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Liquid Injection Recording Head And
Liquid Injection Recording Apparatus

5 BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a liquid injection recording head and a liquid injection recording apparatus.

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In a liquid injection recording apparatus, it will be desirable that a liquid injection recording head (hereinafter referred to as the recording head) can be easily mounted and dismounted with respect to a carriage for the purpose of maintenance or interchange of the recording head. Therefore, in order to supply a driving power and a signal to the recording head, it may heretofore be considered to provide electrical contacts on the recording head and the carriage, respectively, and bring the electrical contacts of the two into contact with each other when the recording head will be mounted on the carriage, thereby accomplishing the supply of the driving power and the signal to the recording head. Most recording heads are of the type which may be mounted on the carriage and therefore, the electrical contacts of the recording head will be taken out from the recording head by flexible

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wiring or the like or may be provided on the lower portion of the orifice surface of the recording head in which orifices may be provided.

- 5 In a recording head wherein the orifice surface in which orifices for injecting ink may be provided and an electrical wiring substrate having said electrical contacts may be formed on the same plane, the electrical contacts may be provided below the orifice
- 10 surface for the reason set forth above, and this will result in an inconvenience that the electrical contacts are stained or corroded by the ink dropping from the orifices and cause unsatisfactory contact and thus, orifices do not discharge the liquid (ink) or
- 15 the discharging condition becomes unstable.

- The present invention provides a liquid jet recording apparatus having mounted thereon a liquid jet recording head in which there is provided an
- 20 electrically actuable element for causing a recording liquid to eject from an orifice of the head, and in which an electrical contact for receiving electrical signals for said actuable element is provided at an outwardly exposed portion of the head which is
- 25 inaccessible, in use, to liquid from said orifice, the electrical contact on the recording head engaging,

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when the head is mounted on a mounting portion of said apparatus, with an electrical contact provided on the mounting portion.

1 BRIEF DESCRIPTION OF THE DRAWINGS

 Figures 1 and 2 are schematic perspective views of the recording heads of the present invention.

 Figure 3 is a schematic perspective view of
5 a liquid injection recording apparatus according to an embodiment of the present invention.

 Figures 4 to 7 are schematic perspective views of the carriages and recording heads of the present invention.

10 Figure 8 is a perspective view for explaining a method of fixing the recording head to the carriage and a method of connecting the contacts of the recording head and the carriage.

 Figures 9 and 10 are schematic cross-
15 sectional views of the recording head.

 Figure 11 shows the structure of the liquid injection recording head used in the present invention.

20 DESCRIPTION OF THE PREFERRED EMBODIMENTS

 Some embodiments of the liquid injection recording head of the present invention will herein-
after be described specifically and in detail with reference to the drawings.

25 Figure 1 is a perspective view of a recording head 52 according to a first embodiment of the present invention, and the recording head 52 in its shown

1 state is mounted on a carriage, not shown. Orifices
54 are provided in that surface of the recording
head 52 which is opposed to printing paper, and
electrical contacts 56 are provided on a surface
5 of the recording head which is different from the
surface in which the orifices 54 are provided.
Reference numeral 58 designates discharged droplets
such as ink. The recording head 52 is mounted on
the carriage (not shown) in such a manner that the
10 electrical contacts 56 are in contact with the ele-
ctrical contacts (not shown) of the carriage. A
driving power signal is applied from the carriage
side to the recording head 52 and the droplets (ink)
58 are injected from the orifices 54, whereby the
15 recording by the recording head 52 is accomplished.
At this time, in the present embodiment, the
electrical contacts 56 can be prevented from being
stained by the ink dropping from the orifices 54
because the orifices 54 and the electrical contacts
20 56 are provided in the different surfaces.

Figure 2 shows another embodiment of the
present invention. A feature of this embodiment
is that the electrical contacts 56 are provided
above the orifices 54. Thus, the electrical
25 contacts 56 can be better prevented from being
stained by the ink than in the above-described
embodiment.

1 In the above-described embodiments, the
electrical contacts have been shown as being
provided on the underside or a side surface of the
recording head, but alternatively, the electrical
5 contacts may be provided on any other surface of
the recording head such as the upper surface or the
back surface which is opposite to the orifices 54.

 An embodiment of the liquid injection record-
ing apparatus of the present invention will now be
10 described specifically and in detail.

 Figure 3 is a perspective view of the liquid
injection recording apparatus 72 according to the
present embodiment. In Figure 3, reference numeral
74 designates a platen rotatable in the direction
15 of arrow A about a platen shaft 76, and reference
numeral 78 denotes a recording medium (hereinafter
referred to as paper) such as printing paper. The
paper 78 is rotated in the same direction as the
platen 74 when the platen 74 is rotated. Reference
20 numerals 80 and 82 designate guide shafts. A
carriage 84 is provided for sliding movement in the
directions of bilateral arrow B relative to the
guide shafts 80 and 82. Reference numeral 86
denotes a flexible cable for transmitting a
25 driving power and a signal to the carriage 84.
Reference numeral 88 designates a liquid injection
recording head (hereinafter referred to as the

1 recording head) mounted on the carriage 84.

Figure 4 is a detailed view of the carriage 84 and recording head 88 according to the present embodiment. Recording head side electrical contacts 5 90 (hereinafter referred to as the first contacts) for transmitting an electric power and a signal are formed on a surface of the recording head 88 which is different from a surface in which orifices 92 are provided. Reference numeral 94 designates a 10 liquid reservoir for containing therein liquid such as ink, and reference numeral 96 denotes discharged droplets such as ink.

The carriage 84 is provided with a protruded portion 98, which in turn is provided with carriage 15 side electrical contacts 100 (hereinafter referred to as the second contacts) adapted to contact the first contacts 90 of the recording head 88. To mount recording head 88 on the carriage 84, the recording head 88 is placed onto the upper surface 20 102 of the carriage 84 in such a manner that the first contacts 90 of the recording head 88 contact the second contacts 100 of the carriage 84. When effecting the printing, a driving power and a control signal supplied through a flexible cable 86 provided 25 on the carriage 84 are supplied to the first contacts 90, the former being contactly supplied and the latter being converted into a driving signal voltage by a

1 control circuit (not shown) in the carriage,
whereafter they are transmitted to the second
contacts 100 which are in contact with the first
contacts 90, whereby liquid (ink) is injected from
5 the orifices 92.

Figure 5 shows still another embodiment of
the present invention. A feature of this embodiment
is that for the recording head 88 in which the first
contacts 90 are formed above the orifices 92 to be
10 mounted on the carriage 84, the second contacts 100
formed on the protruded portion 98 are disposed at
a higher position than in the previous embodiment
and correspondingly the height of the protruded
portion 98 is greater than in the previous embodi-
15 ment. According to this embodiment, the first
contacts 90 and the second contacts 100 are located
above the orifices 92 and therefore, the contacts
can be even better prevented from being stained by
the ink flowing out of the orifices.

20 Figure 6 shows yet still another embodiment
of the present invention. In this embodiment, a
groove 104 which partitions the orifices 92 side
and the first contacts 90 is provided in the bottom
surface of the recording head 88 provided with the
25 orifices 92 in a side surface thereof and provided
with the first contacts 90 on the bottom surface
thereof. Second contacts 100 adapted to contact

1 the first contacts 90 and a barrier 106 engageable
with the groove 104 of the recording head 88 are
provided on the upper surface of the carriage 84
for mounting the recording head 88 thereon, and
5 partition means is formed by the groove 104 and
the barrier 106. By the barrier 106 being so
provided between the orifices 92 and the first
contacts 90 and between the orifices 92 and the
second contacts 100, the first and second contacts
10 90 and 100 can be better prevented from being stained
by the ink dropping from the orifices 92.

Figure 7 shows a further embodiment of the
present invention. In this embodiment, there is
shown a carriage 84 for mounting thereon the record-
15 ing head 88 provided with orifices 92 in a side
surface thereof and provided with first contacts 90
on the bottom surface thereof. Second contacts 100
are provided on the upper surface 102 of the carriage
84, and a groove 108 which is partition means is
20 formed in the upper surface of the carriage 84 so
as to partition the orifices 92 and the first and
second contacts 90, 100 when the recording head 88
is mounted on the carriage 84. According to this
embodiment, the ink having flowed out of the orifices
25 92 does not come to the first and second contacts 90
and 100 and thus, these contacts 90 and 100 are very
rarely stained by the ink dropping from the orifices

1 92.

According to the present invention, as described above specifically and in detail, by a simple structure in which the orifices and the electrical contacts are disposed in different surfaces and further the electrical contacts are disposed above the orifices, the electrical contacts can be prevented from being stained or corroded by the ink dropping from the orifices and causing unsatisfactory contact and thus, a stable droplet discharging condition can always be kept.

Also, according to the present invention, as described above specifically and in detail, the recording head in which the orifices and the electrical contacts are disposed in different surfaces is mounted on the carriage, whereby the electrical contacts can be prevented from being stained or corroded by the ink dropping from the orifices and causing unsatisfactory contact and thus, a stable droplet discharging condition can always be kept.

An embodiment of the method of fixing the recording head shown in Figure 6 to the carriage and of the method of connecting the contacts will now be described in detail by reference to the drawings.

As shown in Figure 8, the recording head 88 has on side surfaces thereof a mounting portion 111

1 having a hole 110 which is a positioning fitting
portion, and an engaging portion 112. The carriage
84 has on the upper surface 102 thereof a head keep-
ing plate spring 113 engageable with the mounting
5 portion 111, a head keeping plate spring 114 engage-
able with the engaging portion 112, and a positioning
pin 115 for fitting in the hole 110.

The second contacts 100 are formed by plate
spring-like members curved so as to protrude toward
10 the recording head 88 so as to correspond to the
first contacts 90 formed on the bottom of the record-
ing head 88. As the first contacts 90, use may
sufficiently be made, for example, of an electrical
wiring portion formed on a printed wiring substrate
15 or contacts of the heretofore known contact shape.
It is preferable from the viewpoint of preventing
unsatisfactory contact that the second contacts 100
be formed of a material such as phosphor bronze
having resiliency, but any of generally known
20 materials may be used for the second contacts if
they have electrical conductivity.

To mount the recording head 88 on the carriage
84 thus constructed, the recording head 88 may be
simply urged against the carriage 84 from above
25 against the forces of the head keeping plate springs
113 and 114. If the positions of the hole 110 and
the pin 115 are accurately coincident with each

1 other at that time, the mounting portion 111 and
the engaging portion 112 are engaged with the plate
springs 113 and 114, respectively, and at the same
time, electrical connection is completed.

5 While the mounting portion 111 and the
engaging portion 112 have been shown as being directly
integral with the recording head 88, they may be
separate from and adapted to be attached to the
recording head 88. However, making the mounting
10 portion and the engaging portion integral with the
recording head is preferable because, in that case,
detachment or positional deviation of those portions
does not occur.

The schematic cross-sectional views of.
15 Figures 9 and 10 show the engaged condition and the
electrically connected condition in a state in which
the recording head 88 is mounted.

The relation between the hole and pin which
are positioning means may be reverse.

20 Figure 11 shows the structure of the liquid
injection recording head used in the present inven-
tion. In Figure 11, reference numeral 10 designates
an orifice, reference numeral 11 denotes an orifice
plate, reference numeral 12 designates a flow path
wall, reference numeral 13 denotes a base plate,
25 and reference numeral 14 designates an energy
generating member.

1 According to the present embodiment, the
positioning, mounting and dismounting of the record-
ing head can be easily accomplished by means of the
positioning pin and plate spring and therefore, when
5 the ink in the recording head has become exhausted
or non-discharge of droplets has occurred, the
recording head can be simply interchanged to con-
tinue the recording.

10 By making the recording head interchangeable
from above, the interchanging operation becomes
easy and the recording head hardly interferes with
other mechanism such as the platen during the inter-
change of the recording head and compactness and
light weight of the apparatus body can be achieved.

15 Also, by making the recording head mountable
and dismountable by one touch, the ordinary user
can easily interchange the recording head, and
this leads to a further effect that the down-time
of the apparatus is shortened.

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CLAIMS

1. A liquid jet recording apparatus having mounted thereon a liquid jet recording head in which there is provided an electrically actuatable element for causing a recording liquid to eject from an orifice of the head, and in which an electrical contact for receiving electrical signals for said actuatable element is provided at an outwardly exposed portion of the head which is inaccessible, in use, to liquid from said orifice, the electrical contact on the recording head engaging, when the head is mounted on a mounting portion of said apparatus, with an electrical contact provided on the mounting portion.

2. A liquid ejection recording apparatus according to claim 1, characterized in that said electrically actuatable element is an electro-thermal converting member.

3. A liquid ejection recording apparatus according to claim 1 or 2, characterized in that said recording head is provided with positioning means for engagement with complementary means on the apparatus.



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4. A liquid ejection recording apparatus according to claim 1, 2 or 3, characterized in that said electrical contacts of said recording head are provided on the bottom surface of said recording head, said electrical contacts of said mounting portion are provided on the upper surface of said mounting portion, and fluid flow inhibiting means for partitioning said electrical contacts of said recording head and said electrical contacts of said mounting portion from said orifices of said recording head is provided in at least one of the bottom surface of said recording head and the upper surface of said mounting portion.

5. A liquid ejection recording apparatus according to claim 4, characterized in that said inhibiting means is a groove.

6. A liquid ejection recording apparatus according to claim 4, characterized in that said inhibiting means is a ridge.

7. A liquid ejection recording apparatus according to claim 4, characterized in that said recording head has a mounting engaging portion.



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8. A liquid jet recording apparatus according to claim 1, wherein said electrical contacts are provided on a surface of the recording head different from that in which the orifice is provided.

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9. A liquid jet recording apparatus, substantially as described with reference to any of Figures 1 to 10 of the drawings.

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10. A liquid jet recording apparatus according to any preceding claim, wherein the recording head has a structure substantially as described with reference to Figure 11 of the drawings.
