodes,
liquid channel walls, and a ceiling plate as the film on
a substrate through a semiconductor fabrication process
such as etching, vapor deposition or sputtering, thereby
allowing for the further compact construction.

20 An ink vessel for use in the ink jet recording
apparatus is required to excellently supply the ink
corresponding to an ink amount to be discharged from the
recording head during the recording, and have no ink
leakage through the discharge ports when the recording
25 is not performed.

If the ink vessel is of replacement type, the
ink vessel is required to be easily mounted or demounted,

1 without ink leakage, and surely supply the ink to the
recording head.

One of the ink vessels useful for the ink jet
recording apparatus is of a constitution as disclosed
5 in Japanese Laid-Open Patent Application No. 63-87242
(hereinafter referred to as a first conventional
example), that is, an ink jet recording cartridge
having a plurality of ink injection orifices with a
foamed member disposed within the ink vessel.

10 This ink vessel can store the ink in a porous
medium such as polyurethane foam which is a foamed
member owing to negative pressure caused by capillary
force of the foam and hold the ink therein (prevent ink
leakage from the ink vessel).

15 Also, Japanese Laid-Open Patent Application No.
2-522 (hereinafter referred to as a second example)
discloses an ink jet recording cartridge provided with
a porous member between a primary ink reservoir and a
secondary ink reservoir and between the secondary ink
20 reservoir and the ink jet recording head.

In this invention, by disposing the porous member
only in the ink flow passage but not containing it in the
ink reservoir, the ink storable amount is increased as
compared with that of the first conventional example.

25 Also, by providing the secondary ink reservoir, the
ink distribution or the air flow when the temperature
rises or during the recording can be regulated to

1 stabilize the negative pressure of the recording head.

However, since in the first conventional example, the ink storing portion needs the foam substantially over its entire area, the filling amount of the ink is restricted, with more ink unused and left in the foam, 5 resulting in a problem that the ink use efficiency is bad. And there was a further problem that remaining amount of ink is difficult to detect, and the substantially constant negative pressure is difficult to attain during 10 the period of consuming the ink.

Also, as seen in the first conventional example, in an ink cartridge having the form of inserting a foam into the ink storing portion, the corner portion of the foam may be distorted, depending on the way of inserting 15 the foam, when inserting the foam, bringing about uneven compression distribution of the whole foam, with the possibility that the distribution of the ink in the ink storing portion is biased.

In this case, due to a bias of negative pressure 20 generating power, the ink flow passage may be disrupted even if the ink is sufficiently stored, causing a discharge failure, or possibly ink leakage upon impacts as the ink is concentrated near the atmosphere communicating port. Accordingly, when inserting the 25 foam into the ink cartridge, there is requirement for the high precision, with great restrictions on the manufacture.

1 On the other hand, in the second conventional
example, the porous medium as a negative pressure
generating member is sufficiently impregnated with the
ink because a negative pressure generating member is
5 disposed in the ink flow passage when the
recording is not performed, causing insufficient
generation of negative pressure with capillary force of
the porous medium, resulting in a problem that ink
leakage is likely to occur through orifices of the ink
10 jet recording head by slight impact.

Also, in the technical fields of recording
using the ink, there is a contact recording technique
for use with the plotters. In this contact recording
technique, the ink supply is typically made to a
15 recording core or wick having ink absorbability and
retainability like a felt-tipped pen.

One example of the ink supply form in the above
contact recording technique is Japanese Laid-Open
Utility Model Application No. 57-16385. This discloses
20 a recording instrument pen relying on the use of a
recording core (porous ink absorptive core) for
recording in contact with the recording medium.

The invention which this official gazette
discloses adopts a constitution of comprising a central
25 chamber having a recording core, a first flocculent
fiber in contact with the recording core, and a second
flocculent fiber having small amount of ink absorbed in
the upper atmosphere communicating port side and being

1 less permeable to the ink than the first flocculent
fiber, and a closed type ink storing chamber from which
the ink can be supplied via a communicating hole to
either side of the central chamber.

5 With this constitution, the air within the closed
type ink storing chamber expands due to rises in the
ambient temperature, so that the ink within the closed
type ink storing chamber flows into the first
flocculent fiber. The ink exceeding the acceptable
10 impregnated amount of the first flocculent fiber is
impregnated by the second flocculent fiber, thereby
preventing the ink overflowing from the recording core
and dripping down.

Also, there is provided a groove of fixed width
15 to cause the expanded air to escape into the atmosphere
communicating port, when one of two closed type ink
storing chambers is only filled with the air, the groove
extending from the uppermost end to the lowermost end
of a lateral surface different from that of a partition
20 wall between the central chamber and the closed type ink
storing chamber, as disclosed above.

However, in the above contact recording instrument
pen, no attention is paid to the stable generation of
negative pressure serving to prevent ink leakage from
25 the recording unit in the ink jet technique which
involves a non-contact recording.

Also, the consumption of the ink from the ink

1 storing chambers on both sides is not necessarily
identical, but it is pointed out that the ink of one
ink storing chamber may be possibly exhausted ahead.
Some attention is paid concerning the ink leakage from
5 the recording core due to environmental changes in this
case, but in the ink jet recording field, some problem
such as the disruption of ink flow passage, or the
penetration of air bubbles into the recording portion
may occur.

10 To solve the above background problems, the
present inventors have previously made an application of,
as the ink vessel suitable for the ink jet print
technical field, an ink jet cartridge having both
features of the capability of supplying excellently
15 the ink in the amount corresponding to that discharged
from the recording head during printing, and the
expedience of having no ink leakage from the discharge
ports when the printing is not performed (Japanese Laid-
Open Patent Application No. 4-198474, Japanese Laid-Open
20 Patent Application No. 4-198681).

Herein, it has been found that the fundamental
constitution effective for the ink jet characteristics
is one having a first accommodating chamber which is a
negative pressure generating member receiving portion
25 having an atmosphere communicating portion for
communicating to the atmosphere as well as receiving a
negative pressure generating member as well as, and

1 a second accommodating chamber which communicates to
the first accommodating chamber but lies in
substantially closed state, and which is an ink
storing portion for directly storing the ink to be
5 supplied to the first accommodating chamber (hereinafter
referred to as a presupposed constitution).

Because this constitution has a tank structure
in which the negative pressure can be made substantially
constant for most of the term from the initiation of
10 using the head cartridge to the termination thereof,
it is possible to provide a replacement-type head
cartridge and an ink jet head and a printer which can
cope with the high speed recording.

Further, in recent years, the ink jet recording
15 art is not only applied to the printer, but also employed
in the communication technical field such as facsimile,
the copying machine field usable for the large paper
(large size), and in the printing field onto the cloths.
With this trend, the larger capacity of the ink vessel
20 is desired for the apparatus.

SUMMARY OF THE INVENTION

The present invention aims to increase the ink
storable amount in an ink tank unit for storing the ink
25 to be supplied to an ink jet recording apparatus, and
enhance the use efficiency of the ink.

Also, the present invention aims to produce

1 evenly the back pressure to an ink jet head unit in an
ink tank unit as well as making it substantially
constant, and further to facilitate the formation of an
ink flow passage from the ink tank unit to the ink jet
5 head unit to maintain the ink supply performance at
high level.

Further, the present invention aims to enhance
the reliability in preventing ink leakage through a
discharge portion or an atmosphere communicating port
10 portion in the ink jet cartridge.

Also, it is another object of the present
invention to provide an ink jet head cartridge of the
integral type which is highly reliable in preventing the
ink leakage through an atmosphere communicating port
15 portion against various changes in the attitude during
physical distribution and changes in the ambient
temperature and humidity, and which is inexpensive in
the manufacturing costs.

To solve the above subjects, the present
20 invention proposes a construction in which when using
an ink tank unit having an ink supply port for
supplying the ink to an ink jet head unit for the
discharge of the ink, said ink tank unit having a
partition portion for partitioning between an ink
25 storing portion for storing the ink to be supplied to
said ink jet head unit and a negative pressure generating
member receiving portion having a negative pressure

1 generating member, as well as having an ink communicating
portion, on the bottom portion thereof, for communicating
said ink storing portion with said negative pressure
generating member receiving portion on the inner surface
5 on which said ink supply port is provided, said
partition portion allowing said ink storing portion and
said negative pressure generating member receiving
portion to be contiguous in a movement direction of
said ink tank unit in discharging the ink.

10 Further, the present invention also proposes, in
addition to the above construction, a construction of
providing a groove (concavity) leading to said ink
communicating portion on said negative pressure
generating member receiving portion side of said
15 partition portion, or a construction of providing a
concave (recess) portion between said ink supply port
portion of said negative pressure generating member
receiving portion and said ink supply port portion.

Also, the present invention proposes a further
20 construction in which when using an ink tank unit having
an ink supply port for supplying the ink to an ink jet
head unit for the discharge of the ink and an atmosphere
communicating portion for communicating the inside to
the atmosphere, said ink tank unit has an ink storing
25 portion for storing the ink to be supplied to said ink
jet head unit and a negative pressure generating member
receiving portion for communicating via an ink

1 communicating portion to said ink storing portion as
well as having a negative pressure generating member,
said atmosphere communicating portion and said ink
supply port being disposed in said negative pressure
5 generating member receiving portion, said atmosphere
communicating portion having one aperture, said
aperture having a barrel portion extending from the
inside of said ink tank to the inner surface of a wall
portion and deadlocked near the outer surface of the
10 wall portion, and an opening portion divided into
branches from a deadlocked portion of said barrel portion.

Further, the present invention also proposes, in
addition to the above construction, a construction in
which a groove extending from said opening portion of
15 said aperture is formed on the outer surface of an ink
tank unit on which an outer opening of said atmosphere
communicating portion is provided, and said groove and
said opening portion are covered with a seal member
having a shorter width than the length of said groove.

20 By adopting the previous constructions, the
volume of ink storing portion for directly storing the
ink within the ink jet cartridge can be increased, so
that the use efficiency of the ink can be enhanced.
The ink supply can be stabilized because the ink is
25 supplied via the ink communicating portion, with the
ink leakage through the atmosphere communicating port
prevented.

1 To further enhance the stability of the ink
supply, a groove portion in the partition portion, or
a recess portion on the bottom portion of negative
pressure generating member receiving portion may be
5 provided to adjust the ink amount within the negative
pressure generating member receiving portion or increase
the width of ink flow passage.

BRIEF DESCRIPTION OF THE DRAWINGS

10 Figs. 1A and 1B are views showing one embodiment
of an ink jet cartridge, in which Fig. 1A is a
schematic perspective view and Fig. 1B is a perspective
view.

Fig. 2A is a cross-sectional view of a unit of
15 Fig. 1B as looked from the B direction in Fig. 1B, and
Fig. 2B is a perspective cross-sectional view of the
unit of Fig. 2A as looked from the discharge port side.

Fig. 3 is a view showing an ink tank unit
according to an embodiment 2 of the present invention.

20 Figs. 4A and 4B are views showing an ink jet
cartridge according to an embodiment 3 of the present
invention, in which Fig. 4A is a cross-sectional view
of the inside along the ink discharge direction and
Fig. 4B is a cross-sectional view of the inside along
25 the main scan direction of the ink jet cartridge.

Figs. 5A and 5B are views showing an ink jet
cartridge according to an embodiment 4 of the present

1 invention, in which Fig. 5A is a cross-sectional view
of the inside along the ink discharge direction and
Fig. 5B is a cross-sectional view of the inside along
the main scan direction of the ink jet cartridge.

5 Fig. 6 is a view showing the state of holding
the ink in the ink cartridge of Figs. 5A and 5B.

Figs. 7A and 7B are views showing an ink jet
cartridge according to an embodiment 5 of the present
invention, in which Fig. 7A is a cross-sectional view
10 of the inside along the ink discharge direction and
Fig. 7B is a cross-sectional view of the inside along
the main scan direction of the ink jet cartridge.

Figs. 8A and 8B are views showing an ink tank
unit according to an embodiment 6 of the present
15 invention, in which Fig. 8A is a cross-sectional view
of the ink tank unit, and Fig. 8B is a cross-sectional
view the tank of Fig. 8A taken along the line X-X, which
is a schematic view with a negative pressure generating
member 205 as shown in Fig. 8A removed to better
20 represent the features of this embodiment.

Fig. 9A is a detail view of a portion D of Fig.
8A, and Fig. 9B is a variation of the portion D of Fig.
8A.

Figs. 10A and 10B are views showing an ink jet
25 cartridge according to an embodiment 7 of the present
invention, in which Fig. 10A is a cross-sectional view
of the inside along the ink discharge direction and

1 Fig. 10B is a cross-sectional view of the inside along
the main scan direction of the ink jet cartridge.

 Fig. 11 is a schematic perspective view of a
portion of Figs. 10A and 10B in an enlarged scale.

5 Figs. 12A and 12B are views showing an ink jet
cartridge according to an embodiment 8 of the present
invention, in which Fig. 12A is a cross-sectional view
of the inside along the ink discharge direction and
Fig. 12B is a cross-sectional view of the inside along
10 the main scan direction of the ink jet cartridge.

 Fig. 13 is a typical perspective view showing
another constitution of an ink jet cartridge, with a
portion in cross section.

 Fig. 14 is a schematic cross-sectional view of
15 the ink jet cartridge as shown in Fig. 13 as looked from
the back side.

 Fig. 15 is an enlarged perspective view showing
the constitution around the periphery of an atmosphere
communicating portion in an ink tank unit of the ink jet
20 cartridge as shown in Figs. 13 and 14, with a portion
in cross section.

 Fig. 16 is a plan view showing the constitution
of an opening face of the atmosphere communicating
portion as shown in Fig. 15.

25 Figs. 17A to 17C are plan views showing the
opening profile of another atmosphere communicating
portion according to the present invention, and Fig. 17D

1 is a cross-sectional view showing the internal structure of the atmosphere communicating portion of Fig. 17C.

Fig. 18 is a cross-sectional view showing the internal structure of a first accommodating chamber of the ink tank unit in the ink jet cartridge as shown in Figs. 13 to 16.

Fig. 19 is a cross-sectional view of the ink tank portion as shown in Fig. 18 as looked from the bottom side.

10 Figs. 20A and 20B are cross-sectional views for explaining the ink movement within the ink tank portion as shown in Fig. 19, respectively.

Figs. 21A to 21C are cross-sectional views for explaining the mechanism of the ink movement within the ink tank unit without a bottom projection 1201.

Fig. 22 is an exploded perspective view showing the constitution of the ink jet cartridge, particularly the ink tank unit, as shown in Figs. 13 to 16.

20 Figs. 23A to 23D are cross-sectional views for sequentially explaining the ink pouring process into the ink tank unit of the ink jet cartridge as shown in Figs. 13 to 16.

Fig. 24 is an exploded perspective view showing the constitution of the ink jet cartridge as shown in Figs. 13 to 16, particularly the ink jet head unit as the head portion.

25 Fig. 25 is a typical perspective view for explaining the periphery of the ink discharge port of

1 the ink jet head unit as shown in Fig. 24 in an
enlarged scale.

Fig. 26 is a lateral cross-sectional view for
explaining the top end of the ink jet head unit as
5 shown in Fig. 24 in an enlarged scale.

Fig. 27 is a perspective view for explaining the
protection of the top end of the discharge port portion
of the ink jet head unit in the ink jet cartridge as
shown in Figs. 13 to 16.

10 Fig. 28 is an exploded perspective view showing
the constitution of a package applicable to the ink jet
cartridge as shown in Figs. 13 to 16.

Fig. 29 is a perspective view showing a final
package of the ink jet cartridge received within the
15 package as shown in Fig. 28.

Fig. 30 is a perspective view showing one example
of an ink jet apparatus on which an ink jet cartridge
of the present invention can be mounted.

20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be described in
detail using the drawings. Note that the "negative
pressure" as referred to in the present invention is a
back pressure applied to an ink jet head unit
25 (hereinafter also referred to as a recording head unit)
in a direction of the ink supply, by which the water head
at an ink discharge portion provided on the ink jet head

1 unit is made lower than the atmospheric pressure.

Figs. 1A and 1B show one embodiment of an ink jet cartridge which is mountable on a carriage of an ink jet recording apparatus. Fig. 1A is an external
5 perspective view of the ink jet cartridge of the present invention, and Fig. 1B is a perspective projection view of an ink tank unit, with the recording head unit removed from the ink jet cartridge as shown in Fig. 1A, as seen through one lateral side (which corresponds to
10 the bottom face of the ink tank unit which is an ink reservoir in this embodiment).

Herein, 200 is an ink tank unit (ink cartridge) which is an ink reservoir for storing the ink, and 100 is a head unit for performing the recording by discharging
15 the ink through the discharge ports 101.

Note that in the present invention, an ink tank unit and a head cartridge connected together is referred to as an ink jet cartridge.

The ink jet cartridge in this embodiment has an
20 ordinary ink tank unit 200 and a head unit 100 connected, as shown in Fig. 1A, and is detachably mounted on a carriage (not shown) of the ink jet recording apparatus, with a discharge port portion 101 faced downward. Note that in the ink jet cartridge of this embodiment, the
25 head unit 100 as shown in Fig. 1B can be detached from the ink tank unit 200.

102 is a wiring connector for accepting the signal

1 for driving the ink discharge portion 101 of the head
unit 100, as well as outputting an ink remaining amount
sensing signal, this wiring connector being connected to
a wiring connector (not shown) on the ink jet recording
5 apparatus side. This wiring connector 102 is provided
along the lateral side of the head unit 100 and the
ink tank unit 200, that is, along the vertical direction
in mounting the carriage as will be described later.

103 is a pin engagement portion provided on the
10 head unit 100 to engage a pin provided on the carriage
side when mounting the ink jet cartridge on the ink jet
recording apparatus. With this pin engagement portion
103, the ink jet head unit 100 can be positioned.

When mounting the ink jet cartridge on the
15 carriage, a knob 201 provided on the ink tank unit 200 is
grasped, with the discharge portion 101 directed
downward, to mount the ink jet cartridge at a
predetermined position on the carriage. Accordingly,
splashing or sticking of the ink to the apparatus or
20 the undischARGE will not occur even if the user touches
the ink discharge portion by mistake, when removing or
replacing the ink jet cartridge.

104 is a head side absorbing member provided for
the recovery of recovery member for the ink discharge port
25 portion 101 provided on the ink jet head unit 100, the
details of which will be described later.

The ink tank unit 200 is comprised of a negative

1 pressure generating member receiving portion 203 which
is a negative pressure generating chamber and an ink
storing portion 204, the negative pressure generating
chamber having inserted therein a porous ink absorbing
5 member 205 which is a negative pressure generating
member. Between the negative pressure generating member
receiving portion 203 and the ink storing portion 204 is
provided an ink communicating portion 206.

The ink storing portion 204 has a pair of
10 electrode pins installed therein for use in sensing the
remaining amount of the ink. The ink storing portion
204 is configured such that the ink storing portion and
the negative pressure generating member receiving portion
are disposed contiguously along a vertical direction to
15 the main scan direction as a whole by providing a
partition portion 215 (partition wall) of an L-character
shape as seen from the A direction of Fig. 1B.

Since the ink storing portion 204 is partitioned
by the partition portion with the longitudinal direction
20 of the ink storing portion 204 being perpendicular to
the main scan direction along which the ink jet
cartridge moves as a whole in discharging the ink,
the ink tank unit is reduced in size while the ink
capacity is increased simultaneously, with the
25 vibration of the ink inside suppressed in making the
main scan for the recording.

Note that in this embodiment, the ink storing

1 portion has one and half or more the volume of the
negative pressure generating member receiving portion,
wherein the greater ink capacity is achieved by
increasing the ratio of the ink storage to the volume of
5 the ink storing portion of the ink vessel, as compared
with the conventional constitution of the ink storing
portion for storing the ink using only an ink absorbing
member.

Referring now to Figs. 2A and 2B the state where
10 the ink is stored within the ink jet cartridge will be
described below. Fig. 2A is a cross-sectional view of
a unit of Fig. 1B as looked from the B direction in
Fig. 1B. Fig. 2B is a perspective cross-sectional view
of the unit of Fig. 2A as looked from the discharge
15 port side.

In Fig. 2A, the ink discharge from the head unit
is performed in a downward direction in the figure,
wherein an ink supply port 209 is located on the bottom
side when the ink jet cartridge is mounted on the ink
20 jet recording apparatus. An atmosphere communicating
port 208 and the ink supply port 209 are disposed on
the opposite upper and lower surfaces, respectively,
within the negative pressure generating member receiving
portion, with the ink absorbing member 205 which is a
25 negative pressure generating member interposed
therebetween.

The ink supply from the ink storing portion 204

1 to the negative pressure generating member receiving
portion 203 is carried out in response to pressure
changes upon the ink consumption of the head unit (not
shown).

5 Normally, since there is the ink within the
negative pressure generating member receiving portion,
the ink storing portion 204 is in the closed state, so
that the internal pressure will decrease with the ink
supply.

10 And the pressure within the ink storing portion
204 decreases with the ink consumption, but because the
negative pressure generating member receiving portion is
opened to the atmosphere, the gas-liquid interface
within the receiving portion will drop, finally allowing
15 the air to enter the ink storing portion 204 via the
ink communicating portion 206, bringing about the gas-
liquid exchange.

Herein, with too small spacing of the ink
communicating portion 206, the meniscus force is so
20 great that the ink supply from the ink storing portion
to the negative pressure generating chamber is not
allowed, this spacing being preferably about 3 mm,
considering from the pore diameter (substantially 0.1 mm)
of a porous member as the ink absorbing member receivable
25 within the negative pressure generating chamber. In this
embodiment, this spacing was 2 mm.

As shown in Figs. 2A and 2B, since the ink supply

1 port 209 is located on the bottom side in making the ink
discharge, the positional relation between the ink
communicating portion 206 and the ink supply port 209
at the time of ink discharge is such that the ink supply
5 port 209 is lower in level than the ink communicating
portion 206 with respect to the gravitational direction.

Accordingly, before the ink level within the
negative pressure generating chamber falling with the
ink consumption within the negative pressure generating
10 portion reaches a point provided on the ink supply
port 209, the ink within the ink storing portion 204 is
supplied via the ink communicating portion 206 to the
negative pressure generating member receiving portion
203, so that the ink within the ink storing portion can
15 be completely used, causing no ink interruption, with
the enhanced use efficiency of the ink attained.

Considering from the aspect of the ink
interruption, the ink communicating portion may be
provided anywhere as far as the previously-described
20 positional relation is met with respect to the ink
supply port. However, taking into consideration the
fluctuation of the ink within the ink storing portion,
it is preferable to supply the ink from the ink storing
portion to the negative pressure generating member
25 receiving portion in a direction orthogonal to the main
scan direction.

In this embodiment, as shown in Figs. 2A and 2B,

1 owing to the provision of the ink communicating portion on a
wall of the partition portion parallel to the main scan
direction, a more preferable form of stable ink supply
can be attained without influence from the fluctuation
5 of the ink within the ink storing portion.

Fig. 3 shows one example of an ink tank unit
according to an embodiment 2. This embodiment offers
a constitution for further stabilizing the ink storing
state within the negative pressure generating member
10 receiving portion 203 as shown in the embodiment 1.

In this embodiment, as shown in Fig. 3, the
negative pressure generating member receiving portion
203 is rounded R at the four corners 210 within the
negative pressure generating member receiving portion
15 203. With this curved profile, the absorbing member can
press evenly at the four corners so that no exfoliation
or distortion occurs at the edge corners of the ink
absorbing member 205 due to the friction, avoiding the
ink concentration on the locally deformed portion.

20 Accordingly, the possibility of the ink flow
passage formed in the ink concentrated portion can be
further reduced, resulting in stabler ink distribution
to collect the ink only near the ink supply port 209
more securely.

25 Further, the ink absorbing member near the
atmosphere communicating port is not wet by the ink,
and lower in wettability (less likely to be wet) than

1 when it is wet by the ink.

Thereby, the ink within the ink absorbing member is difficult to migrate toward the atmosphere communicating port, creating a very strong structure
5 against the ink wetness. Hence, the absorbing member
205 near the atmosphere communicating port can be utilized as the buffer.

While in this embodiment, curvature is provided at the four corners, it is noted that multi-angle may be
10 made to eliminate the angle at the four corners to prevent exfoliation. However, the profile of R is most preferable from the aspect of the insertion precision or even insertion.

Figs. 4A and 4B show internal structures of another
15 ink tank unit for use in the ink jet cartridge of the present invention which is mounted on the ink jet recording apparatus according to an embodiment 3. In the figure, like symbols are attached to the parts having the same functions as in the previous embodiment 1.

20 Fig. 4A is a cross-sectional view of the inside along the ink discharge direction, and Fig. 4B is a cross-sectional view of the inside along the main scan direction of the ink jet cartridge. Herein, Fig. 4A corresponds to the D-D cross-sectional view in Fig. 4B.

25 As seen from Fig. 4B, an ink storing portion is extended on both sides of negative pressure generating member receiving portion along a direction crosswise to

1 the main scan direction when mounting the ink cartridge
by a partition portion 215 in this cartridge, with the
ink storing portion like a U-character. In this
embodiment, like the previous embodiment 1, the direction
5 of supplying the ink via the ink communicating portion
206 from the ink storing portion to the negative
pressure generating member receiving chamber is made a
longitudinal direction of the ink storing portion, so
that the ink storing amount is increased.

10 As above described, with such U-character
structure where the longitudinal direction of the ink
storing portion is orthogonal to the main scan direction,
the fluctuation of the ink due to the movement of the
cartridge in the main scan direction can be suppressed,
15 like the previous embodiment 1. In this embodiment,
the ink communicating portion 206 is provided in the
central portion of the partition portion 215 of U-
character shape, i.e., on the wall along the main scan
direction of the partition portion 215, whereby the
20 effects of the ink fluctuation can be further avoided.

Figs. 5A and 5B show the internal structures of
another ink tank unit for use in the ink jet cartridge of
the present invention as an embodiment 4. In this figure,
like symbols are attached to the parts having the same
25 functions as in the previous embodiment.

Fig. 5A is a cross-sectional view of the inside
along the ink discharge direction and Fig. 5B is a

1 cross-sectional view of the inside along the main scan
direction of the ink jet cartridge.

In this embodiment, as shown in Fig. 5A, an
absorbing member 205 within the negative pressure
5 generating member receiving portion 203 is divided into
two portions 205-1 and 205-2, and a gap 213 serving as
a meniscus generating portion is provided so that a
meniscus may be formed between these portions 205-1 and
205-2.

10 Upon the ink reaching this gap portion, a
meniscus is formed therein so that the movement of the
ink from an ink absorbing member 205-2 to an ink
absorbing member 205-1 is made difficult.

15 Accordingly, by adopting the constitution of this
embodiment, the wetting with the ink from the atmosphere
communicating port 218 can be prevented at higher
reliability.

Fig. 6 shows an instance where the ink is filled
in the ink jet cartridge of this embodiment. In this
20 case, even if the expanded ink wets the whole portion of
205-2 in reducing the pressure or maintaining high
temperature, the ink is held by the meniscus generating
portion 213, and the ink is difficult to flow to the
portion 205-1, so that the ink leakage from the
25 atmosphere communicating port 208 is less likely to occur.

Figs. 7A and 7B show the internal structures of
another ink tank unit for use in the ink jet cartridge of

1 the present invention which is mounted on the ink jet
recording apparatus, as an embodiment 4. In this
figure, like symbols are attached to the parts having
the same functions as in the previous embodiment.

5 Fig. 7A is a cross-sectional view of the inside
along the ink discharge direction and Fig. 7B is a
cross-sectional view of the inside along the main scan
direction of the ink jet cartridge.

In this embodiment, as shown in Fig. 7A, like
10 the embodiment 4, two divided portions 205-3 and 205-4
are provided within the negative pressure generating
member receiving portion 203. A different point from
the previous embodiment 4 is that a buffer chamber 211
communicating to the atmosphere communicating port 208
15 within the negative pressure generating member receiving
portion is provided adjacent the ink absorbing member
205-4 as negative pressure generating means.

This buffer chamber is secured within the negative
pressure generating member receiving portion by a rib 214
20 to store the ink overflowing from the ink absorbing
member due to environmental changes as previously
described, preventing the ink from reaching the
atmosphere communicating port portion.

Further, in this embodiment, by disposing an ink
25 absorbing member 205-3 between two absorbing member stop
ribs 214, the ink overflowing into the buffer chamber is
prevented from directly reaching the atmosphere

1 communicating port 208.

In this embodiment, the reliability in preventing the ink leakage is enhanced by virtue of this buffer chamber.

5 A constitution other than preventing the ink leakage through the atmosphere communicating port portion by changing the form of receiving the negative pressure generating member within the negative pressure generating member receiving portion as previously
10 described is shown below.

Figs. 8A and 8B are views showing an ink tank unit according to this embodiment, in which Fig. 8A is a crosssectional view of the ink tank unit, and Fig. 8B is a schematic cross-sectional view of the tank taken along
15 the line X-X, with the negative pressure generating member 205 removed to better represent the features of this embodiment.

Fig. 9A is a detail view showing a portion D of Fig. 8A. In this embodiment, an atmosphere communicating
20 passage of which the end portion is projected into negative pressure generating member receiving portion 203 is used, and further, a partition wall 219 is provided around the periphery of atmosphere communicating passage, as shown in Figs. 8A to 9A.

25 Herein, when the height of a projected atmosphere communicating port portion 218 is assumed to be c , the height of the partition wall 219 which is an annular

1 projection provided circumferentially thereof is made
2c or greater, with a gap 211 formed as a buffer chamber
between negative pressure generating member (ink
absorbing member) 205 and a projection 218 of atmosphere
5 communicating port, thereby preventing the ink leakage
through the atmosphere communicating port portion.

Further, the outside annular partition wall 219
is spaced away from a projected tubular end portion 218
of the atmosphere communicating port not to be in
10 contact therewith, and even if the ink leakage occurs
from the negative pressure generating member 205, no
leaked ink passes along the partition wall 219 into
the atmosphere communicating port portion 218.

However, in this case, it is desired that the
15 interval provided between both projections is set to be
large enough to cause no capillary phenomenon, thereby
reducing the possibility that the ink sticking to the
partition wall reaches an opening portion at the end of
the atmosphere communicating port portion.

20 It will be appreciated that the atmosphere
communicating port portion within the negative pressure
generating member receiving portion is of a triple
structure, with increasing height of the partition wall
in more outside, as shown in Fig. 9B.

25 Where the length of an innermost projection or a
projection portion 218 of the atmosphere communicating
port portion is assumed to be c, the length of the

1 outermost annular projection 220 is made 2c or greater
 (e.g., 3c). Thereby, the reliability in preventing the
 ink leakage through the atmosphere communicating port
 is further increased.

5 Besides the above embodiments, modifications
 such as a quadruple or more multi-structure may be made
 within the scope of the present invention to enhance the
 reliability in preventing the ink leakage.

 In this embodiment, the atmosphere communicating
10 port portion within the negative pressure member
 receiving portion of the ink tank unit is made the above
 structure, forming a clearance as the buffer chamber
 between the ink absorbing member and the surface
 provided with the atmosphere communicating port, and
15 further preventing the ink from the partition wall
 constituting the buffer chamber reaching the opening
 portion at the end of the atmosphere communicating port
 portion to increase the reliability in preventing the
 ink leakage through the atmosphere communicating port
20 portion.

 Further, even if the ink enters inside the
 annular projection, the ink is trapped prior to reaching
 the innermost projection of the atmosphere communicating
 port, whatever attitude the ink jet cartridge is placed
25 in, because the annular projections are spaced part,
 thereby enhancing the reliability of ink leakage
 prevention.

1 In embodiments as previously described,
an ink tank unit has been proposed which is comprised of
a negative pressure generating member receiving portion
(ink absorbing member receiving portion) having an ink
5 supply port in communication with the recording head
and receiving a negative pressure generating member
(ink absorbing member) and an ink storing portion
contiguous to and in communication with the absorbing
member receiving portion via an ink communicating
10 portion on its bottom side in order to accomplish
simultaneously the enhanced use efficiency of the ink
and the proper generation of negative pressure force.

 In the above constitution, the ink supply from
the ink storing portion to the negative pressure
15 generating member receiving portion is made in such a
process that the ink within the ink storing portion 204
is supplied via the ink communicating portion 206 to the
negative pressure generating member receiving portion 203
when the ink level near the partition portion 215
20 decreases at least to the ink communicating portion 206
of the partition portion 215 by the ink consumption
within the negative pressure generating portion.

 The ink level in the negative pressure generating
member receiving portion necessarily decreases because
25 the ink communicating portion communicating to the ink
storing portion lies on the bottom of the partition
portion 215. However, the compression of the absorbing

1 member received within the negative pressure generating
member receiving portion is difficult to become even
in practice, and the decreasing ink level is not
necessarily uniform.

5 On the other hand, because the negative pressure
generating member has a function of holding the ink, the
ink level within the negative pressure generating member
receiving portion will rise again, if the ink is
supplied from the ink storing portion. Accordingly,
10 there is the possibility that the amount of ink held
above the ink supply port 209 within the negative
pressure generating member receiving portion is not
always constant.

The negative pressure generated by the ink
15 absorbing member is possibly affected by the weight of
the ink itself within the negative pressure generating
member receiving portion. In particular, when the ink
supply port portion 209 for communicating to the
recording head is provided on the bottom portion of the
20 negative pressure generating member receiving portion,
as in the previous embodiment, the variation in the ink
amount will cause a variation in the negative pressure.

In this case, by increasing the gap of the ink
communicating portion between both receiving portions,
25 the ink level can not be adjusted. Because the increased
gap prevents the formation of ink meniscus in the ink
communicating portion, the ink is supplied excessively to

1 the absorbing member receiving portion, causing the
negative pressure within the absorbing member to
decrease extremely, resulting in a risk that ink leakage
may occur.

5 In the following embodiment, one constitution
to enhance the stability of this negative pressure will
be proposed.

Figs. 10A and 10B are views best representing the
features of an ink jet cartridge according to an embodiment 7.
10 In the figure, like symbols are attached to the
elements having the same functions as in the previous
embodiment.

Fig. 10A is a cross-sectional view of the inside
of an ink tank unit connected to an ink jet head unit,
15 taken along the ink discharge direction. Fig. 10B is a
cross-sectional view of the inside of the ink jet
cartridge along the main scan direction.

Herein, 105 is an ink communicating member for
introducing the ink within the ink jet head unit, and 106
20 is a filter provided at the end portion of the ink
communicating member 105 for preventing the flow of fine
dirts into the ink jet head.

In Figs. 10A to 11, a is the height of ink
absorbing member receiving portion, and h represents the
25 height of the top of a groove portion with reference to
the filter surface disposed at the end portion of the
ink communicating member.

1 This embodiment is different from the embodiment
1 as previously described in that the wide groove portion
216 (concavity) is provided at the upper portion of the ink
communicating portion so that the lower portion or one
5 end of the negative pressure generating member receiving
portion on a partition wall 215 in the partition portion
may be in communication with the ink communicating
portion 206. By providing this groove portion 216, the
admission passage of the air into the ink storing
10 portion can be easily secured upon the gas-liquid
replacement which is made with the ink consumption.

 Herein, through the end portion opposite that
leading to the ink communicating portion of the groove
portion, the gas-liquid replacement is effected. In
15 this embodiment, the groove portion at the end of the
gas-liquid replacement side is shallower in depth when
leaving farther away from the ink communicating portion.
Thereby, the introduction of the air into the groove
portion is facilitated.

20 In this embodiment, the negative pressure
condition within the negative pressure generating member
receiving portion can be determined by the negative
pressure generating force (capillary force) of the ink
absorbing member 205 which is the negative pressure
25 generating member and the amount of holding the ink
within the ink absorbing member 205 residing above the
ink supply port portion 209, as shown in Figs. 8A and 8B.

1 In this case, the negative pressure generating
force within the negative pressure generating member
receiving portion is set with a back pressure of $DmmAq$
or greater in a reverse direction to the ink supply
5 direction in the ink supply port, assuming the
distance between the ink supply port face and the
discharge port face of the recording head to be Dmm , in
order to prevent the ink leakage through the discharge
ports of the recording head.

10 On the other hand, the upper limit value of
negative pressure generating force must be determined in
consideration of the ink exhaustion in the ink supply
or reduced print density due to insufficient ink supply.
In this embodiment, D is equal to 200 mm, and the
15 negative pressure generating force within the negative
pressure generating member receiving portion is set in
the range from 20 mmAq to 40 mmAq.

 As means for controlling the negative pressure
within the negative pressure generating member receiving
20 portion, a method of adjusting the height h of the
gas-liquid replacement groove portion 216 as previously
described is adopted in this embodiment. By changing the
height of this groove portion, the position of the gas-
liquid boundary face within the negative pressure
25 generating member receiving portion can be adjusted to
realize the stability of the negative pressure.

 The positional relation between the groove

1 portion and the filter face in this embodiment is such
that the distances from the negative pressure generation
chamber bottom portion to the filter face of the ink
supply port and to the partition wall end portion at the
5 upper portion of the ink communicating portion are
identical, as shown in Figs. 10A and 10B.

The distance h up to the top of the groove
portion with reference to the filter face is set at 5 mm,
and the gas-liquid interface (ink level) from the ink
10 storing portion to the remaining ink in the absorbing
member receiving portion is maintained at a position of
about 5 mm or less with reference to the filter face
within the absorbing member receiving portion. And by
setting the position of the gas-liquid interface to be
15 less than about 5 mm, the negative pressure is generated
within the condition range as previously described.
Note that the height a of the negative pressure
generating member receiving portion is 48 mm in this
embodiment.

20 Accordingly, by adopting the constitution of
having a groove portion provided as proposed in this
embodiment, the ink supply from the ink storing portion
in the ink communicating portion to the negative
pressure generating member receiving portion can be
25 stably maintained, and the ink level (gas-liquid
interface) within the negative pressure generating
member receiving portion can be retained substantially

1 constant. Thereby, the amount of ink received within
the negative pressure generating member receiving
portion is substantially constant, and the variation in
the ink supply or the negative pressure which may have
5 effects on the recording quality can be suppressed.

In this embodiment, as above described, because
the filter face of the ink communicating member end
portion is projected from the bottom face of the negative
pressure generation chamber, the ink absorbing member in
10 the neighborhood of the ink supply port is compressed to
concentrate the ink, in order to enhance the ink supply
performance to the ink jet head unit.

Note that the height of the groove portion is set
above the filter face at minimum, preferably, 1 mm above
15 the filter face, and more preferably 2 mm above.

This is because the uneven distribution of
compressing the ink absorbing member may be caused by
the condition of insertion of the ink absorbing member,
resulting in the possibility that the ink level varies
20 locally within the negative pressure generating member
receiving portion, thereby giving rise to ink interruption.

Accordingly, by providing a groove portion as
proposed in this embodiment at the upper portion of the
ink communicating portion, the ink level within the
25 absorbing member receiving portion in supplying the ink
from the ink storing portion to the absorbing member
receiving portion is held at an appropriate position,

1 until the ink is used up, so that the static negative
pressure within the absorbing member can be generated
more stably.

5 In the embodiment 1 as previously described,
there is the possibility that the ink level varies with
the ink consumption, as already pointed out. The bottom
face of the ink storing portion and that of the
absorbing member receiving portion are coplanar, whereby
the changes in the ink level will not only give rise to
10 the changes in the negative pressure as previously
described, but also possibly disrupt the ink flow
passage within the absorbing member, when supplying the
ink from the ink storing portion to the absorbing member
receiving portion, as with the embodiment 1 in which the
15 ink supply port is provided on the bottom face of the
negative pressure generating member receiving portion.

In this case, because such a problem can not be
resolved by increasing the gap of the ink communicating
portion between both receiving portions as previously
20 described, the following constitution is adopted in the
embodiment 8 to realize a further stabilization of the
ink supply.

The constitution of this embodiment is shown in
Figs. 12A and 12B. In the figure, like symbols are
25 attached to the elements having the same functions as in
the previous embodiment.

Fig. 12A is a cross-sectional view of the inside

1 taken along the ink discharge direction, and Fig. 12B is
a cross-sectional view of the inside of an ink jet
cartridge taken along the main scan direction.

As shown in Fig. 12B, a recess portion 9 (concave)
5 is provided in the bottom portion of the negative pressure
generating member receiving portion, so that the bottom
portion of the negative pressure generating member
receiving portion is lower than the bottom portion of
the negative pressure generating member receiving portion
10 when mounting the ink jet cartridge. This recess
portion 217 is provided to have the depth b in the area
from the neighborhood of the ink communicating portion
206 to the neighborhood of the ink supply port 209, as
shown in Fig. 12A.

15 By providing this recess portion, the ink flow
passage within the negative pressure generating member
receiving portion can be secured in the height direction
without preventing the formation of meniscus upon the
gas-liquid replacement in the ink communicating portion.

20 Note that the depth b of the recess portion
determines the formation width of ink flow passage,
greater value of b resulting in more effect, and higher
reliability of preventing ink interruption.

The constitution of this embodiment in addition
25 to the constitution of having a groove portion provided
on the partition wall as previously described in the
embodiment 6 allows more positively the stable generation

1 of the negative pressure, or the securement of ink flow
passage, resulting in the stabler ink supply.

Other embodiments which are able to enhance the
ink supply performance and the reliability of preventing
5 ink leakage will be described below with reference to
the drawings.

Figs. 13 and 14 show one embodiment of the
present invention of an ink jet cartridge having a head
unit and an ink tank unit connected, wherein Fig. 13 is
10 a typical perspective view showing the constitution of
the ink jet cartridge of this embodiment, partly in
cross section, and Fig. 14 is a schematic cross-sectional
view of the head as shown in Fig. 13 as looked from the
back side thereof.

15 As shown in Fig. 13, an ink tank unit 1000 in
this embodiment has a connecting opening portion 1101 as
the ink supply port for supplying the ink to an ink jet
head unit 2000 as the head portion on the bottom face
of the ink tank unit 1000. And the ink tank unit is
20 comprised substantially of a first accommodating chamber
1100 which is a negative pressure generating member
receiving portion having an atmosphere communicating
portion 1150 for receiving a negative pressure
generating member 1102, a posterior second accommodating
25 chamber 1200 for communicating to the bottom face of the
first accommodating chamber 1100 through a minute
communicating portion 1300 as the ink communicating

1 portion and for storing the ink to be supplied to the
first accommodating chamber 1100, and a lateral second
accommodating chamber 1250 for communicating at
partition walls 1251a and 1251b having a communicating
5 portion larger than the minute communicating portion 1300
to the posterior second accommodating chamber 1200. In
this embodiment, an L-character shaped ink storing
portion as in the previously described embodiment is
formed by the posterior second accommodating chamber 1200
10 and the lateral second accommodating chamber 1250.

Herein, the negative pressure generating member
1102 is accommodated in the first accommodating chamber
1100 in two-thirds region from the bottom face of the
first accommodating chamber.

15 The negative pressure generating member stopper
ribs 1103a, 1103b and 1103c are disposed at three sites
on a ceiling of the first accommodating chamber 1100 so
that the volume of not accommodating the negative
pressure generating member 1102 can be positively
20 reserved, thereby suppressing excessive insertion of
the negative pressure generating member 1102.

With the three stopper ribs as above, the region
of the first accommodating chamber formed therebetween
consists of an air layer 1104, with the atmosphere
25 communicating portion 1150 disposed in this air layer.
Herein, it is important that an opening portion 1152 on
the first accommodating chamber side of the atmosphere

1 communicating portion is located at a position spaced
a fixed interval apart from the negative pressure
generating member 1102 at any time. As a result of
examinations, the present inventors have found that in
5 consideration of the fluctuation in inserting the
negative pressure generating member 1102, the compressive
strain of the stopper ribs 1103, or the softening
deformation of the stopper ribs 1103 due to rise in
temperature, it is preferred that the above interval is
10 within a range from 3 mm to 5 mm. Herein, the reason
for regulating the upper limit is that securing the
sufficient distance from the ceiling of the first
accommodating chamber to the opening portion 1152 of the
first accommodating chamber is important in obtaining
15 safety factor against the ink leakage in the inverted
attitude (as will be detailed later). Note that the
direction of the arrow E in Fig. 13 points to the
scanning direction of the head according to this
embodiment, and the direction of the arrow F points to
20 the ink discharge direction from the head.

Fig. 15 is an enlarged cross-sectional
perspective view of the atmosphere communicating portion
and its surrounding in this embodiment. Fig. 15 is a
view of an opening portion 1151 of the atmosphere
25 communicating port as shown in Fig. 14, as looked from
the above. The atmosphere communicating portion 1150
is substantially comprised of a barrel portion 1150a

1 extending from the inside of the first accommodating
chamber 1100 to its wall portion and deadlocked near
the outer face of the wall portion, as shown in Fig. 14,
and an opening portion (opening portion 1151 of the
5 atmosphere communicating port) divided into plural
(three in this embodiment) branches from the deadlock
portion of the barrel portion 1150a. This opening
portion is provided on the outer surface of a housing
for the ink tank unit 1000. Note that the opposite
10 end to the opening portion 1151 of the atmosphere
communicating port of the barrel portion 1150a
corresponds to the opening portion 1152 of the first
accommodating chamber. And this atmosphere communicating
portion 1150 is a hole for introducing the outside air
15 into the ink tank unit 1000 to obtain a pressure
equivalent to the external pressure during the printing,
but considering the vaporization of the ink, it is
preferred to be slender and long. However, such a shape
was contrary to its function from the respects of the
20 process maintenance of the mold and the molding cycle
in injection molding the vessel in plastic in the
manufacturing process of the ink tank unit 1000. As a
result, the evaporation of the ink may be permitted to
some extent, or the part around the atmosphere
25 communicating portion constituted of a plurality of
members to attain its goal. The former has a problem,
particularly in the color recording head, that the color

1 tint may change between the initial time of the use and
its terminal time, while the latter brings about the
increased number of processes because of the complex
manufacturing process with the increased number of
5 parts, resulting in expensive recording head.

For the above problem, the present inventors
have proposed a construction of holding a slender pin of
the mold not to be swung in injection molding a slender
and long atmosphere communicating port, as well as
10 effecting the integration (integral molding) of complex
shaped parts and preventing the foreign matter from
directly entering the inside of the tank vessel through
the opening portion of the atmosphere communicating
portion disposed on the surface of the product.

15 In Fig. 15, the opening portion 1151 of the
atmosphere communicating port is configured to accept
the pin on the slide side with three claws provided on
the fixed side CAV (cavity) of the mold, whereby the
splender pin can be positioned and molded at high
20 precision. In this embodiment, the atmosphere
communicating port having an inner diameter ϕ of 1.0 mm
and a length of 10 mm can be fabricated in about 20
seconds in the typical molding cycle. In this embodiment,
the opening portion 1151 of the atmosphere communicating
25 port is divided into three sections, but not limited to
three, the opening portion may be divided into two or
four sections with two or four claws (see Figs. 17A and

1 17B). From the positional relation between the gate
position and the atmosphere communicating portion, a
through hole like a crank may be molded by providing a
claw at one site on the side of keeping the slide pin
5 from inclination due to the pressure of flowing resin
(see Fig. 17C). It goes without saying that the ink
jet cartridge in the previous embodiment may be used,
but not limited to the tank unit in this embodiment, and
is also effective in an integral or replacement-type
10 tank vessel in which the negative pressure generating
member is received substantially entirely within the
ink storing portion.

Then, the surface of the opening portion 1151 of
the atmosphere communicating port opens into a groove
15 1153 depressed 1 mm below a label pasting flank 1105
constituting a part of the outer surface of the ink tank
unit 1000 which is 0.2 mm or more below the surface of
the tank vessel, this groove 1153 being covered with a
plastic film (e.g., label) (not shown) having a adhesive
20 layer, and the port communicating to the atmosphere
through the groove extended beyond the film.

The groove 1153 is formed in greater length than
the film width on both sides of the film. When the film
is pasted at the normal position, two opening portions
25 to the atmosphere are provided on the both sides of the
film. And even if the film is deviated to either one
side, one opening portion to the atmosphere can be

1 secured at any time. One aim of covering the opening
portion 1151 of the atmosphere communicating portion
with the film is mostly the appearance, but the other
aim is to secure the total extension of the atmosphere
5 communicating port and suppress the evaporation. The
plastic film may be a laminate of synthetic paper UPO
and polypropylene film, or a film having a print layer
inserted between former two layers and an adhesive layer
applied.

10 Referring now to Fig. 18, the generation of
negative pressure in the ink tank unit of this embodiment
will be described.

 The condition of the negative pressure in the
first accommodating chamber 1100 is determined by the
15 negative pressure generating force of the negative
pressure generating member 1102 and the holding amount
of the ink within the negative pressure generating member
1102 provided above the connecting face of the ink
discharge portion, as previously described. Also, the
20 negative pressure within the first accommodating chamber
1100 must be $-D \text{ mmHg}$ or greater, assuming the distance
between the connecting face of the ink discharge portion
and the head discharge port face to be $D \text{ mm}$, taking into
consideration the ink leakage through the head discharge
25 ports.

 Also, the upper limit of the negative pressure
must be determined by taking into consideration the ink

1 exhaustion in the ink supply, the reduced print density
in the insufficient supply, and the disorder in the
image. In this embodiment, D is equal to 20 mm, and the
negative pressure of the negative pressure generating
5 member 1102 is set within the range from -20 mmAq to
-40 mmAq.

As one means for controlling the negative
pressure of the first accommodating chamber 1100, there
is a way of adjusting the height h of a gas-liquid
10 replacement promoting structure 1110 having a
construction in which on the wall surface on the first
accommodating chamber 1100 of the partition wall 1100a
for partitioning between the first accommodating chamber
1100 and the second accommodating chamber 1200, the upper
15 portion of the minute communicating portion 1300 is
formed thin, or a construction containing a groove
provided on the wall surface of the partition wall
1100a as previously described. By using this structure,
the air moves from the first accommodating chamber 1100
20 to the posterior second accommodating chamber 1200 in
the closed state, while at the same time the ink is
supplied from the second accommodating chamber to the
negative pressure generating member 1102 within the
first accommodating chamber 1100 so that the ink liquid
25 level can be maintained below the top of the gas-liquid
replacement promoting structure 1110. Accordingly, by
changing the top portion of this gas-liquid replacement

1 promoting structure 1110, the gas-liquid boundary surface
within the first accommodating chamber 1100 can be set
at any level.

In this embodiment, assuming the height h from
5 the connecting surface of the ink discharge portion to
the top portion of the gas-liquid replacement promoting
structure to be 5 mm, the ink liquid level in the gas-
liquid replacement during the recording and non-
recording (including standby) is always maintained in
10 the range from 2 mm to 5 mm above the connecting surface
of the ink discharge portion, whereby the stable state
can be established until all the ink within the
posterior second accommodating chamber 1200 and the
lateral second accommodating chamber 1250 is used up.

15 In this embodiment, on the bottom face of
the first accommodating chamber 1100 is provided an
ink supply promoting structure 1120 having a portion
slightly lower than its bottom face. The structure of
this ink supply promoting structure 1120 will be
20 detailed later. This structure is disposed for the
purpose of eliminating the interruption of the ink from
the minute communicating portion 1300 to the connecting
surface of the ink discharge portion, but becomes
extremely effective means when the proper negative
25 pressure can not be obtained only by the adjustment of
the height of the gas-liquid replacement promoting
structure 1110. For example, this is effective when

- 1 the connecting opening portion 1101 with the ink jet
head unit 2000 is on the bottom face of the ink tank
portion 1100, or when the distance from the minute
communicating portion 1300 to the connecting opening
5 portion 1101 is large, or both as in this embodiment
shown in Figs. 2A and 2B.

In this embodiment, the depth of the ink supply
promoting structure 1120 is 1.5 mm lower than the bottom
surface of the posterior second accommodating chamber
10 1200 and the lateral second accommodating chamber 1250,
or the bottom surface of the minute communicating
portion 1300, thereby resolving all the previous
problems.

The ink supply promoting structure 1120 in this
15 embodiment has an evenly lower bottom surface, but may
have several slits of equivalent depth disposed. Also,
in the ink tank unit of a structure wherein the
connecting opening portion 1101 is opposed to the
partition wall 1100a having the minute communicating
20 portion 1300, it has been confirmed that the same
effects can be obtained by disposing a projection-like
rib.

Referring now to Figs. 19 to 21C, the ink leakage
through the atmosphere communicating port of the ink tank
25 unit will be described below.

The ink jet cartridge of the constitution of
this embodiment can prevent evaporation during physical

1 distribution, and is placed in such a packaged state
that the head is not damaged and the function is not
impaired.

Meanwhile, the discharge port face most
5 governing the head characteristics is covered with a
protecting seal tape, but the opening portion of the
atmosphere communicating portion leading to the
inside of the ink jet cartridge is not sealed. In the
case of a replacement-type ink cartridge, there are only
10 provided the connecting opening portion to the head
portion and the atmosphere communicating port, wherein
these two opening portions may be sealed with a seal
tape.

However, in the case of an integral-type head,
15 when all the opening portions are closed to prevent ink
leakage, the increased internal pressure caused by
environmental changes may produce ink leakage through
the opening portion and the connecting portion between
the discharge portion and the tank portion.

20 Also, the ink discharge port can not be completely
sealed by a seal tape owing to pits structure. For such
reasons, in the integral-type ink jet cartridge, the
atmosphere communicating port is opened within the
physical distribution package.

25 Therefore, in the ink tank unit having the first
and second accommodating chambers, if the head cartridge
is physically distributed in the device attitude, the

1 atmosphere communicating port is located upward,
without ink leakage, but in other attitude, particularly
in the inverted attitude, the ink in the second
accommodating chamber may flow into the air layer 1104,
5 sometimes leakage through the atmosphere communicating
port and splashing into the package.

In this embodiment, as means of preventing ink
leakage within the ink tank unit through the atmosphere
communicating portion in all the attitudes of physical
10 distribution as above described and under the
environmental temperature or humidity condition or
both complicated condition, four vertical edge line
portions 1115a, 1115b, 1115c and 1115d contacted by the
negative pressure generating member 1102 of the first
15 accommodating chamber 1100 are curved with a radius of
curvature R of 2 mm, so that the negative pressure
generating member 1102 can evenly press on the absorbing
member at four corners not to cause exfoliation or distortion
to produce interstice and cause the inflow or concentration
20 of the ink at the corner portion.

On the other hand, five vertical edge line
portions 1215a, 1215b, 1215c, 1215d and 1215e of the
posterior second accommodating chamber 1200 and the
lateral second accommodating chamber 1250 except for
25 the minute communicating portion 1300 are curved
with a radius of curvature of 2 mm, and a projection
1201 having a height of 2 mm and a width of 14 mm
is disposed in the neighborhood of the minute

1 communicating portion 1300 on the bottom surface of
the posterior second accommodating chamber 1200. The
necessity for providing curvature for each of the edge
line portions of two second accommodating chambers and
5 the projection on the bottom surface as above described
is based on the following experimental results conducted
by the present inventors.

Figs. 21A to 21C are cross-sectional views of an
ink jet cartridge without vertical edge line portion
10 1215a to 1215e and the bottom projection 1201 in the two
second accommodating chambers 1200 and 1250. If the
ink jet cartridge is placed in the inverted state with
the discharge port face upward, and under the physical
distribution environment of high temperatures (60°C to
15 80°C), the ink filled within the second accommodating
chamber thermally will expand and permeate through the
minute communicating portion 1300 into the negative
pressure generating member 1102. At this time, the
internal pressure is released through the atmosphere
20 communicating port. Then, the gas-liquid replacement
occurs through the atmosphere communicating port and the
minute communicating portion 1300, so that the air is
filled in the second accommodating chamber 1250 (see
Fig. 21A).

25 Further, the gas-liquid replacement between the
ink within the second accommodating chamber and the air
within the first accommodating chamber 1200 occurs even

1 if the ink liquid level falls below the height of the
minute communicating portion 1300 of the partition wall
1100a. This is due to the fact that the edge portions
of five vertical edge lines orthogonal to the bottom
5 surface (upper surface in this figure) within the
second accommodating chamber 1250 pull up the ink owing
to capillary force, and the expanded air within the
second accommodating chamber 1250 promotes it (see
Fig. 21B).

10 Further, the air layer within the second
accommodating chamber 1250 contains the evaporation of
the water content in the ink, causing a phenomenon
in which the water vapor in the supersaturated state is
bedewed on the bottom surface of the second accommodating
15 chamber (upper face in this figure). In particular,
if there is a temperature variation, this state will
occur more remarkably. As a result, dewed water
droplets are gradually accumulated to become larger
water droplets, some part of which will drip into the
20 ink, other part being sucked through the minute
communicating portion into the negative pressure
generating member 1102. Because of this and the pulling
up of the ink in the edge line portions as above described
due to capillary force, the ink moved into the first
25 accommodating chamber is reserved in the air layer 1104,
and begins to leak through the atmosphere communicating
port to the outside when the ink liquid level exceeds

1 the height of the atmosphere communicating portion (see
Fig. 21C).

On the contrary, Figs. 20A and 20B are cross-
sectional views of an ink jet cartridge according to
5 this embodiment in which five vertical edge line portions
orthogonal to the bottom surface of the second
accommodating chamber are curved, and a projection
1201 is disposed in the neighborhood of the minute
communicating portion 1300. With the discharge port
10 face upward.

In Figs. 20A and 20B, if exposed to high temperature
environment at the initial stage, the ink will expand in
volume to permeate into the negative pressure generating
member 1102. Because of this and the gas-liquid
15 replacement, the ink in the amount corresponding to
the height of the minute communicating portion 1300 is
moved from the second accommodating chamber 1200 to the
first accommodating chamber 1100 (see Fig. 20A).

However, because the vertical edge line portions
20 of the second accommodating chamber 1200 are curved,
there is no capillary force exerted on the ink, causing
no movement of the ink still in the initial state.

Also, water droplets bedewed to the bottom
surface (upper surface in this figure) of the second
25 accommodating chamber 1200 are blocked by the projection
1201 provided near the minute communicating portion 1300,
but not absorbed by the negative pressure generating

1 member 1102, and will drip into the ink within the
second accommodating chamber 1200. Accordingly, the
ink is not moved beyond a certain amount, thereby
preventing ink leakage through the atmosphere
5 communicating port (see Fig. 20B).

Herein, the height H of the connecting portion
in the atmosphere communicating port (see Fig. 18) is
necessary to be high enough that when the ink flows into
the air layer 1104, the ink may not flow into the
10 opening portion in the first accommodating chamber of the
atmosphere communicating port. In this embodiment,
H = 10 mm was obtained by multiplying the ink liquid
level corresponding to the maximum flowable amount of the
ink of the second accommodating chamber 1200 in the
15 inverted state, by a safety factor of two.

Referring now to Fig. 22 and Figs. 23A to 23D, a
manufacturing process of the ink tank unit in this
embodiment will be described below.

In Fig. 22, 1600 is an ink tank unit housing,
20 1102 is a negative pressure generating member, and 1400
is a vessel lid. 1202a and 1202b are electrode pins for
sensing the remaining amount of ink, and 1203 and 1204
are contact members extending from each electrode pin
to electrode disposed in the ink discharge portion.
25 1206 is an ink pouring port, and 1205 is an ink pouring
port plug. The ink tank unit housing 1600 is formed by
integral molding of resin. Within the first accommodating

1 chamber 1100 of the ink tank unit housing 1600 is
accommodated a negative pressure generating member 1102,
which is inserted after compressed from both sides in the
direction of the arrow of Figs. 21A to 21C. The negative
5 pressure generating member 1102 is compressed to one-
third to one-fourth the volume when accommodating it.

Thereafter, the vessel lid 1400 is joined with the
ink tank unit housing 1600, but this connection is
effected by welding from the respects of the air-
10 tightness in the junction and the productivity.
Especially, the ultrasonic welding is preferable means
from the aspects of both the reliability and the
productivity. Thereafter, the electrode pins 1202a and
1202b are forced via the contact members 1203 and 1204 into
15 the neighborhood of the bottom face of the lateral
second accommodating chamber 1250 of the tank housing
1600, and welded thereto.

The ink is poured into the ink tank unit 1000
thus assembled through the ink pouring port opened in
20 the vessel lid 1400. The pouring process is shown in
Figs. 23A to 23D. In pouring the ink, the ink is poured
under pressure by a fixed amount in the inverted
attitude where the minute communicating portion is
placed on the uppermost portion, with an inner diameter
25 ϕ of the ink supply port of 1.5 mm and at a pouring
speed of about 4 cc/sec as shown in Fig. 23A, whereby
the excellent pouring conditions without bubbling can be

1 obtained. The pouring of the ink is stopped at the
time when the second accommodating chamber is filled
with the ink to cause the ink to flow from the minute
communicating portion into the negative pressure
5 generating member, and the supply port portion is pulled
out at the top end and plugged substantially at the
same time (primary pouring) (Figs. 23B and 23C).
Thereafter, by adopting an attitude with the opening of
the ink discharge portion placed at the uppermost
10 position, the ink is poured under pressure by a fixed
amount, whereby the pouring is completed (secondary
pouring).

This secondary pouring is made through a nozzle
of ϕ 1.5 mm and at a pouring rate of about 4 cc/sec by
15 inserting it to the extent that the supply port touches
the negative pressure generating member 1102, like the
primary pouring, so that the ink is dispersed evenly.

Finally, a label is pasted on the outer surface
of the tank, thereby completing the ink tank unit.

20 Next, the ink jet unit and its assembling
method will be described.

Fig. 24 is an exploded perspective view showing a
constitution of an ink jet unit 2000 in this embodiment.
Herein, 2100 is a substrate (heater board) with elements
25 (heaters) arranged for generating the heat energy which
is ink discharge energy, and 2400 is a ceiling plate
(grooved ceiling plate) having grooves for forming liquid

1 flow passages corresponding to elements as well as
having a member with the ink discharge ports formed
corresponding to liquid flow passages. 2200 is a circuit
substrate for supplying electric power to a heater board
5 2100, 2300 is a base plate serving as the reference in
packaging the ink discharge portion, 2500 is a presser
spring for applying even pressure (line pressure) near
the discharge ports of the discharge portion by forcing
the ceiling plate 2400 and the heater board 2100 into
10 intimate contact with each other.

2600 is a holder having inside a flow passage
for supplying the ink from the ink tank unit to the ink
jet head unit, wherein a filter 2700 for preventing the
invasion of foreign matter is welded on the connecting
15 surface with the ink tank of the ink communicating
portion 2600 of the holder.

In Fig. 24, an adhesive is applied a predetermined
thickness in a predetermined region 2405 near the front
end face 2300a on the surface of a support 2300, on the
20 applied surface of which a heater board 2100 is secured
by adhesive so that its front end face 2100a and a
front end face 2300a of the support 2300 are flush.
The ceiling plate 2400 is disposed on this heater board
2100 by temporarily joining so that an orifice plate
25 2400a is disposed in front of both front end faces 2100a
and 2300a of the heater board 2100 and the support 2300,
as shown in Fig. 14. Herein, in Fig. 25, 2105 is a

1 discharge heater as electrothermal converter provided
at a predetermined position on the heater board 2100.
Also, 2411 and 2412 are ink flow passage grooves
formed on the ceiling plate 2400, and 2421 and 2422
5 are discharge ports bored by excimer laser on the
orifice plate 2400a of the ceiling plate 2400.

In this way, with the ceiling plate 2400
temporarily joined on the heater board 2100, the heater
board 2100 and the ceiling plate 2400 are on the support
10 2300, as shown in Fig. 26, and further a holder 2600
covering and protecting the wiring substrate 2200 is
placed thereon.

An assembling method of an ink jet head unit of
the present invention will be described below.

15 After the heater board 2100 is bonded by an
adhesive (silicon-type adhesive SE4400: made by Toray)
10 to 30 μ m thick on the support 2300, the connection
with the wiring substrate 2200 is made by wire bonding
with aluminum wire. The ink discharge ports of the
20 ceiling plate 2400 and the discharge heaters 2105 of
the heater board are aligned with each other and then
temporarily secured by applying a ultraviolet curable
adhesive (TB3006B: made of Three Bond) to both end
portions of the ceiling plate 2400. Then, for the
25 junction between the ceiling plate 2400 and the heater
board 2100, a spring 2500 for concentratively pressing on
the discharge ports and the neighborhood of the liquid

1 flow passage is settled. The spring 2500 has spring
legs 2500a, 2500b on both sides, and secured by
engagement with the heater board 2100. Then, the ceiling
plate 2400 is put on the heater boards 2100, 2200, and
5 the support 2300. The holder 2600 has a pair of leg
portions 2600e disposed on both sides of the ceiling
plate 2400, which are inserted through a pair of holes
2300b in the support 2300 to project the top ends of
the leg portions 2400e beyond the back face side of the
10 support 2300.

Finally, a silicon sealing agent (TSE399BC
Toshiba Silicon) is poured from the upper portion of the
holder to the gap between the holder 2600 and the
ceiling plate 2400 or the base plate 2300, the gap
15 between the ceiling plate 2400 and the heater board
2100, the gap between the orifice plate 2400a and the
heater board end portion 2100a or the base plate end
portion 2300a, for the protection of the wire bonding
portion.

20 Next, the mounting of the ink jet head unit
2000 on to the ink tank unit 1000 will be described
below. In Figs. 22 and 24, 1610 and 2600f are a
projection and a latch having spring property attached
to the ink tank unit housing 1600 and the holder 2600,
25 whereby the falling of the ink jet head unit can be
prevented by engagement of both.

On the other hand, the connecting opening portion

1 1101 of the ink jet head unit in the ink tank unit 1000
is joined via an O-ring 1500 to the ink tank connecting
portion 2600h of the ink head unit to prevent ink
leakage.

5 In the above way, the ink jet cartridge is
completed.

Then, the packaging of the ink jet cartridge
will be described below. Fig. 27 shows the assembling
of a protective tape 3100 and a protection cap 3200 for
10 protecting the discharge ports from drying and fixing
or damage during physical distribution in packaging.
The protection cap 3200 has a sponge 3220 in an area
in contact with the discharge port face via the
protective tape 3100, the protective tape 3100 being
15 forced into contact with the discharge port face by a
pressing force of 500 to 2000 g of this sponge.

The protection cap 3200 has a projection 3210
engaging the holder 2600, while the holder 2600 has a
depression caught by the projection on either side to
20 prevent the falling by engagement of both.

Fig. 28 shows the constitution of a package 4000
for protecting the ink jet cartridge against the
physical distribution environment changes, and
preventing the falling. In Fig. 28, 4100 is a case
25 body, 4200 is a case lid, and 4300 is a buffer body for
preventing the vibration of the ink jet cartridge
within the case.

1 The case body 4100 is formed of a molding made
of polypropylene from the aspects of impact durability,
gas barrier property of preventing evaporation of the
ink from the ink jet cartridge, as well as the costs.

5 The case lid 4200 is formed of a multi-layer film
having excellent gas barrier property, for example,
one in which a polyethylene terephthalate layer 12 μm ,
an aluminum evaporation layer 0.05 μm , a nylon layer
15 μm , a polyethylene layer 25 μm , an easy peel layer
10 25 μm are laminated in sequence from the outermost
layer or the outside, or one in which a nylon 15 μm , an
aluminum foil 9 μm and an easy peel layer 75 μm are
laminated in sequence from the outermost layer.

 The packaging procedure is as follows.

15 After inserting the ink jet cartridge into the
case body 4100, the buffer body 4300 is placed therein,
a welding rib 4120 disposed in a flange portion 4110
of the case body 4100 and the easy peel layer of the
case lid 4200 are welded together by heating to obtain
20 a package.

 Further, this package 4000 is accommodated
within a pillow bag 5100 fancy printed, and then a
package 5000 of the ink jet recording head is completed
(see Fig. 18). In the above example, a head cartridge
25 with an ink tank unit and a head unit integrated was
described below, but the head unit and the ink tank
unit may be separated as independent parts.

1 (Other Embodiment)

Fig. 30 shows one embodiment of an ink jet recording apparatus having an ink jet cartridge mounted thereon according to the present invention.

5 In the figure, C is an ink jet cartridge of the present invention, as previously described, and 2 is a carriage for mounting for the movement four ink jet cartridges corresponding to four color inks of yellow, magenta, cyan and black.

10 Herein, the carriage 2 is slidably engaged in a guide shaft 11, a part of the carriage 2 being connected to a belt 42 driven by a motor. Thereby, the carriage 2 is movable along the guide shaft 11, allowing the ink jet cartridge C to be moved in the recording area and
15 its adjacent area.

15, 16 are feed rollers for driving the motor. With such constitution, a recording medium 10 is supplied to a position opposite the discharge port face of the recording head, and fed via rollers 17, 18 into
20 a paper exhaust portion when the recording is progressed.

In this embodiment, the recording medium 10 is conveyed along a conveying direction (sub-scan direction) by the feed rollers, and after the recording medium 10 is set at predetermined recording position,
25 the operation of recording (scanning) an image by the ink jet cartridge C mounted on the carriage 2 which moves along the recording medium 10, feeding (pitch

1 conveying) the sheet by a predetermined amount after
recording one line, and then recording (scanning) the
image at the next line is repeated, until the entire
image is recorded for the recording medium.

5 401 is a blade as the wiping member, one end
thereof being held by a blade holding member to become
a secured end, and taking a form of cantilever. The
blade 401 is disposed at a position adjacent the
recording area with the recording head, and in this
10 embodiment, held in the projected form into the course
of movement of the recording head.

300 is a cap which is disposed at a home position
contiguous to the blade 401 and movable back and forth
in the directions perpendicular to the moving direction of
15 the recording head to make direct contact with the
discharge port face, thereby effecting the capping.
Further, 403 is an absorbing member provided adjacent
the blade 401, which is held, like the blade 401, in
the projected form into the course of movement of the
20 recording head.

A discharge port recovery portion 500 is
constituted of the blade 401, the cap 300 and the
absorbing member 403, wherein the ink and the dirt
sticking to the ink discharge port face can be removed
25 by the blade 401 and the absorbing member 403.

With the above constitution, when the ink jet
cartridge C returns to the home position after completion

1 of the recording, the cap 300 of the discharge port
recovery portion 500 of the recording head is retreated
from the movement passage of the ink jet cartridge C,
but the blade 401 is projected into the movement
5 course. As a result, the discharge port face of the
ink jet cartridge C is wiped by the blade 401 projected
therefrom.

Also, when the cap 300 makes direct contact with
the discharge port face of the ink jet cartridge to
10 effect the capping, the cap 300 is moved to project
into the course of movement of the cartridge. When the
cartridge C is moved from the home position to the start
position of recording, the cap 300 and the blade 401
are located at the same position as in the wiping as
15 above described. As a result, upon the movement before
starting the recording, the discharge port face of the
cartridge C is wiped.

The recovery of the discharge port portion of
the recording head with the blade is performed at a
20 predetermined interval not only during the movement of
the carriage before and after the recording, but also
during the recording.

Note that the ink sticking to this blade 401
with the recovery is receivable by the ink absorbing
25 member 104 (see Fig. 1A) on the head side as previously
described.

When the ink jet cartridge of the present

1 invention is used for the recording apparatus as above,
the height H of the ink jet cartridge will not increase
with the increased receivable amount of ink, in the
attitude of mounting it on the carriage, because the
5 ink receivable amount of the ink tank unit is
increased by raising the ink filling ratio in the
present invention.

The present invention makes it possible to
reduce the total thickness because of no porous member
10 disposed in the ink storing portion, and reduce the
size of the carriage, when a plurality of ink jet
cartridges such as for a color recording apparatus are
arranged side-by-side as shown in Fig. 11.

The embodiment employs a recording head or a
15 recording device of the ink jet recording system of
performing the recording by forming flying liquid
droplets by the use of the heat energy among the various
ink jet recording systems, but is conveniently usable in
other constitution of flying liquid droplets.

20 Its representative constitution and principle of
the ink jet system using the heat energy are disclosed
in, for example, U.S. Patents 4,723,129 and 4,740,796,
and it is preferred that the present invention is
practiced using these basic principles. This
25 recording system is applicable to either of the so-
called on-demand type and the continuous type.

Briefly stating this recording system, by applying

1 at least one driving signal which gives rapid
temperature elevation exceeding nucleus boiling and
causing film boiling phenomenon in the ink corresponding
to the recording information to electrothermal converters
5 arranged corresponding to the liquid channels holding a
liquid (ink), heat energy is generated to effect film
boiling at the heat acting surface of the recording
head.

Thus, because the bubbles within the liquid
10 (ink) can be formed corresponding one by one to the
driving signals which are applied to the electrothermal
converters, the recording system of the on demand type
is especially effective. By discharging the liquid
(ink) through an opening for discharging by growth
15 and shrinkage of the bubble, at least one droplet is
formed. By making the driving signals into the pulse
shapes, growth and shrinkage of the bubbles can be
effected instantly and adequately to accomplish more
preferably discharging of the liquid (ink) particularly
20 excellent in response characteristic.

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

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

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

20 Further, as the recording mode of the recording
device, the present invention is extremely effective for
not only the recording mode only of a primary color
such as black, etc., but also a device equipped with at
least one plural different colors or full color by color
25 mixing, whether the recording head may be either integrally
constituted or combined in plural number.

In the ink jet head cartridge of the present

1 invention, because the atmosphere communicating port of
the negative pressure generating member receiving
portion of the ink tank and the ink supply port are
disposed on the opposed surfaces, with the atmosphere
5 communicating port located above the ink supply port,
the state where no ink resides near the atmosphere
communicating port even with the ink accumulated near
the ink supply port is easy to hold, and the ink
leakage is less likely to occur.

10 In addition, owing to the action of the negative
pressure generating member as the buffer in the state of
having ink wetness only near the ink supply port but
not in the remaining portion, the ink leakage is less
likely to occur, because no ink is reserved in the
15 space portion even if the ink runs along the interstice
produce by exfoliation or distortion at the angled
portion of the negative pressure generating member (ink
absorbing member).

Further, in the cartridge of the present
20 invention, by shaping the ink storing portion like an
L-character or J-character, the volume of the ink
storing portion can be made greater than that of the
negative pressure generating member receiving portion,
whereby the reduction in the running cost can be
25 realized without increasing the size of the ink tank.

Still further, in the cartridge of the present
invention, by rounding the edge angled portion within

1 the negative pressure generating member receiving
portion by R1 to R3 to make four corners curved, the
exfoliation or distortion at the angled portion of the
negative pressure generating member can be suppressed
5 in inserting the negative pressure generating member,
resulting in no gap between the ink storing portion and
the negative pressure generating member, whereby the ink
is concentrated in the neighborhood of the ink supply
port, without the ink flowing near the atmosphere
10 communicating port located upward, and ink leakage can
be prevented beforehand.

And by providing a groove portion having a
height of the top of less than 5 mm from the filter face
at the end portion of the ink communicating member of
15 the ink jet head unit on the partition wall within the
ink cartridge for the ink jet, the ink supply to the
recording head can be performed stably and highly
reliably.

Also, by providing a recess portion on the
20 bottom portion of the negative pressure generating
member (ink absorbing member) receiving portion of the
ink cartridge for the ink jet, the ink flow passage
can be secured more widely, resulting in no ink
interruption.

25 Further, with the present invention, by
dividing one aperture of the atmosphere communicating
port into two or more openings, the necessity of

1 providing the multiplicity of parts or the inconformity
with the molding as conventionally occurs can be
improved, and the structure of atmosphere communicating
port with high productivity and reliability can be
5 obtained, which is applicable to the ink storing
vessel using the negative pressure generating member,
whether the division-type or the integral-type.

With a recording head having integrally an ink
tank portion having first and second accommodating
10 chambers and an ink discharge portion, there is the
effect that the stabler gas-liquid interface in
supplying the ink within the ink chamber in the ink
tank portion to the negative pressure generating member,
as well as the stabler supply of the ink, can be
15 achieved.

Also, by making the vertical edge lines of the
first accommodating chamber and the second accommodating
chamber a curved shape, and providing a projection on
the bottom surface of the second accommodating chamber
20 near the minute communicating portion, there is the
effect that the ink leakage through the atmosphere
communicating port due to changes in the attitude during
physical distribution or changes in the environmental
temperature or humidity can be prevented.

25 As above described, with the present invention,
an ink jet head cartridge with a large ink storage
capacity can be provided with high reliability in

1 preventing ink leakage and ink exhaustion, and an ink
jet recording apparatus capable of the excellent
printing for the long term can be provided.

5 An ink jet cartridge comprises an ink jet head
unit for discharging the ink, and an ink tank unit having
an ink supply port for supplying the ink to the ink jet
head unit. The ink tank unit has a partition portion
for partitioning between an ink storing portion for
10 storing the ink to be supplied to the ink jet head unit
and a negative pressure generating member receiving
portion having a negative pressure generating member.
The ink supply port is provided on the negative pressure
generating member receiving portion. And the partition
15 portion has an ink communicating portion at an end
portion of the partitioning portion on the side of the
negative pressure generating member receiving portion
where the ink supply port is provided, and makes contiguous
the ink storing portion and the negative pressure
20 generating member receiving portion in a movement
direction of the ink tank unit when discharging the ink.



1 WHAT IS CLAIMED IS:

1. An ink jet cartridge comprising:
an ink jet head unit for discharging the ink;
and

5 an ink tank unit having an ink supply port for
supplying the ink to said ink jet head unit;

characterized in that said ink tank unit has a
partition portion for partitioning between an ink storing
portion for storing the ink to be supplied to said ink
10 jet head unit and a negative pressure generating member
receiving portion having a negative pressure generating
member;

said ink supply port is provided on said negative
pressure generating member receiving portion; and

15 said partition portion has an ink communicating
portion at an end portion of said partitioning portion
on the side of the negative pressure generating member
receiving portion where said ink supply port is provided,
and makes contiguous said ink storing portion and said
20 negative pressure generating member receiving portion
in a movement direction of said ink tank unit when
discharging the ink.

2. An ink jet cartridge according to claim 1,
25 characterized in that said ink communicating portion is
provided at a position at which the ink supply direction
from the ink storing portion to the negative pressure



* C L M S *

THIS SHEET HAS BEEN
REPLACED



1 generating member receiving portion is orthogonal to
said movement direction.

5 3. An ink jet cartridge according to claim 1,
characterized in that said negative pressure generating
member receiving portion has an atmosphere communicating
port at a position opposite said ink supply port.

10 4. An ink jet cartridge according to claim 1,
characterized in that said negative pressure generating
member receiving portion has a portion of the curved
shape with which the angled portion of said negative
pressure generating member is brought into direct
contact.

15 5. An ink jet cartridge according to claim 1,
characterized in that said negative pressure generating
member receiving portion has at least two or more negative
pressure generating members.

20 6. An ink jet cartridge according to claim 1,
characterized in that said ink jet head unit has
electrothermal converters for causing the discharging
in such a manner as to cause a state change in the ink
25 by generating the heat with electrical energy supplied
to discharge the ink.



* C L H S *

THIS SHEET HAS BEEN
REPLACED



1 7. An ink jet cartridge comprising:
 an ink jet head unit for discharging the ink;
 and
 an ink tank unit having an ink supply port for
5 supplying the ink to said ink jet head unit;
 characterized in that said ink tank unit has a
 partition portion for partitioning between an ink storing
 portion for storing the ink to be supplied to said ink
 jet head unit and a negative pressure generating member
10 receiving portion having a negative pressure generating
 member;

 said ink supply port is provided on said negative
 pressure generating member receiving portion; and

 said partition portion has an ink communicating
15 portion at an end portion of said partitioning portion
 on the side of the negative pressure generating member
 receiving portion where said ink supply port is provided,
 and a groove portion leading to said ink communicating
 portion on the side of said negative pressure generating
20 member receiving portion, and makes contiguous said ink
 storing portion and said negative pressure generating
 member receiving portion in a movement direction of
 said ink tank unit when discharging the ink.

25 8. An ink jet cartridge according to claim 7,
 characterized in that said ink jet head unit has an ink
 communicating member which is inserted into said ink





1 supply port portion, the distance from an end portion of
said ink communicating member to an upper end of said
groove portion being within 5 mm.

5 9. An ink jet cartridge according to claim 7,
characterized in that said ink jet head unit has
electrothermal converters for causing the discharging in
such a manner as to cause a state change in the ink by
generating the heat with electrical energy supplied to
10 discharge the ink.

10. An ink jet cartridge according to any one
of claims 1 to 9, characterized in that said negative
pressure generating member receiving portion has a
15 recess portion between said ink supply port and said
ink communicating portion.

11. An ink tank unit having an ink supply port
for supplying the ink to an ink jet head unit for
20 discharging the ink, characterized in that:

said ink tank unit comprises a partition
portion for partitioning between an ink storing portion
for storing the ink to be supplied to said ink jet head
unit and a negative pressure generating member receiving
25 portion having a negative pressure generating member;

said ink supply port is provided on said
negative pressure generating member receiving portion;





1 and

said partition portion has an ink communicating
portion at an end portion of said partitioning portion
on the side of the negative pressure generating member
receiving portion where said ink supply port is provided,
5 and makes contiguous said ink storing portion and said
negative pressure generating member receiving portion
in a movement direction of said ink tank unit when
discharging the ink.

10

12. An ink tank unit having an ink supply port
for supplying the ink to an ink jet head unit for
discharging the ink, characterized in that:

said ink tank unit has a partition portion for
15 partitioning between an ink storing portion for storing
the ink to be supplied to said ink jet head unit and a
negative pressure generating member receiving portion
having a negative pressure generating member;

said ink supply port is provided on said negative
20 pressure generating member receiving portion; and

said partition portion has an ink communicating
portion at an end portion of said partitioning portion
on the side of the negative pressure generating member
receiving portion where said ink supply port is provided,
25 and a groove portion leading to said ink communicating
portion on the side of said negative pressure generating
member receiving portion, and makes contiguous said





1 ink storing portion and said negative pressure generating
member receiving portion in a movement direction of said
ink tank unit when discharging the ink.

5 13. An ink tank unit according to claim 11 or
12, characterized in that said negative pressure
generating member receiving portion has a recess portion
between said ink supply port and said ink communicating
portion.

10

14. An ink jet apparatus comprising:
an ink jet cartridge having an ink jet head unit
for discharging the ink, and an ink tank unit having
an ink supply port for supplying the ink to said ink jet
15 head unit; and

a carriage for detachably mounting said ink
jet cartridge;

characterized in that said ink tank unit has a
partition portion for partitioning between an ink
20 storing portion for storing the ink to be supplied to
said ink jet head unit and a negative pressure generating
member receiving portion having a negative pressure
generating member;

said ink supply port is provided on said negative
25 pressure generating member receiving portion; and

said partition portion has an ink communicating
portion at an end portion of said partitioning portion





1 on the side of the negative pressure generating member
receiving portion where said ink supply port is provided,
and makes contiguous said ink storing portion and said
negative pressure generating member receiving
5 portion in a movement direction of said ink tank unit
when discharging the ink;

wherein said ink jet apparatus further comprises
conveying means for conveying the recording medium which
accepts the ink discharged from said ink jet head unit.

10

15. An ink jet cartridge comprising an ink jet
head unit for discharging the ink, and an ink tank unit
having an ink supply port for supplying the ink to said
ink jet head unit and an atmosphere communicating
15 portion for communicating the inside to the atmosphere,
characterized in that:

said ink tank unit having:

an ink storing portion for storing the ink to
be supplied to said ink jet head unit; and

20 a negative pressure generating member receiving
portion having a negative pressure generating member as
well as communicating to said ink storing portion via
an ink communicating portion;

wherein said atmosphere communicating portion
25 and said ink supply port are disposed in said negative
pressure generating member receiving portion;

wherein said atmosphere communicating portion



* C L M S *

THIS SHEET HAS BEEN
REPLACED



1 has one aperture, said aperture including a barrel
portion extending from the inside of said ink tank to
the inner surface of a wall portion, and deadlocked near
the outer surface of the wall portion, and an opening
5 portion divided from a deadlocked portion of said
barrel portion into branches.

16. An ink jet cartridge according to claim 15,
wherein on the outer surface of an ink tank unit provided
10 with an outer opening of said atmosphere communicating
portion is formed a groove extending from said opening
portion of said aperture, and said groove and said
opening portion are covered with a seal member having a
shorter width than the length of said groove.

15 17. An ink jet cartridge according to claim 15,
wherein said ink jet head cartridge has electrothermal
converters for generating the heat energy causing film
boiling in the ink as the elements for generating the
20 energy useful for discharging the ink.

18. An ink tank unit having an ink supply port
for supplying the ink to an ink jet head unit for
discharging the ink, and an atmosphere communicating
25 portion for allowing the inside to the atmosphere,
characterized in that:

said ink tank unit having:



* C L M S *

THIS SHEET HAS BEEN
REPLACED



1 an ink storing portion for storing the ink to
be supplied to said ink jet head unit;

a negative pressure generating member receiving
portion having a negative pressure generating member
5 as well as communicating to said ink storing portion via
an ink communicating portion;

wherein said atmosphere communicating portion and
said ink supply port are disposed in said negative pressure
generating member receiving portion;

10 wherein said atmosphere communicating portion
has one aperture, said aperture including a barrel
portion extending from the inside of said ink tank to the
inner surface of a wall portion, and deadlocked near the
outer surface of the wall portion, and an opening
15 portion divided from a deadlocked portion of said barrel
portion into branches.

19. An ink tank unit according to claim 18,
wherein on the outer surface of an ink tank unit provided
20 with an outer opening of said atmosphere communicating
portion is formed a groove extending from said opening
portion of said aperture, and said groove and said
opening portion are covered with a seal member having a
shorter width than the length of said groove.

25

20. An ink jet apparatus comprising:
an ink jet cartridge having an ink jet head unit





1 for discharging the ink, and an ink tank unit having
an ink supply port for supplying the ink to said ink
jet head unit and an atmosphere communicating portion
for communicating the inside to the atmosphere; and
5 a carriage for detachably mounting said ink jet
cartridge;
characterized in that:
an ink tank unit has:
an ink storing portion for storing the ink to
10 be supplied to said ink jet head unit; and
a negative pressure generating member receiving
portion having a negative pressure generating member as
well as communicating to said ink storing portion via
an ink communicating portion;
15 wherein said atmosphere communicating portion and
said ink supply port are disposed in said negative
pressure generating member receiving portion;
wherein said atmosphere communicating portion
has one aperture, said aperture including a barrel
20 portion extending from the inside of said ink tank to
the inner surface of a wall portion, and deadlocked near
the outer surface of the wall portion, and an opening
portion divided from a deadlocked portion of said barrel
portion into branches,
25 said ink jet apparatus further comprising:
conveying means for conveying the recording
medium which accepts the ink discharged from said ink



1 jet head unit.

21. An ink jet apparatus according to claim 20,
wherein said ink jet head cartridge has electrothermal
5 converters for generating the heat energy causing film
boiling in the ink as the elements for generating the
energy useful for discharging the ink.

10

15

This Sheet Has Been Replaced



20



25

THIS SHEET HAS BEEN
REPLACED