

INKJET RECORDING APPARATUS AND INK CARTRIDGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an inkjet recording apparatus fitted with a recording head for ejecting droplets of ink onto a recording medium in response to a print signal and also to an ink cartridge used in this inkjet recording apparatus.

2. Description of the Related Art

An inkjet recording apparatus has a recording head for ejecting droplets of ink. This head is mounted on a carriage that reciprocates relative to a recording medium. The recording apparatus currently available is so designed that ink is supplied to the recording head from an ink cartridge via an ink channel such as a tube or that ink is supplied to the recording head via an ink supply needle formed on the carriage where an ink cartridge is mounted.

Either of these types employs an arrangement in which an ink leading-out member, such as the ink supply needle, of the main body side is inserted into or connected to an ink supply port of the ink cartridge, and therefore the ink cartridge and the ink leading-out member must be reliably connected and fixed to each other so as to avoid an unintentional disconnection therebetween. To this end, it is necessary to provide a member

for fixing the ink cartridge to the cartridge accommodation portion in the related art.

The arrangement using the aforementioned fixing member, however, requires two operations, i.e. mounting an ink supply port of the ink cartridge to a coupling member formed at an end of the ink supply path, and thereafter fixing the cartridge by the fixing member. Consequently, the sequence of operations for mounting is cumbersome to perform. Further, the fixing means is required to make the structure complicated.

SUMMARY OF THE INVENTION

In view of these problems, the present invention has been made. It is an object of the present invention to provide an inkjet recording apparatus permitting an inkjet cartridge to be fixed to an ink cartridge accommodation portion simply by pushing-in the ink cartridge in the mounting direction.

It is another object of the invention to provide an ink cartridge adapted for the recording apparatus described above.

To solve these problems, according to a first aspect of the present invention, there is provided an ink cartridge, comprising: a container body having a first wall and a second wall, the first wall lying in a first plane and the second wall lying in a second plane that intersects the first plane, the container body having an interior; an ink supply port formed in the second wall; a recess formed in the first wall, the recess including a floor lying in a plane parallel to the first plane and a perimeter wall; a guide structure disposed within the recess, at least a portion of said guide structure extending from the floor of the recess toward the first wall; and a first slanted surface that is inclined from a first part of the floor of the recess toward the first wall, the first slanted surface being located between the guide structure and the perimeter wall.

According to a second aspect of the present invention, there is provided an ink cartridge, comprising: a container body having a first wall and a second wall, the first wall lying in a first plane and the second wall lying in a second plane that intersects the first plane, the container body having an interior; an ink supply port formed in the second wall; a recess formed in the first wall, the recess including a floor lying in a plane parallel to the first plane and a perimeter wall; and a guide structure disposed within and occupying a portion of the recess, at least a portion of the guide structure extending from the floor of the recess toward the first wall, the guide structure having a first side wall, a second side wall leading from the first side wall and a third side wall leading from the second side wall, the guide structure being sized so that there is a path between the perimeter wall and the first side wall, the second side wall and the third side wall.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing an embodiment of an inkjet recording apparatus of the present invention.

Fig. 2 is a perspective view showing the structure of a cartridge accommodation holder of a carriage which is a component of the inkjet recording apparatus of the invention.

Fig. 3A is a perspective view showing an embodiment of a fixing protrusion, Fig. 3B is a perspective view showing a mounting state of the fixing protrusion at a front side on a vertical wall in the holder, and Fig. 3C is a perspective view showing the mounting state of the fixing protrusion at a rear side on the vertical wall in the holder.

Fig. 4 is a perspective view of an embodiment of an ink cartridge adapted for the recording apparatus.

Fig. 5 is a cross-sectional view of the ink cartridge, taken through the ink supply port, and in which the cartridge is mounted_____

on the carriage.

Fig. 6 is an enlarged perspective view of a fixing member formed in the ink cartridge.

5 Figs. 7I and 7II are views illustrating the former half of steps performed when the ink cartridge is mounted.

Figs. 8I and 8II are views illustrating the latter half of the steps performed when the ink cartridge is mounted.

Figs. 9I and 9II are views illustrating steps for taking out the ink cartridge.

10 Fig. 10 is an exploded perspective view showing another embodiment of the ink cartridge to which the invention can be applied.

Fig. 11 is a view showing an embodiment of a cartridge holder adapted for the ink cartridge.

15 Fig. 12 is a perspective view in which another embodiment of the recording apparatus of the invention is shown by the structure of a cartridge accommodation region.

Figs. 13A and 13B are perspective views, each showing another embodiment of the ink cartridge of the invention.

20 DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is hereinafter described in detail with reference to the illustrated embodiments.

Fig. 1 shows an embodiment of an inkjet recording apparatus of the present invention. A case is made up of a case body 1
25 and a cover 2. A carriage 4 is accommodated in the case to be

opposed to a platen 3 and to be reciprocatingly movable. Two kinds of ink cartridges 5 and 6 having different widths are detachably mounted on the top surface of the carriage 4.

Fig. 2 shows an embodiment of the carriage 4. In this embodiment, inkjet recording heads 7 and 8 that receive supply of inks from ink cartridges 5 and 6, respectively, are disposed on the bottom surface of the carriage 4. Vertical walls 11 form a boxlike enclosure on the upper surface of the carriage 4 to accommodate the ink cartridges 5 and 6 such that their top surfaces are exposed. In this way, a cartridge holder 9 is integrally formed.

The cartridge holder 9 is partitioned by a rib 10 into two sections to accommodate the two kinds of ink cartridges 5 and 6 in given regions. Windows 11c and 11d for forming fixing members are respectively formed at substantially central portions of the vertical walls 11a and 11b that respectively define the regions for accommodating the cartridges. Fixing protrusions 12a and 13a of fixing members 12 and 13 as described later protrude through the windows 11c and 11d into the side of the cartridge accommodation regions.

The windows 11c and 11d are formed as arc-shaped through holes which limit the movement of the fixing protrusions 12a and 13a to a certain angular range L. Mounting holes 11e and 11f are formed on the centerlines of the windows 11c and 11d and under these windows 11c and 11d.

These window 11c, 11d and fixing member 12, 13 together form a one-push type fixing member.

Fig. 3A shows an embodiment of the fixing member 12, 13.

In this embodiment, the fixing members 12 and 13 are shaped

5 identically. The fixing members 12 (13) has an arm 12b (13b).

The fixing protrusion 12a (13a) that is longer than the thickness of the vertical wall 11a (11b) but does not hinder insertion of the cartridge is formed at one end of the arm 12b (13b) perpendicularly to the longitudinal direction of the arm 12b

10 (13b). A mounting portion 12c (13c) that is rotatably inserted into the mounting hole 11e (11f) is formed at the other end in the same direction as the fixing protrusion 12a (13a). A tapering

portion 12d (13d) for preventing disconnection and a split groove 12e (13e) are formed at the front end of the mounting portion

15 12c (13c). The arm 12b (13b) is so designed that the position of the fixing protrusion 12a (13a) is displaceable in a direction intersecting a surface direction of a fixing member 30 described later in conformity with recessed and protruded portions of the fixing member 30, and that the arm 12b (13b) has such an elasticity

20 as to cause the fixing protrusion 12a (13a) to contact the fixing member 30 with a given contact force. This ensures reliable contact between the fixing protrusion 12a (13a) and the fixing member 30, to thereby eliminate failure of fixing the ink cartridge caused due to insufficient contact.

25 Because of this structure, when the fixing protrusion 12a

(13a) of the fixing member 12 (13) is inserted into the window 11c (11d) and the tapering portion 12d (13d) of the mounting portion 12c (13c) is forced into the mounting hole 11e (11f), the mounting portion is permitted by the split groove 12e (13e) to be deformed and then rotatably fitted in the mounting hole 11e (11f).

Figs. 4A and 4B show embodiments of the ink cartridges 5 and 6 of the invention. Namely, Fig. 4A shows the ink cartridge which contains one kind of ink, black ink in this embodiment, and Fig. 4B shows the ink cartridge which is formed with a plurality of separate ink storage chambers by partition walls or the like and which contains different kinds of inks, yellow, magenta and cyan in this embodiment, in respective ink storage chambers, each having an independent ink supply port.

Here, only one ink cartridge 5 is described. A fixing member 30 that guides and engages the aforementioned fixing protrusion 12a is formed in one wall surface 21 parallel to the direction of insertion of a container 20 that contains ink therein.

Another wall surface 29 that is perpendicular to the direction of insertion is provided with an ink supply port 22 that engages an ink supply needle 14 of the carriage to discharge the ink inside the cartridge therefrom.

In this ink cartridge, the fixing member 30 is disposed at a position offset toward the surface (the bottom surface) 29 where the ink supply port 22 is formed, i.e. at a lower portion

region in the insertion direction of the ink cartridge in this embodiment, and further the ink supply port 22 is disposed at a position offset toward the wall surface (the side surface) 21 (i.e. at the right side in the figure). Consequently, the
5 fixing member 30 can surely fix a portion of the ink cartridge in the vicinity of the ink supply port 22. This arrangement can prevent the displacement of the ink cartridge even when an external force is applied in a state in which the ink supply needle 14 is inserted into the ink supply port 22, to thereby
10 reduce an adverse affect on the connection portion between the ink supply port 22 and the ink supply needle 14. That is, since the ink supply port 22 is located at the position offset toward the wall surface 21 where the fixing member is formed, the fixing member 30 can receive the external force to reliably provide
15 the above-noted advantageous effect.

As shown in Fig. 5, a packing 26 and a valve body 23 are loaded in the ink supply port 22 in such a way that the valve body 23 is biased by a spring 24 which is a coiled spring. The packing 26 serves as a sealing member, which closely and sealingly
20 contacts the circumference of the ink supply needle 14. The valve body 23 contacts one end face of the packing 26 to close and seal an opening formed through the packing 26 when the cartridge is removed from the carriage, and opens the ink supply port by insertion of the ink supply needle 14 when the ink cartridge
25 is mounted on the carriage. The extent of resilience of the spring

24 is such that even when the ink cartridge 5 is fully filled with ink and the ink supply port 22 engages the ink supply needle 14, the spring can bias the cartridge 5 in the direction opposite to the direction of insertion against the frictional force caused between the ink supply needle 14 and the packing 26.

In the aforementioned embodiment, the spring 24, provided in the ink supply port 17, for biasing the valve body 23 in the direction to close the valve body 23 is used to bias the ink cartridge in the direction opposite to the direction in which the cartridge 5 is inserted. In a case where the repulsion force of the spring 24 is small or the cartridge does not have the valve body 23 biased by the spring 24, the same advantages can be obtained by mounting a biasing spring 25 near the ink supply port 22 and in the front-end surface as viewed in the direction of insertion of the ink cartridge (i.e., the surface in which the ink supply 22 is formed) or in the surface of the carriage 4 that faces the ink supply port 22.

Fig. 6 shows an embodiment of the fixing member 30 formed on the ink cartridge, which constitutes the one-push type fixing member. A recess portion 31 having an entrance port of width W capable of almost covering the range of movement L of the fixing protrusion 12a is formed at the front end as viewed in the direction in which the cartridge is loaded (in this embodiment, in a lower portion). A guide portion 32 having an upper portion on one side is formed in the center of the recess portion 31 as viewed in

the direction of insertion of the cartridge. A protruded portion 32a is formed in the center of the guide portion 32 such that passages through which the protrusion 12a can pass are formed on both sides of the protruded portion 32a.

5 In a lower portion side (the left side in the figure) relative to the protruded portion 32a, there are formed a vertical wall 32b over which the protrusion 12a cannot pass during the movement of the ink cartridge in the insertion direction, and an inclined surface 32c, above the vertical wall 32b, over which the protrusion
10 12a can easily pass during the movement of the ink cartridge in the removal direction.

In the other side, i.e. an upper portion side (the right side in the figure) relative to the protruded portion 32a, there are formed an inclined surface 32d over which the protrusion
15 12a can easily pass during the movement of the ink cartridge in the insertion direction, and a vertical wall 32e, above the inclined surface 32d, over which the protrusion 12a cannot pass during the movement of the ink cartridge in the removal direction.

This arrangement of the inclined surface 32d and the vertical
20 wall 32e in the upper portion side is reverse to the arrangement of the vertical wall 32b and the inclined surface 32c in the lower portion side. The protrusion 12a enters through the inclined surface 32d, and exits through the inclined surface 32c.

An angular vertical wall 33a, whose vertex 33 is located
25 slightly offset from the centerline C of the recess portion 31

toward the inclined surface 32d, is formed in a deeper portion of the recess portion 31 relative to the entrance side of the protrusion 12a. A vertical wall 32g obliquely upwardly extends substantially from the centerline C of the protruded portion 32a toward the exist side (the left side in the figure) to provide
5 a holding portion 34 made up of a V-shaped recess portion for engagement with the protrusion 12a.

This holding portion 34 is disposed at a center in the width direction of the cartridge, or on a plane which passes
10 through a central axis of the ink supply port and which is perpendicular to the wall surface, so that the holding portion 34 in cooperation with the protrusion 12a can reliably fix the ink cartridge 5 at a predetermined position, while causing no moment on the ink supply needle 14.

15 Indicated by numeral 35 in the figure is a movement direction-restricting member disposed closer to the inclined surface 32c than to the holding portion 34. This restricting member 35 has an inclined surface 35a over which the protrusion 12a can easily pass and a vertical wall 35b over which the protrusion
20 12a cannot easily pass.

In this embodiment, when the ink cartridge 5 is inserted, the fixing protrusion 12a enters the opening of the recess portion 31 of the fixing member 30 and reaches the inclined surface 32d while being guided by the guide portion 32 (the vertical wall
25 32b) in one direction (Fig. 7I). Then, the fixing protrusion

12a passes over this inclined surface 32d (Fig. 7II).

Under this condition, when the cartridge 5 is further pushed-in against the elastic force of the spring 24 of the ink supply port, the ink cartridge 5 reaches a dead point at which the fixing protrusion 12a contacts the angular wall 33a located in the deeper portion of the recess portion 31 (Fig. 8I). Under this condition, if the hand is released from the ink cartridge 5, the ink cartridge 5 is moved by a slight distance ΔG in the direction opposite to the direction of insertion by the reaction force of the spring 24 so that the fixing protrusion 12a is fitted into the holding portion 34, while being guided toward the centerline C by the vertical wall 32e (Fig. 8II).

There is a slight clearance between the dead point at the pushing-in of the ink cartridge 5 into the cartridge holder and a cartridge holding position. For this reason, when the ink cartridge is moved from the dead point at the pushing-in to the cartridge holding position, the packing 26 is moved in the contracting direction due to the friction to the ink supply needle 14, so that the packing 26 reliably contacts the circumference of the ink supply needle 14 elastically, to thereby ensure air-tightness.

In addition, such clearance can be determined by the diameter of the fixing protrusion 12a, the position of the holding portion 34, or the like.

On the other hand, in a case where the ink in the ink cartridge

has been consumed and the ink cartridge 5 is replaced, the cartridge 5 is pushed-in against the reaction force of the spring 24. The fixing protrusion 12a passes over the inclined surface 35a of the movement-restricting member 35, while being guided by the angular wall 33a located in the deeper portion of the recess portion 31 (Fig. 9I). The amount of the movement during this pushing-in corresponds to the aforementioned slight clearance between the dead point at the pushing-in and the cartridge holding position. By this movement, the packing 26 is relatively moved with respect to the ink supply needle 14 so that ink flows in therebetween. The ink serves as lubricant to reduce the friction during the removal.

Under this condition, if the hand is released from the cartridge 5, the reaction force of the spring 24 elevates the cartridge 5. During this process, the fixing protrusion 12a passes over the inclined surface 32c to be free from the restriction (Fig. 9II).

When a new cartridge 5 is loaded into a given position and then pushed-in, the ink cartridge can be fixed into a predetermined position in the same way as the foregoing.

In the embodiment described above, a recording apparatus of the type where the cartridge holder is mounted to the carriage has been described. It is apparent that similar advantages can be produced when the invention is applied to a type of the recording apparatus in which the cartridge is installed on the case body

1 forming the recording apparatus and ink is supplied to the
recording head by the use of an ink supply tube.

That is, in a case of an ink cartridge 45 in which a flexible
bag 41 containing ink therein and having an ink supply port 40
5 on one side thereof is accommodated in a hard case 44 made up
of a case body 42 and a cover 43 in such a way that the ink supply
port 40 is exposed, the aforementioned one-push type fixing member
30 is formed on a side surface of the hard case 44 such that
the front side as viewed in the direction of insertion becomes
10 an opening portion.

On the other hand, the other one-push type fixing member
is formed such that the fixing protrusion 12a is protruded from
the rotational range limiting window 47 at the side of the ink
cartridge accommodating holder 46 to be opposed to the fixing
15 member 30. A resilient member 48 is disposed on the side of
an ink supply needle 49. In this way, the cartridge 45 can be
fixed into a predetermined position simply by pushing it in.
When the ink cartridge 45 is removed, the ink cartridge 45 is
pushed in against the resilient member 48. In this way, the ink
20 cartridge 45 can be taken out.

This embodiment can also employ, in place of the resilient
member 48, a valve arrangement having the valve body 23 installed
in the ink supply port 22 and the spring 24 for biasing the valve
body 23 toward the ink supply port side as discussed with reference
25 to Fig. 5, in order to produce the same effect using the elastic

force of the spring for biasing the valve body.

In the embodiment described above, a one-push type fixing member for receiving a fixing protrusion and another one-push type fixing member having the fixing protrusion are formed on the ink cartridge and cartridge holder, respectively. It is apparent that, the same advantages can be obtained when one-push type fixing member 30 for receiving the fixing protrusion is arranged on the cartridge holder 9 and another one-push type fixing member having the fixing protrusion 12a, 13a is arranged on the ink cartridge 5, 6 as shown in Figs. 12 and 13.

CLAIMS:

1. An ink cartridge, comprising:

a container body having a first wall and a second wall, the first wall lying in a first plane and the second wall lying in a second plane that intersects the first plane, the container body having an interior;

an ink supply port formed in the second wall;

a recess formed in the first wall, the recess including a floor lying in a plane parallel to the first plane and a perimeter wall;

a guide structure disposed within the recess, at least a portion of said guide structure extending from the floor of the recess toward the first wall; and

a first slanted surface that is inclined from a first part of the floor of the recess toward the first wall, the first slanted surface being located between the guide structure and the perimeter wall.

2. The ink cartridge of claim 1, further comprising:

a second slanted surface that is inclined from a second part of the floor of the recess toward the first wall and which is located between the guide structure and the perimeter wall,

wherein the portion of the guide structure is located between the first and the second slanted surfaces.

3. The ink cartridge of claim 1, wherein the perimeter wall has two straight side portions and a generally M-shaped portion having side legs, the side legs of the M-shaped portion meeting, respectively, the straight side portions.

4. The ink cartridge of claim 3, wherein the side legs of the M-shaped portion are not parallel to the straight side portions.

5. The ink cartridge of claim 1, wherein the guide structure has a V-shaped section, the opening of the V-shaped section facing a portion of the perimeter wall, the V-shaped section being located between the portion of the perimeter wall and the second wall as viewed in a direction perpendicular to the first plane.
6. The ink cartridge of claim 1, further comprising:
 - a supplemental guide structure disposed within the recess, the supplemental guide structure having a further slanted surface that is inclined from a further part of the floor of the recess toward the first wall.
7. The ink cartridge of claim 6, wherein the supplemental guide structure is located on the opposite side of the guide structure to the second wall, as viewed in a direction perpendicular to the first plane.
8. The ink cartridge of claim 7, wherein the recess, the guide structure and the supplemental guide structure are dimensioned so that a path exists between the guide structure and the perimeter wall.
9. The ink cartridge of claim 8, wherein the path is generally M-shaped.
10. The ink cartridge of claim 9, wherein the side legs of the M-shaped path are at least in part parallel.
11. An ink cartridge, comprising:
 - a container body having a first wall and a second wall, the first wall lying in a first plane and the second wall lying in a second plane that intersects the first plane, the container body having an interior;
 - an ink supply port formed in the second wall;

a recess formed in the first wall, the recess including a floor lying in a plane parallel to the first plane and a perimeter wall; and

a guide structure disposed within and occupying a portion of the recess, at least a portion of the guide structure extending from the floor of the recess toward the first wall, the guide structure having a first side wall, a second side wall leading from the first side wall and a third side wall leading from the second side wall, the guide structure being sized so that there is a path between the perimeter wall and the first side wall, the second side wall and the third side wall.

12. The ink cartridge of claim 11, wherein the path is generally M-shaped.

13. The ink cartridge of claim 12, wherein the side legs of the M-shaped path are at least in part parallel.

14. The ink cartridge of claim 11, wherein the container body also includes a third wall, and the ink cartridge further comprises a first slanted portion beginning at a first part of the floor of the recess and extending toward both the first wall and the third wall of the container body and a second slanted portion beginning at a second part of the floor of the recess and extending toward the first wall of the container body and away from the third wall of the container body.

15. The ink cartridge of claim 11, further comprising

a supplemental guide structure disposed within the recess, the guide structure having at least one slanted surface that is inclined from a third part of the floor of the recess toward the first wall of the container body.

16. The ink cartridge of claim 11, wherein at least part of at least one of the first and third side walls are straight.