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LIQUID CONTAINER AND LIQUID SUPPLYING SYSTEM

ABSTRACT OF THE DISCLOSURE:

5 A liquid container (1) detachably mountable to a recording apparatus to which a plurality of liquid containers are detachably mountable, wherein the recording apparatus includes apparatus electrical contacts (152) corresponding to the liquid containers (1), respectively, photoreceptor means for receiving light, and an electric circuit connected with a line which is commonly connected with the apparatus electrical contacts, the liquid
10 container includes a container electrical contact (102) electrically connectable with one of the apparatus contacts (152); an information storing portion capable of storing at least individual information of the liquid container; a light emitting portion (101); a controller (103) for controlling emission of light of the light emitting portion (101) in response to a correspondence between a signal indicative of individual information supplied through
15 the container electrical contact and the information stored in the information storing means.

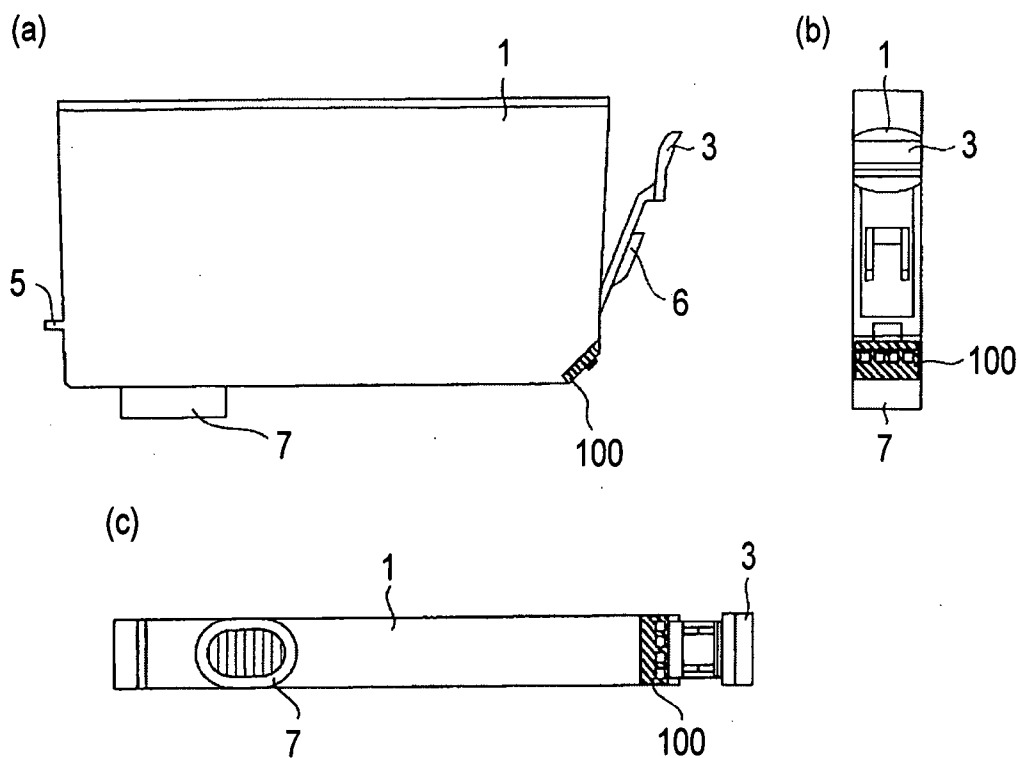


FIG.1

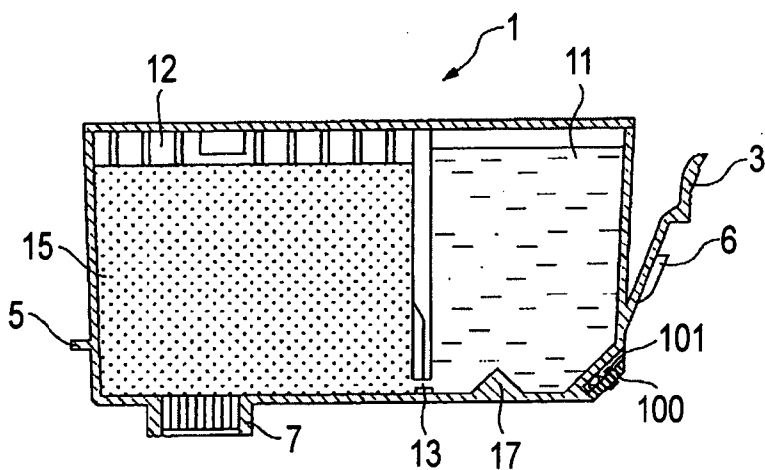


FIG.2

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The following statement is a full description of this invention, including the best method of performing it known to me/us:-

LIQUID CONTAINER AND LIQUID SUPPLYING SYSTEM

FIELD OF THE INVENTION AND RELATED ART:

5 The present invention relates to a liquid container and a liquid supplying system, more particularly, to a liquid container which is capable of notifying a state of the liquid container using light emitting means such as a LED, the state
10 including an ink remaining amount of an ink container for ink jet recording.

 With recent wider use of digital camera, the demand is increasing for printing with the digital camera being directly connected with a printer
15 (recording device), that is, non-PC printing. Another increasing demand is for printing by setting a card type information memory medium detachably mountable to a digital camera directly in a printer to transfer the data, and printing them (another non-PC recording).
20 Generally, the ink remaining amount in the ink container of the printer is checked on a display through a personal computer. In the case of the non-PC printing, this is not possible. However, capability of checking the ink remaining amount in the ink container
25 is desired even in the non-PC printing. This is because if the user can be aware of the fact that ink remaining amount in the ink container is small, the

user can exchange the ink container with a fresh one prior to starting printing operation, so that printing failure during the course of printing on a sheet can be avoided.

5 Use of a display element such as a LED is known to notify the user of such a state of the ink container. For example, Japanese Laid-open Patent Application Hei 4- 275156 discloses that ink container which is integral with a recording head is provided
10 with two LED elements, which are switched on depending on the ink remaining amount in two steps. Japanese Laid-open Patent Application 2002- 301829 also discloses that ink container is provided with a lamp which is switched on depending on the ink remaining
15 amount. The same also discloses that four ink containers used with one recording device are provided with said lamps, respectively.

 In addition, in order to meet a demand for high image quality, light magenta ink, light cyan ink and
20 so on become used in addition to the conventional four color (black, yellow, magenta and cyan) inks. Furthermore, use of special color inks such as red ink or blue ink are proposed. In such a case, seven - eight color ink containers are used
25 individually in an ink jet printer. Then, a mechanism for preventing the ink containers from being mounted at erroneous positions is desired. US Patent

No.6302535 discloses that engaging configurations of the carriage, the ink containers are made different from each other, so that erroneous mounting (incorrect position) is prevented, when the ink containers are
5 mounted on the carriage.

Even when the ink container is provided with a lamp, as disclosed in Japanese Laid-open Patent Application2002- 301829, the main assembly side controller has to identify the ink container which is
10 recognized as containing less ink. To do this, it is necessary to identify the ink container to which the signal for turning the right lamp on. If, for example, the ink container is mounted on a wrong position, there is a liability that small ink remaining amount
15 is displayed for another ink container which contains a sufficient amount of the ink. Therefore, the emission control for the displaying device such as a lamp has to have correct information of the carried positions of the ink containers.

20 As to a structure for detecting the carried position of an ink container, there is a structure in which the mutual configuration relations between the carrying portions and the associated ink containers are made different depending on the carrying positions.
25 However, in such a case, it is required to manufacturing ink containers which are different depending on the color and/or kind of the ink, with

the result of disadvantages in terms of manufacturing efficiency and/or cost.

As another structure for accomplishing this, a signal line of a circuit which will be closed by connection between the electrical contact of the ink container and the main assembly side electrical contact at the carrying position of a carriage or the like, is provided substantially independently for each of the carrying positions. For example, the signal line for reading ink color information of an ink container out of the ink container, for controlling the actuation of a LED is provided for each of the carrying positions, by which if the read color information does not meet the carrying position, the erroneous mounting of the ink container is discriminated.

However, this structure result in increased number of signal lines. As mentioned hereinbefore, recent ink jet printers or the like use a greater number of kinds of inks to improve the image quality. The increase of the number of the signal lines increases the cost particularly in such printers. On the other hand, in order to reduce the number of wiring leads, it would be effective to employ a so-called common signal line using a bus connection, but simple use of such a common signal line as bus connection cannot determines the ink containers or the

carrying positions of the ink containers.

SUMMARY OF THE INVENTION:

5

Disclosed is a liquid container in which emission control is effected for displaying devices such as LEDs using a common signal line for a plurality of ink container carrying positions, and the carrying positions for the respective liquid containers (ink container) can be determined to effect the emission control of the displaying device for the respective liquid containers, despite the use of the common signal line.

15

In accordance with one aspect of the present invention there is provided a liquid container detachably mountable to a recording apparatus to which a plurality of liquid containers are detachably mountable, wherein said recording apparatus includes apparatus electrical contacts corresponding to the liquid containers, respectively, photoreceptor means for receiving light, and an electric circuit connected with a line which is commonly connected with said apparatus electrical contacts, said liquid container comprising a container electrical contact electrically connectable with one of said apparatus contacts; an information storing portion capable of storing at

20

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least individual information of said liquid container;
a light emitting portion; a controller for controlling
emission of light of said light emitting portion in
response to a correspondence between a signal

- 5 indicative of individual information supplied through
said container electrical contact and said information
stored in said information storing portion.

With this structure, the light emission of the
light emitting portion is controlled on the basis of a
10 signal inputted through a contact (pad) of an ink
container (liquid container) connected with a contact
(connector) provided in the main assembly side of the
recording device and the information belonging to the
ink container, so that even if the ink containers
15 receive the same control signal through the common
signal line, only the ink container having the matched
individual information can be subjected to the light
emission control. In this manner, the light emission
control such as lightening of the light emitting
20 portion can be effected for the matched ink container.
As an additional feature, the light emission
controller can sequentially actuate the light emitting
portions of the ink containers carried on the carriage
when the carriage is being moved, by providing means
25 for detecting the light emission, and erroneous
mounting of an ink container can be discriminated when
the light is not detected at a position. By doing so,

the user may be prompted to remount the ink container to a right position, and as a result respective carried positions of the ink containers can be detected.

5 Therefore, the use is made with a common signal line for a plurality of ink container carrying positions to control the light emission of displaying devices such as LEDs, even in such a case, the start effect controls of the displaying devices can be
10 effected with the carrying positions of the liquid containers such as ink containers being specified.

 The above and other features and advantages associated with the present invention will become more apparent upon a consideration of the following
15 description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

20 BRIEF DESCRIPTION OF THE DRAWINGS:

 Figure 1 is a side view (a), a front view (b) and a bottom view (c) of an ink container according to a first embodiment of the present invention.

 Figure 2 is a sectional side elevation of the
25 ink container according to the first embodiment of the present invention.

 Figure 3 is schematic side views (a) and (b) of

the ink container according to the first embodiment of the present invention, illustrating function of a substrate provided on the ink container.

Figure 4 is an enlarged view (a) of a major
5 part of the ink container shown in Figure 3, and a view (b) as seen in a direction IVb.

Figure 5 is a side view (a) and a front view (b) of an example of a controller substrate mounted on the ink container of the first embodiment.

10 Figure 6 is a side view (a) and a front view (b) of a modified example of the controller substrate mounted on the ink container according to the first embodiment.

Figure 7 is a side view (a) and a front view
15 (b) of another modified example of the controller substrate mounted on the ink container according to the first embodiment.

Figure 8 is a side view of an ink container illustrating an usage of the controller substrate of
20 Figure 7.

Figure 9 is a side view illustrating another example of usage of the controller substrate of Figure 7.

Figure 10 is a side view (a) and a front view
25 (b) of a further modified example of the controller substrate mounting on the ink container according to the first embodiment.

Figure 11 is a side view illustrating an usage of the controller substrate of Figure 10 provided on the ink container.

Figure 12 is a schematic side view illustrating
5 another example of the structure and an operation of a major part of the ink container according to the first embodiment of the present invention.

Figure 13 is a side view (a) and a front view (b) of a further example of the controller substrate
10 mounted on the ink container.

Figure 14 is a perspective view illustrating an example of a recording head unit having a holder to which the ink container according to the first embodiment is mountable.

15 Figure 15 is a schematic side view illustrating an operation of mounting and demounting of the ink container according to the first embodiment to the holder shown in Figure 14.

Figure 16 are perspective views (a) and (b) of
20 another example of a mounting portion of the ink container according to the first embodiment of the present invention.

Figure 17 shows an outer appearance of an ink jet printer to which the ink container according to
25 the first embodiment is mountable.

Figure 18 is a perspective view of the printer in which the main assembly cover 201 of Figure 17 is

open.

Figure 19 is a block diagram showing a structure of a control system of the ink jet printer.

Figure 20 shows structure of signal line wiring
5 for signal transmission between the ink container and the flexible cable of the ink jet printer in terms of the substrate of the ink container.

Figure 21 is a detailed circuit diagram of the substrate having a controller or the like.

10 Figure 22 is a circuit diagram of a modified example of the substrate of Figure 21.

Figure 23 is a timing chart illustrating the data writing and reading operations to and from a memory array of the substrate.

15 Figure 24 is a timing chart illustrating actuation and deactuation of LED 101.

Figure 25 is a flow chart illustrating a control process relating to mounting and demounting of the ink container according to an embodiment of the
20 present invention.

Figure 26 is a flow chart of a mounting and demounting process of the ink container in Figure 25.

Figure 27 is a flow chart showing in detail a mounting confirmation control in Figure 26.

25 Figure 28 shows a state (a) in which all of the ink containers are correctly mounted at correct positions, and therefore the LEDs are switched on,

respectively, in the process of the control for the mounting and demounting of the ink containers, in which (b) shows movement of the carriage to a position for validation which is carried out using light (light validation), after the main assembly cover is closed
5 subsequently to the LED lightening.

Figure 29 illustrates the light validation process (a) - (d).

Figure 30 figure 30 also illustrates the light
10 validation process (a) - (d).

Figure 31 is a flow chart illustrating a recording process according to the embodiment of the present invention.

Figure 32 illustrates structures of an ink
15 container and a mounting portion thereof according to another embodiment of the present invention, and a mounting operation thereof (a) - (c).

Figure 33 is a perspective view illustrating a modified example of the structure of Figure 32.

20 Figure 34 is a perspective view of a printer to which the ink container according to said another embodiment of the present invention.

Figure 35 is a schematic side view (a) and a schematic front view (b) of an ink container according
25 to a further embodiment of the present invention.

Figure 36 is a schematic side view of a modified example of the structure of Figure 35.

Figure 37 is a schematic side view of a modified example of the structure of Figure 35.

Figure 38 is a perspective view of a printer having a structure according to a further embodiment
5 of the present invention.

Figure 39 is a circuit diagram of a substrate having a controller and the like, according to a further embodiment of the present invention.

Figure 40 is a timing chart of an operation in
10 the structure of the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

The description will be made as to the
15 embodiments of the present invention in conjunction with the accompanying drawings, in the following order:

1. Mechanical Structure:

1.1 Ink Container

20 1.2 Modified Example:

1.3 Ink Container Mounting Portion

1.4 Recording Device:

2. Control System:

2.1 General Arrangement:

25 2.2 Connecting Portion:

2.3 Control Process:

3. Other Embodiments:

1. Mechanical Structure:

1.1 Ink Container (Figure 1 - Figure 5)

5 Figure 1 is a side view (a), a front view (b)
and a bottom view (c) of an ink container according to
a first embodiment of the present invention.

Figure 2 is a sectional side elevation of the ink container according to the first embodiment of the present invention. In the following descriptions, the front side of the ink container is the side which is faced to the user who is manipulating the ink container (mounting and demounting operation of the ink container), which provides the user with information (by light emission of LED which will be described hereinafter).

In Figure 1, the ink container 1 of this embodiment has a supporting member 3 supported on the lower portion at the front side thereof. The supporting member 3 is made of resin material integrally molded with an outer casing of the ink container 1, and the ink container 1 is displaceable about a portion of the ink container to be supported when the ink container 1 is mounted to the container holder. The ink container 1 is provided on its rear side and front side with a first engaging portion 5 and second engaging portion 6, respectively, which are

engageable with locking portions provided in a container holder. In this embodiment, they are integral with the supporting member 3. By engagement of the engaging portion 5 and the engaging portion 6 with the locking portions, the ink container 1 is securedly mounted in the ink container 1. The operation during the mounting will be described hereinafter referring to Figure 15.

The bottom surface of the ink container 1 is provided with an ink supply port 7 for ink supply, which port is connectable with an ink introduction opening of the recording head which will be described hereinafter, by mounting of the ink container 1 to the container holder. A base member is provided on the bottom side of the supporting portion of the supporting member 3 at a position where the bottom side and the front side intersect with each other. The base member may be in the form of a chip or a plate. In the following description, it is called "substrate" 100.

Figure 2 is a sectional side elevation of the ink container 1. An inside of the ink container 1 is divided into an ink reservoir chamber 11 which is provided adjacent the front side where the supporting member 3 and the substrate 100 are provided, and a negative pressure generating member accommodating chamber 12 which is provided adjacent the rear side

and which is in fluid communication with an ink supply port 7. The ink reservoir chamber 11 and the negative pressure generating member accommodating chamber 12 are in fluid communication with each other through a communication port 13. The ink reservoir chamber 11 contains the ink alone in this embodiment, whereas the negative pressure generating member accommodating chamber 12 accommodates an ink absorbing material 15 (negative pressure generating member which is a porous member in this embodiment) made of sponge, fiber aggregate or the like for retaining the ink by impregnation. The porous member 15 functions to generate such a negative pressure as is sufficient to provide balance with the force of meniscus formed in the ink ejection nozzle of the recording head to prevent ink leakage from the ink ejection portion to the outside and to permits ink ejection by actuation of the recording head.

The internal structure of the ink container 1 is not limited to such a partitioned structure in which the inside is partitioned into the porous member accommodating chamber and the reservoir containing the ink alone. In another example, the porous member may occupy substantially all of the inside space of the ink container. The negative pressure generating means is not limited to the one using the porous member. In another example, the ink alone is contained in a

bladder-like member made of elastic material such as rubber or the like which produces tension in the direction of expanding the volume thereof. In such a case, the negative pressure is generated by the
5 tension in the bladder-like member to retain the ink. In a further example, at least a part of the ink accommodation space is constructed by a flexible member, and the ink alone is accommodated in the space, wherein a spring force is applied to the flexible
10 member, by which a negative pressure is generated.

The bottom portion of the ink reservoir chamber
11 is provided with a portion to be detected 17 at a position for facing a sensor (which is provided in the apparatus, as will be described hereinafter) for
15 detecting an ink remaining amount when the ink container 1 is mounted in the apparatus. In this embodiment, the ink remaining amount detection sensor is in the form of a photo-sensor comprising a light emitting portion and a light receiving portion. The
20 portion to be detected 17 is made of a transparent or semi-transparent material, and when the ink is not contained, the light from the light emitting portion is appropriately reflected toward the light receiving portion (which will be described hereinafter) by
25 providing an inclined surface portion having a configuration, angle or the like for this purpose.

Referring to Figure 3 - Figure 5, the

description will be made as to the structure and the function of the substrate 100. Figure 3 is schematic side views (a) and (b) of the ink container according to the first embodiment of the present invention,

5 illustrating function of a substrate provided on the ink container. Figure 4 is an enlarged view (a) of a major part of the ink container shown in Figure 3 and a view (b) as seen in a direction IVb. Figure 5 is a side view (a) and a front view (b) of an example of
10 a controller substrate mounted on the ink container of the first embodiment.

The ink container 1 is securedly mounted in or to the holder 150 which is integral with the recording head unit 105 having the recording head 105, by
15 engagements of the first engaging portion 5 and the second engaging portion 6 of the ink container 1 with a first locking portion 155 and a second locking portion 156 of the holder 150, respectively. At this time, a contact (connector) 152 provided in the holder
20 150, and a contact in the form of an electrode pad 102 ((b) of Figure 5) provided on a surface of the substrate 100 facing to outside, are electrically contacted to establish electrical connection.

A surface of the substrate 100 facing inwardly
25 of the ink container 1 is provided with a first light emitting portion 101 such as a LED for emitting visible light and a control element 103 for controlling

the light emitting portion, and the control element 103 controls the light emission of the first light emitting portion 101 in accordance with the electric signal supplied through the connector 152 and the pad 102. In Figure 5, (a) shows a state in which after the control element 103 is set in the substrate 100, it is coated with a protecting sealant. When a memory element for storing information such as a color or the remaining amount of the ink contained in the ink container is employed, it is set at the same place, so that it is coated with the sealant.

Here, as described hereinbefore, the substrate 100 is disposed at a lower portion of the supporting portion of the supporting member 3 adjacent the portion where the sides of the ink container 1 constituting the bottom side and the front side cross with each other. At this position, an inclined surface is provided between the bottom and front sides of the ink container 1. Therefore, when the first light emitting portion 101 emits light, a part thereof is emitted outwardly from the front side of the ink container 1 along the inclined surface.

By this disposition of the substrate 100, the information relating to the ink container 1 can be directly provided not only to the recording device (and to a host apparatus such as a computer connected thereto) also to the user, by the first light emitting

portion 101 alone. As shown by (a) in Figure 3, the light receiving portion is disposed at a position for receiving the light emitted in an upper right direction in the Figure adjacent an end of a scanning range of the carriage for carrying the holder 150, and at the timing when the carriage comes to the position, the light emission of the first light emitting portion 101 is controlled, by which the recording device side can obtain predetermined information relating to the ink container 1 on the basis of a content of the light received by the light receiving portion. In addition, by controlling the light emission of the first light emitting portion 101 with the carriage being disposed at a center portion of the scanning range, as shown by (b) in Figure 3, the user is visually informed of the state of the light emission, so that user can be given the predetermined information relating to the ink container 1.

Here, the predetermined information of the ink container (liquid container) 1 includes at least one of properness of the mounting state of the ink container 1 (i.e. whether the mounting is mounting or not), properness of the position of mounting of the ink container 1 (i.e. whether or not the ink container 1 is mounted on the right position in the holder which is determined corresponding to the ink color), and sufficiency of the ink remaining amount (i.e. whether

the remaining amount of the ink is sufficient or not). The information relating to them can be provided by emission or non-emission of the light and/or states of light emission (flickering or the like). The control
5 of the light emission, the manners of providing the information will be described hereinafter in the description of the structure of the control system.

In Figure 4, (a) and (b) show a preferable example of the disposition, the operation of the
10 substrate 100, and the first light emitting portion 101. For the purpose of smooth reaching of the light light emitted from the first light emitting portion 101 into the view field of the first light receiving portion 210 or the user, it is preferable that such a
15 portion of the ink container 1 as is opposed to the surface of the substrate 100 having the first light emitting portion 101 and the control element 103 is provided with a space 1A at least along the optical axis, as indicated by the arrow. For the same purpose,
20 the arrangement and the configuration of the supporting member 3 are so selected that optical axis is not blocked. In addition, the holder 150 is provided with a hole (or a light transmitting portion) 150H to assure non-blocking of the optical axis.

25

1.2 Modified Example (Figure 6 - Figure 13):

The foregoing structures are examples and can be modified as long as the predetermined information relating to the ink container 1 can be given to the recording device and to the user by the first light emitting portion 101. The description will be made as
5 to some modified examples.

Figure 6 is a side view (a) and a front view (b) of a modified example of the controller substrate mounted on the ink container according to the first
10 embodiment. In this example, a directivity is provided such that light is directed particularly toward the first light receiving portion 210 and toward the eyes of the user. To accomplish this, the attitude of the first light emitting portion 101 is appropriately
15 determined, and an element (a lens or the like) for providing the directivity may be employed.

In the example of (a) and (b) of Figure 7, the surface of the substrate 100 facing toward the inside of the ink container 1 is provided only with the first
20 light emitting portion 101, and the surface of the substrate 100 facing toward the outside is provided with the control element 103 and the electrode pad 102. With this structure, the light emitted from the first light emitting portion 101 is not blocked by the
25 control element 103, so that light is directed not only in an inclined upward direction but also in an inclined downward direction along the surface of the

substrate 100.

Figure 8 is a side view of the ink container illustrating an usage of the controller substrate of Figure 7. As will be understood from this Figure, the first light emitting portion 101 directs the light not only in the upper right direction toward the user's observation but also in the lower left direction. In this citation, the first light receiving portion 210 is disposed across the optical axis extending toward the lower left, so that recording device side can receive the predetermined information relating to the ink container 1.

Figure 9 is a side view illustrating another example of usage of the controller substrate of Figure 7. This example is suitable to the case that sensor 117, in the form of a photosensor, for detection of the ink remaining amount is provided in the apparatus so as to be opposed to the portion to be detected 17 which is in the form of a prism, when the ink container 1 is mounted on the apparatus. More particularly, the sensor 117 for detection of the ink remaining amount includes a light emitting portion 117A and a light receiving portion 117B, and when the ink remaining amount in the ink chamber 11 of the ink container 1 is small, the light from the light emitting portion 117A is reflected by the prism-like portion to be detected 17, and returns to the light

receiving portion 117B, so that apparatus can detect the ink shortage. In this embodiment, the light receiving portion 117B is utilized also as a photoreceptor for receiving the light from the first light emitting portion 101 to permit for the apparatus to detect the presence or absence and/or properness of the mounted ink container 1.

In the example shown in (a) and (b) of Figure 10, the surface of the substrate 100 facing inwardly of the ink container 1 is provided with a control element 103, and the first light emitting portion 101 and the electrode pad 102 are disposed on the surface of the substrate 100 facing outwardly. With this structure, the light emitted from the first light emitting portion 101 travels also in the outward direction from the surface of the substrate 100.

Figure 11 is a side view illustrating an usage of the ink container having such a controller substrate. As will be understood from the Figure, the first light emitting portion 101 emits the light not only in the upper right direction by which the user can visually receive the light, but also in the lower right direction. The first light receiving portion 210 is disposed across the optical axis extending in the lower right direction, so that predetermined information relating to the ink container 1 can be transmitted to the recording device side.

With the above-described structures, the position and/or the configuration of a member or members which may block the light travelling along the optical axes, are appropriately selected, and an opening and/or light-transmissive are provided, so that optical axes directing toward the eyes of the user and toward the light receiving portion are positively assured. However, other arrangements are usable by which the light is directed to the eyes of the user and/or to the light receiving portion.

In Figure 12, (a) and (b) shows an example of such a structure, wherein the light emitted from the first light emitting portion 101 is directed to a desired position by using a light guiding member 154 such as optical fibers. By means of the light guiding member 154, the predetermined information relating to the ink container 1 can be transmitted to the first light receiving portion 210 (Figure 12, (a)), to the eyes of the user (Figure 12, (b)).

In the foregoing, the description has been made with various arrangements relating to the first light emitting portion 101 of the controller substrate, but the pad 102 can be appropriately arranged.

Figure 13 is a side view (a), a front view (b) of a further example of the controller substrate mounted on the ink container. In the foregoing example, a plurality of electrode pads 102 are provided aligned

on a surface of the substrate 100 (Figure 5, (b), for example), but the plurality of electrode pads 102 are provided distributed on the surface of the substrate 100 (staggered arrangement in the Figure). Such an arrangement is advantages in that distortion of the substrate 100 which may be caused by the load applied to the substrate when it is contacted to the connector 152, can be suppressed even in the case that contact pressure is relatively high.

10

1.3 Mounting Portion of Ink Container:

Figure 14 is a perspective view illustrating an example of a recording head unit having a holder to which the ink container according to the first embodiment is mountable. Figure 15 is a schematic side view illustrating an operation of mounting and demounting (a) - (c) of the ink container according to the first embodiment to the holder shown in Figure 14.

The recording head unit 105 is generally constituted by a holder 150 for detachably holding a plurality (four, in the example shown in the Figure) of ink containers, and a recording head 105 disposed adjacent the bottom side (unshown in Figure 14). By mounting the ink container to the holder 150, an ink introduction opening 107 of the recording head disposed adjacent the bottom portion of the holder is

25

connected with the ink supply port 7 of the ink container to establish an ink fluid communication path therebetween.

An example of usable recording head 105
5 comprises a liquid passage constituting a nozzle, an electrothermal transducer element provided in the liquid passage. The electrothermal transducer element is supplied with electrical pulses in accordance with recording signals, by which thermal energy is applied
10 to the ink in the liquid passage. This causes a phase change of the ink resulting in bubble generation (boiling), and therefore, abrupt pressure rise, by which the ink is ejected from the nozzle. An electrical contact portion (unshown) for signal
15 transmission provided on the carriage 203 which will be described hereinafter, and an electrical contact portion 157 of the recording head unit 105, are electrically contacted to each other, so that transmission of the recording signal is enabled to the
20 electrothermal transducer element driving circuit of the recording head 105 through the wiring portion 158. From the electrical contact portion 157, a wiring portion 159 is extended to the connector 152.

When the ink container 1 is mounted to the
25 recording head unit 105, the holder 150 is brought to above the holder 150 ((a) in Figure 15), and a first engaging portion 5 in the form of a projection

provided on an ink container rear side is inserted into a first locking portion 155 in the form of a through hole provided in a holder rear side, so that the ink container 1 is placed on the inner bottom surface of the holder ((b) of Figure 15). With this state kept, the front side upper end of the ink container 1 is pressed down as indicated by arrow P, by which the ink container 1 rotates in the direction indicated by the arrow R about the engaging portion between the first engaging portion 5 and the first locking portion 155, so that front side of the ink container displaces downwardly. In the process of this action, the supporting member 3 is displaced in the direction of an arrow Q, while a side surface of a second engaging portion 6 provided in the supporting member 3 on the ink container front side is being pressed to the second locking portion 156 provided on the holder front side.

When the upper surface of the second engaging portion 6 reaches a lower portion of the second locking portion 156, the supporting member 3 displaces in the direction Q ' by the elastic force of the supporting member 3, so that second engaging portion 6 is locked with the second locking portion 156. With this state ((c) in Figure 15), the second locking portion 156 elastically urges the ink container 1 in a horizontal direction through the supporting member 3,

so that rear side of the ink container 1 is abutted to the rear side of the holder 150. The upward displacement of the ink container 1 is suppressed by the first locking portion 155 engaged with the first engaging portion 5 and by the second locking portion 156 engaged with the second engaging portion 6. At this time, the mounting of the ink container 1 in addition completed, wherein the ink supply port 7 is connected with the ink introduction opening 107, and the pad 102 is electrically connected with the connector 152.

The above-described uses the principle of "lever" during the mounting process shown in (b) of Figure 15, wherein the engaging portion between the first engaging portion 5 and the first locking portion 155 is a fulcrum, and the front side of the ink container 1 is a power point where the force is applied. The connecting portion between the ink supply port 7 and the ink introduction opening 107 is a working point which is located between the power point and the fulcrum, preferably, closer to the fulcrum. Therefore, the ink supply port 7 is pressed against the ink introduction opening 107 with a large force by the rotation of the ink container 1. At the connecting portion, an elastic member such as a filter, an absorbing material, a packing or the like which has a relatively high flexibility is provided to assure an

ink communication property to prevent ink leakage there.

Such structure, arrangement and mounting operation are therefore preferable in that such a member is elastically deformed by the relatively large force. When the mounting operation is completed, the first locking portion 155 engaged with the first engaging portion 5 and the second locking portion 156 engaged with the second engaging portion 6 are effective to prevent the ink container 1 from rising away from the holder, and therefore, the restoration of the elastic member is suppressed, so that the member is kept in an appropriately deformed elastically.

On the other hand, the pad 102 and the connector 152 (electrical contacts) are made of a relatively rigidity electroconductive material such as metal to assuring satisfy electrical connection property therebetween. On the other hand, an excessive contact force therebetween is not preferable from the standpoint of damage prevention and sufficient durability. In this example, they are disposed at a position as remote as possible from the fulcrum, more particularly, in the neighborhood of the front side of the ink container, in this example, by which the contact force is minimized.

To accomplish this, it is considered to place

the pad of the substrate at a position very close to the front side on the bottom side of the ink container. Alternatively, it is considered to place the pad of the substrate on the front side of the ink container.

5 In any case, however, some limitation is imparted to the disposition of the first light emitting portion 101 on the substrate, which should be selected such that light should properly reach the first light receiving portion 210 and the eyes of the user. In the

10 case of placing the pad of the substrate at a position very close to the front side on the bottom side of the ink container, the pad 102 and the connector 152 approach to each other in a face-to-face fashion in the state immediately before completion of the

15 mounting of the ink container 1, and they abut each other in such a state. A large mounting force is required in order to provide a satisfactory electrical connection irrespective of the surface conditions of the pad and the connector, with a possible result of

20 excessive force applied to the pad and to the connector. In case the ink leaks out at the connecting portion between the ink supply port 7 and/or the ink introduction opening 107, the leaked ink might reach the pad and/or the connecting portion along the bottom

25 side of the ink container. When the substrate is disposed at the ink container front side, the disengagement of the ink container from the main

assembly of the apparatus may be difficult.

In this example of the embodiment, the substrate 100 is disposed on the inclined surface connecting the bottom side of the ink container 1 with the front side of the ink container 1, namely, at the corner portion therebetween. When the balance of forces only at the contact portion in the state that pad 102 is contacted to the connector 152 immediately before the completion of mounting, is considered, it is such that reaction force (a upward force in the vertical direction) applied by the connector 152 to the pad 102, balancing with the mounting force applied downwardly in the vertical direction, involves a component force of the actual contact pressure between the pad 102 and the connector 152. Therefore, when the user presses the ink container down toward the mounting completion position, an addition of ink container mounting force for electrical connection between the substrate and the connector is small, so that operativity may be quite low.

When the ink container 1 is pressed down toward the mounting completion position where the first engaging portion 5 is engaged with each other, the second engaging portion 6 and the second locking portion 156 are engaged with each other, and there arises a component force (a force sliding the pad 102 on the connector 152) parallel with a surface of the

substrate 100 by the urging force. Therefore, a good electrical connection property is provided and assured upon the completion of the mounting of the ink container. In addition, the electrical connecting
5 portion is at a position high from the bottom side of the ink container, and therefore, the liability of the leaked ink reaching there is small. Furthermore, the optical axes toward the first light receiving portion 210 and toward the eyes of the user can be assured.

10 In this manner, the structure and arrangement of the electrical connecting portion described above is advantageous from the standpoint of assuring the optical path in the case that first light emitting portion 101 is used both for the first light receiving
15 portion, for the eyes of the user, in addition, from the standpoint of the magnitude of the required ink container mounting force, assurance of the electrical contact state and the protection from contamination with the leaked ink.

20 The structure of the mounting portion for the ink container in the first embodiment or the modified example is not limited to that shown in Figure 14.

Referring to Figure 16, the description will be made as to this point. Figure 16 is a perspective view
25 (a) of another example of the recording head unit for executing the recording operation while being supplied with the ink from the ink container, and a carriage

for carrying the recording head unit; and a perspective view wherein the ink container is carried on the carriage.

As shown in Figure 16, the recording head unit 405 of this example is different from those (holder 150) described hereinbefore in that it does not have the holder portion corresponding to the ink container front side, the second locking portion or the connector. The recording head unit 405 is similar to the foregoing one in the other respects, the bottom side thereof is provided with an ink introduction opening 107 to be connected with the ink supply port 7. The rear side thereof is provided with the first locking portion 155, and the back side is provided with an electrical contact portion (unshown) for signal transmission.

On the other hand, as shown by (b) in Figure 16, the carriage 415 is movable along a shaft 417, and is provided with a lever 419 for fixing the recording head unit 405, and an electrical contact portion 418 connected with the electrical contact portion of the recording head. The carriage 415 is also provided with a holder portion corresponding to the structure of the ink container front side. The second locking portion 156, the connector 152 and the wiring portion 159 to the connector, are provided on the carriage side.

With this structure, when the recording head

unit 405 is mounted on the carriage 415, as shown by
(b) in Figure 16, the mounting portion for the ink
container is established. In this manner, through the
mounting operation which is similar to the example of
5 Figure 15, the connection between the ink supply port
7 and the ink introduction opening 107, and the
connection between the pad 102 and the connector 152,
are established, and the mounting operation is
completed.

10

1.4 Recording Apparatus (Figure 17 - Figure 18):

Figure 17 shows an outer appearance of an ink
15 jet printer 200 to which the ink container described
in the foregoing. Figure 18 is a perspective view of
the printer in which the main assembly cover 201 of
Figure 17 is open.

As shown in Figure 17, the printer 200 of this
20 embodiment comprises a main assembly, a sheet
discharge tray 203 at the front side of the main
assembly, an automatic sheet feeding device (ASF) 202
at the rear side thereof, a main assembly cover 201,
and other case portions which cover major parts
25 including a mechanism for scanningly moving the
carriage carrying the recording heads and the ink
containers and for effecting the recording during the

movement of the carriage. There is also provided an operating panel portion 213 which includes a displaying device which in turn displays states of the printer irrespective of whether the main assembly
5 cover is closed or opened, a main switch, and a reset switch.

As shown in Figure 18, when the main assembly cover 201 is open, the user can see the movable range, the neighborhood thereof which carries the recording
10 head unit 105 and the ink containers 1K, 1Y, 1M and 1C (the ink containers may be indicated by reference numeral "1" only hereinafter for simplicity). In this embodiment, when the main assembly cover 201 is opened. A sequence operation is carried out so that carriage
15 205 is automatically comes to the center position ("container exchanging position", shown in the Figure), where the user can do the ink container exchanging operation or the like.

In this embodiment, the recording head
20 (unshown) is in the form of a chip mounted to the recording head unit 105, corresponding to the respective inks. The recording heads scan the recording material by the movement of the carriage 205, during which the recording heads eject the ink to
25 effect the printing. To do this, the carriage 205 is slidably engaged with the guiding shaft 207 which extends in the moving direction thereof, is driven by

a carriage motor through a drive transmission mechanism. The recording heads corresponding to the K, Y, M and C (black, yellow, magenta and cyan) inks eject the inks on the basis of ejection data fed from a control circuit provided in the main assembly side through a flexible cable 206. There is provided a paper feeding mechanism including a paper feeding roller, a sheet discharging roller and so on to feed the recording material (unshown) fed from the automatic sheet feeding device 202 to the sheet discharge tray 203. The recording head unit 105 having an integral ink container holder is detachably mounted on the carriage 205, and the respective ink containers 1 are detachably mounted on the recording head unit 105.

During the recording or printing operation, the recording head scan the recording material by the above-described movement, during which the recording heads eject the inks onto the recording material to effect the recording on a width of the recording material corresponding to the range of the ejection outlets of the recording head. In a time period between a scanning operation and the next scanning operation, the paper feeding mechanism feeds the recording material through a predetermined distance corresponding to the width. In this manner, the recording is sequentially effected to cover the entire

area of the recording material. An end portion of the movement range of the recording head by the movement of the carriage, there is provided an ejection refreshing unit including caps for capping the sides of the recording heads having the ejection outlets. Therefore, the recording heads move to the position of the refreshing unit at predetermined time intervals, and are subjected to the refreshing process including the preliminary ejections or the like.

10 The recording head unit 105 having a holder portion for each ink container 1, is provided with a connector corresponding to each of the ink containers, and the respective connectors are contacted to the pad of the substrate provided on the ink container 1. By this, the control of turn-on and -off of each of the LEDs 101 in accordance with the sequence which will be described hereinafter in conjunction of Figure 25 - Figure 27, are enabled.

More particularly, at the container exchange position, when an ink remaining amount of an ink container 1 is short, the LED 101 of the ink container 1 is switched on or flickered. This applies to each of the ink containers 1. Adjacent to an end portion which is opposite the position where the refreshing unit is provided, a first light receiving portion 210 having a light receiving element is provided. When the LEDs 101 of the ink containers 1 pass by the light receiving

portion 210 by the movement of the carriage 205, the LEDs 101 are switched on, and the light is received by the first light receiving position 210 so that positions of the ink containers 1 on the carriage 205 can be detected on the basis of the position of the carriage 205 when the light is received. In another example of the control for the turn-on of the LED or the like, the LED 101 of the container is switched on when the ink container 1 is correctly mounted at the container exchange position. These controls are executed, similarly to the control for the ink ejection of the recording head, by supplying control data (control signal) to the respective ink containers from the main assembly side control circuit through the flexible cable 206.

2. Control system

2.1 General Arrangement (Figure 19):

Figure 19 is a block diagram showing an example of a structure of a control system of the ink jet printer. The control system mainly comprises a control circuit (PCB (printed-wiring board)) in the main assembly of the printer, and the structure for the light emission of the LED of the ink container to be controlled by the control circuit.

In Figure 19, the control circuit 300 executes

data processing relating to the printer and operation control. More particularly, a CPU 301 carried out processes which will be described hereinafter in conjunction with Figure 25 - Figure 28 in accordance
5 with a program stored in ROM 303. RAM 302 is used as a work area in the process execution of the CPU 301.

As schematically shown in Figure 19, the recording head unit 105 carried on the carriage 205 has recording heads 105K, 105Y, 105M and 105C which
10 have a plurality of ejection outlets for ejecting black (K), yellow (Y), magenta (M) and cyan (C) inks, respectively. On the holder of the recording head unit 105, ink containers 1K, 1Y, 1M and 1C are detachably mounted corresponding to the respective recording
15 heads.

Each of the ink container 1, as described hereinbefore, is provided with the substrate 100 provided with the LED 101, the display control circuit therefor and the pad (electric contact) or the like.
20 When the ink container 1 is correctly mounted on the recording head unit 105, the pad on the substrate 100 is contacted to the connector provided corresponding to each of ink containers 1 in the recording head unit 105. The connector (unshown) provided in the carriage
25 205, the control circuit 300 provided in the main assembly side, are electrically connected for transmission of signals through the flexible cable 206.

Furthermore, by the mounting of the recording head unit 105 on the carriage 205, the connector of the carriage 205 and the connector of the recording head unit 105 are electrically contacted with each other
5 for signal transmission. With such a structure, the signals can be transmitted between the control circuit 300 of the main assembly side and the respective ink containers 1. Thus, the control circuit 300 can perform the control for turn-on and -off of LED in
10 accordance with the sequence which will be described hereinafter in conjunction with Figure 25 - Figure 27.

The control of ink ejections of the recording heads 105K, 105Y, 105M and 105C, is carried out similarly through the flexible cable 206, the
15 connector of the carriage 205, the connector of the recording head unit with the signal connection between the driving circuit and so on provided in the recording head, and the control circuit 300 in the main assembly side. Thus, the control circuit 300
20 controls the ink ejections and so on for the respective recording heads.

The first light receiving portion 210 disposed adjacent one of the end portions of the movement range of the carriage 205 receives light from the LED 101 of
25 the ink container 1, and a signal indicative of the event is supplied to the control circuit 300. The control circuit 300, as will be described hereinafter,

responds to the signal to discriminate the position of the ink container 1 in the carriage 205. In addition, an encoder scale 209 is provided along the movement path of the carriage 205, and the carriage 205 is

5 correspondingly provided with an encoder sensor 211. The detection signal of the sensor is supplied to the control circuit 300 through the flexible cable 206, by which the movement position of the carriage 205 is obtained. The position information is used for the

10 respective recording head ejection controls, and is used also for light validation process in which the positions of the ink containers are detected, which will be described hereinafter in conjunction with Figure 25. A second light emission / receiving portion

15 214 is provided in the neighborhood of the predetermined position in the movement range of the carriage 205, includes a light emitting element and a light receiving element, and it functions to output to the control circuit 300 a signal relating to an ink

20 remaining amount of each of the ink container 1 carried on the carriage 205. The control circuit 300 can detect the ink remaining amount on the basis of the signal.

25

2.2 Connecting Portion (Figure 20 - Figure 24):

Figure 20 figure 20 shows a structure of signal

line wiring for signal transmission between the ink container 1 and the flexible cable 206 of the ink jet printer in terms of the substrate 100 of the ink container 1.

5 As shown in Figure 20, the signal line wiring for the ink container 1 comprises four signal lines in this embodiment, each of them is common for all of four ink containers 1 (bus connection). The signal line wiring for the ink containers 1 include four
10 signal lines, namely, a voltage source signal line VDD relating to electric power supply such as for an operation of a group of function elements for effecting light emission, actuation of the LED 101 in the ink container; a ground signal line GND; a signal
15 line DATA for supplying control signal (control data), the like relating to the process such as turning-on and -off of the LED 101 from the control circuit 300; and a clock signal line CLK therefor. In this embodiment, four signal lines are employed, but the
20 present invention is not limited to this case. For example, the ground signal may be supplied through another structure, and in such a case, the line GND can be omitted in the above-described structure. On the other hand, the line CLK and the line DATA may be
25 made one common line.

Each of the substrates 100 of the ink containers 1 has a controller 103 which is responsive

to the signal supplied through the four signal lines, and a LED 101 actuatable in response to the output of the controller 103.

Figure 21 is a detailed circuit diagram of the substrate having such a controller or the like. As shown in the Figure, the controller 103 comprises an I/O control circuit (I/O- CTRL) 103A, a memory array 103B and a LED driver 103C. The I/O control circuit 103A is responsive to control data fed through the flexible cable 206 from the control circuit 300 of the main assembly side to control the display driving of the LED 101, the writing of the data in the memory array 103B and the reading of the data. The memory array 103B is in the form of an EEPROM in this embodiment, and is able to store individual information of the ink container, such as information relating to the ink remaining amount in the ink container, the color information of the ink therein, and in addition, manufacturing information such as an individual number of the ink container, production lot number or the like. The color information is written in a predetermined address of the memory array 103B corresponding to the color of the ink stored in the ink container. For example, the color information is used as ink container discrimination information (individual information) which will be described hereinafter in conjunction with Figures 23 and 24 to

identify the ink container when the data is written in the memory array 103B and is read out therefrom, or when the actuation and deactuation of the LED 101 is controlled for the particular ink container. The data
5 written in the memory array 103B or read out of it include, for example, the data indicative of the ink remaining amount. The ink container of this embodiment, as described hereinbefore, is provided in the bottom portion with a prism, and when the remaining amount of
10 the ink becomes small, the event can be optically detected by means of the prism. In addition to that, the control circuit 300 of this embodiment counts the number of ejections for each of the recording heads on the basis of the ejection data. The remaining amount
15 information is written in the memory array 103B of the corresponding ink container, and the information is read out. By doing so, the memory array 103B stores the information of the ink remaining amount in real time. The information represents the ink remaining
20 amount with high accuracy since the information is provided with the aid of the prism, too. Also, it is possible to use it to discriminate whether the mounted ink container is a fresh one, or used and then remounted one.

25 A LED driver 103C functions to apply a power source voltage to the LED 101 to cause it to emit light when the signal supplied from the I/O control

circuit 103A is at a high level. Therefore, when the signal supplied from the I/O control circuit 103A is at a high level, the LED 101 is in the on-state, and when the signal is at a low level, the LED 101 is in the off-state.

Figure 22 is a circuit diagram of a modified example of the substrate of Figure 21. This modified example is different from the example of Figure 21 in the structure for applying the power source voltage to the LED 101, more particularly, the voltage source voltage is supplied from the VDD voltage source pattern provided inside the substrate 100 of the ink container. Ordinarily, the controller 103 is built in a semiconductor substrate, and in this example, the connecting contact on the semiconductor substrate is only for the LED connecting contact. Reduction of the number of the connecting contacts is significantly influential to the area occupied by the semiconductor substrate, and in this sense, the modified example in addition advantageous in terms of cost reduction of the semiconductor substrate.

Figure 23 is a timing chart illustrating the data writing and reading operations to and from the memory array 103B of the substrate. newpa Figure 24 is a timing chart illustrating actuation, deactuation of LED 101.

As shown in Figure 23, in the writing in the

memory array 103B, start code plus color information, control code, address code, data code, are supplied in the order named from the control circuit 300 in the main assembly side through the signal line DATA
5 (Figure 20) to the I/O control circuit 103A in the controller 103 of the ink container 1 in synchronism with the clock signal CLK. The start code signal in the start code plus color information indicates the beginning of the series of the data signals, and the
10 color information signal is effective to identify the particular ink container which the series of data signal are related to. Here, the color of the ink includes not only the Y, M, C or the like color but also such ink having different densities.

15 As shown in the Figure, the color information has a code corresponding to each colors of the ink, K, C, M and Y. The I/O control circuit 103A compares the color information indicated by the code with the color information stored in the memory array 103B of the ink
20 container per se. Only if they are the same, the subsequent data are taken in, and if not, the subsequent data are ignored. By doing so, even when the data signal is supplied commonly to all of the ink containers from the main assembly side through the
25 common signal line DATA held in Figure 20, the ink container to which the data are concerned can be correctly identified since the data include the color

information, and therefore, the processing on the basis of the subsequent data, such as the writing, reading of the subsequent data, actuation, deactuation of the LED, can be effected only to the identified ink container (that is, only to the right ink container). As a result, (one) common data signal line is enough for all of the four ink containers to write the data in, to actuate the LED and to deactuate the LED, thus reducing the required number of the signal lines. As will be readily understood, (one) common data signal line is enough irrespective of the number of the ink containers.

As shown in Figure 23, the control modes of this embodiment include OFF and ON codes for actuation and deactuation of the LED which will be described hereinafter, and READ and WRITE codes for reading out of the memory array and writing therein. In the writing operation, the WRITE code follows the color information code for identifying the ink container. The next code, i.e., the address code indicates an address in the memory array in which the data are to be written in, and the last code, i.e., the data code indicates the content of information to be written in.

The content indicated by the control code is not limited to the example described above, and, for example, control codes for verification command and/or continuous reading command may be added.

For the reading operation, the structure of the data signal is the same as in the case of the writing operation. The code of the start code plus color information is taken by the I/O control circuit 103A of all of the ink containers, similarly to the case of the writing operation, and the subsequent data signal are taken in only by the I/O control circuit 103A of the ink container having the same color information. What is different is that. the read data are outputted in synchronism with rising of the first clock (13th clock in Figure 23) after the address is designated by the address code. Thus, the I/O control circuit 103A effects control to prevent interference of the read data with another input signal even though the data signal contacts of the ink containers are connected to the common (one) data signal line.

As shown in Figure 24, with respect to the actuation (turning-on) and the deactuation (turning-off) of the LED 101, the data signal of the start code plus color information is first sent to the I/O control circuit 103A through the signal line DATA from the main assembly side, similarly to the foregoing. As described hereinbefore, the right ink container is identified on the basis of the color information, and the actuation and deactuation of the LED 101 by the control code fed subsequently, are effected only for the identified ink container. The

control codes for the actuation and the deactuation, as described hereinbefore in conjunction with Figure 23, include one of ON code and OFF code which are effective to actuate and deactuate the LED 101, respectively. Namely, when the control code indicates ON, the I/O control circuit 103A outputs an ON signal to the LED driver 103C, as described hereinbefore in conjunction with Figure 22, the output state is continuously maintained thereafter. On the contrary, when the control code indicates OFF, the I/O control circuit 103A outputs an OFF signal to the LED driver 103C, and the output state is continuously maintained thereafter. The actual timing for the actuation or deactuation of the LED 101 is after 7th clock of the clock CLK for each of the data signals.

In the example of this Figure, the black (K) ink container which the leftmost data signal designates is first identified, and then, the LED 101 of the black ink K container is switched on. Then, the color information of the second data signal indicates magenta ink M, and the control code indicates actuation, and therefore, the LED 101 of the ink M container is switched on while the LED 101 of the ink K container is kept in ON state. The control code of the third data signal means instruction of deactuation, and only the LED 101 of the ink K container is deactuated.

As will be understood from the foregoing description, the flickering control of the LED is accomplished by the control circuit 300 of the main assembly side sending repeated actuation and
5 deactuation control codes alternately for the identified ink container. The cyclic period of the flickering can be determined by selecting the cyclic period of the alternating control codes.

10

2.3 Control Process (Figure 25 - Figure 31):

Figure 25 is a flow chart illustrating control processes relating the mounting and demounting of the ink container according to the embodiment of the
15 present invention, and particularly shows the actuation and deactuation control for the LED 101 of each of the ink container 1 by the control circuit 300 provided in the main assembly side.

The process shown in Figure 25 starts in
20 response to the user opening the main assembly cover of the printer 201 which is detected by a predetermined sensor. When the process is started, the ink container is mounted or demounted by step S101.

Figure 26 is a flow chart of a mounting and
25 demounting process of the ink container in Figure 25. As shown in the Figure, in the mounting or demounting process, the carriage 205 moves at step S201, and the

information of the state of ink container (individual information thereof) carried on the carriage 205 is obtained. The information of the state to be obtained here is an ink remaining amount or the like which is
5 read out of the memory array 103B together with the number of the ink container. In step S202, the discrimination is made as to whether the carriage 205 reaches the ink container exchange position having been described in conjunction with Figure 18 or not.

10 If the result of the discrimination is affirmative, step S203 is executed for ink container mounting confirmation control.

Figure 27 is a flow chart showing in detail the mounting confirmation control in Figure 26. First, in
15 step S301, a parameter N indicative of the number of the ink container carried on the carriage 205 is set, and a flag F (k) for confirmation of light emission of the LED correspondingly to the number of the ink container, is initialized. In this embodiment, N is
20 set to 4 since the number of the ink containers is 4 (K, C, M, Y). Then, four flags F (k), k=1- 4 are prepared, and they are all initialized to zero.

In step S302, a variable An of the flag relating to the order of mounting discrimination for
25 the ink container is set to "1", and in step S303, the mounting confirmation control is effected for the Ath ink container. In this control, the contact 152 of the

holder 150 and the contact 102 of the ink container are contacted with each other by the user mounting the ink container to the right position in the holder 150 of the recording head unit 105, by which the control circuit 300 of the main assembly side, as described hereinbefore, identifies the ink container by the color information (individual information for the ink container), and the color information stored in the memory array 103B of the identified container is sequentially read out. The color information for the identification is not used for the already read out one or ones. In this control process, the discrimination is also made as to whether or not the read color information is different from the color information already read out after the start of this process.

In step S304, if the color information have been able to read out, the color information has been different from the already read out piece or pieces of information, it is then discriminated that ink container of the color information is mounted as the A-th ink container. Otherwise, it is discriminated that A-th ink container is not mounted. Here, the "A-th" represents only the order of discrimination of the ink container, does not represent the order indicative of the mounted position of the ink container. When the A-th ink container is

discriminated as being correctly mounted, the flag F (A) (the flag satisfying $k = A_n$ among the prepared flags flag F (k), $k=1-4$) is set to "1" in step S305, as described hereinbefore in conjunction with Figure 24, and the LED 101 of the ink container 1 having the corresponding color information is switched on. When it is discriminated that the ink container is not mounted, the flag F (A) is set to "0" in step S311.

Then, in step S306, the variable A_n is incremented by 1, and in step S307, the discrimination is made as to whether or not the variable A_n is larger than N set in the step S301 (in this embodiment, $N=4$). If the variable A_n is not more than N, the process subsequent to step S303 is repeated. If it is discriminated as being larger than N, the mounting confirmation control has been completed for all of four ink containers. Then, in step S308, the discrimination is made as to whether or not the main assembly cover 201 is in an open position on the basis of an output of the sensor. When the main assembly cover is in a closed state, an abnormality state is returned to the processing routine of Figure 26 in step S312 since there is a possibility that user has closed the cover although one of some of the ink containers are not mounted or are not properly mounted. Then, this process operation is completed.

When, on the contrary, the main assembly cover

201 is discriminated as being open in the step S308, the discrimination is made as to whether or not all of the four flags $F(k)$, $k=1-4$ are "1", that is, whether the LEDs 101 are all switched on or not. If it is
5 discriminated that at least one of the LEDs 101 is not switched on, the process subsequent to the step S302 is repeated. Until the user mount or correctly remount the ink container or ink containers of which the LEDs 101 are not switched on, the LED of the ink container
10 or containers is switched on, and the process operation is repeated.

When all of the LEDs are discriminated as being switched on, a normal ending operation is carried out in step S310, and this process operation
15 is completed. Then, the process returns to the processing routine shown in Figure 26. Figure 28 shows a state (a) in which all of the ink containers are correctly mounted at correct positions, and therefore, the LEDs are all switched on, respectively.

20 Referring back to Figure 26, after the ink container mounting confirmation control (step S203) is executed in the above-described manner, the discrimination is made as to whether or not the control is normally completed, namely, whether or not
25 the ink containers are properly mounted, in step S204. If the mountings are discriminated as being normal, the displaying device (Figure 17 and Figure 18) in the

operating portion 213 is lighted green, for example, and in step S205, a normal ending is executed at step S206, and the operation returns to the example shown in Figure 25. When the abnormality mounting is

5 discriminated, the displaying device in the operating portion 213 is flickered orange, for example, in step S207, and the abnormality ending is carried out, and then, the operation returns the processing routine shown in Figure 25. When the printer is connected with

10 a host PC which controls the printer, the mounting abnormality display is also effected on the display of the PC simultaneously.

In Figure 25, when the ink container seating process of step S101 is completed, the discrimination

15 is made as to whether or not the mounting or demounting process is properly completed in step S102. If the abnormality is discriminated, the process operation waits for the user to open the main assembly cover 201, and in response to the opening of the cover

20 201, the process of the step S101 is started, so that process described in conjunction with Figure 26 is repeated.

When the proper mounting or demounting process is discriminated in step S102, the process waits for

25 the user to close the main assembly cover 201 in step S103, and the discrimination is made as to whether or not the cover 201 is closed or not in step S104. If

the result of the discrimination is affirmative, the operation proceeds to light validation process of step S105. In this case, if the closing of the main assembly cover 201 is detected as shown by (b) in Figure 28, the carriage 205 moves to the position for light validation, and the LEDs 101 of the ink containers are deactuated.

The light validation process is intended to discriminate whether or not the properly mounted ink containers are mounted at the correct positions, respectively. In this embodiment, the structures of the ink containers are not such that configurations thereof are made peculiar depending on the colors of the ink contained therein for the purpose of preventing the ink containers from being mounted at wrong positions. this is for the simplicity of manufacturing of the ink container bodies. Therefore, there is a possibility that ink containers are mounted at wrong positions. The light validation process is effective to detect such wrong mounting and to notify the user of the event. By this, the efficiency and low cost of the ink container manufacturing are accomplished since it is not required to make the configurations of the ink containers different from each other depending on the colors of the ink.

Figure 29 illustrates the light validation process (a) - (d). newpaFigure 30 also illustrates the

light validation process (a) - (d).

As shown by (a) in Figure 29, the movable carriage 205 first starts moving from the lefthand side to the righthand side in the Figure toward the first light receiving portion 210. When the ink container placed at the position for a yellow ink container comes opposed to the first light receiving portion 210, a signal for actuating the LED 101 of the yellow ink container is outputted in order to switch it on for a predetermined time duration, by the control having been described in conjunction with Figure 24. When the ink container is placed at the correct position, the first light receiving portion 210 receives the light from the LED 101, so that the control circuit 300 discriminates that ink container 1Y is mounted at the correct position.

While moving the carriage 205, as shown by (b) in Figure 29, when the ink container placed at the position for a magenta ink container comes opposed to the first light receiving portion 210, a signal for actuating the LED 101 of the magenta ink container is outputted to switch it on for a predetermined time duration, similarly. In the example shown in the Figure, the ink container 1M is mounted at the correct position, so that first light receiving portion 210 receives the light from the LED. As shown by (b) - (d) in Figure 29, the light is emitted sequentially, while

changing the position of discrimination. In this Figure, all of the ink containers are mounted at correct positions.

On the contrary, if a cyan ink container 1C is
5 erroneously mounted at a position for a magenta ink container 1M, as shown by (b) in Figure 30, the LED 101 of the ink container 1C which is opposed to the first light receiving portion 210 is not actuated, but the ink container 1M mounted at another position is
10 switched on. As a result, the first light receiving portion 210 does not receive the light at the predetermined timing, so that control circuit 300 discriminates that mounting position has an ink container other than the ink container 1M (right
15 container). If a magenta ink container 1M is erroneously mounted at a position for a cyan ink container 1C, as shown by (c) in Figure 30, the LED 101 of the ink container 1M which is opposed to the first light receiving portion 210 is not actuated, but
20 the ink container 1C mounted at another position is switched on.

In this manner, the light validation process with the control circuit 300 described above is effective to identify the ink container or ink
25 containers not mounted at the correct position. If the mounting position does not have the correct ink container mounted thereto, the color of the ink

container erroneously mounted there can be identified by sequentially actuating the LEDs of the other three color ink containers.

In Figure 25, after the light validation process in the step S105, the discrimination is made as to whether or not the light validation process is properly completed or not in step S106. When the proper completion of the light validation is discriminated, the displaying device in the operating portion 213 is lighted up green, for example, in step S107, and the process ends. On the other hand, if the ending is discriminated as being abnormal, the displaying device in the operating portion 213 is flickered orange at step S109, and the LED 101 of the ink container which is not mounted at the correct position and which has been identified in the step S105 is flickered or switched on in step S105. In this manner, when the user opens the main assembly cover 201, the user is notified of the ink container which is not mounted at the correct position, so that user is prompted to remount it to the correct position.

Figure 31 is a flow chart illustrating a recording process according to the embodiment of the present invention. In this process, the ink remaining amount is first checked in step S401. In this process, an amount of printing is determined from the printing data of the job for which the

printing is going to be effected, and the comparison is made between the determined amount and the remaining amount of the ink container to check whether the remaining amount is sufficient or not (confirmation process). In this process, the ink remaining amount is the amount detected by the control circuit 300 on the basis of the counting.

In step S402, the discrimination is made as to whether the remaining ink amount is sufficient to the printing or not, on the basis of the confirmation process. If the ink amount is sufficient, the operation goes to the printing in step S403, and the displaying device of the operating portion 213 is lighted green at step S404 (normal ending). On the other hand, if the result of the discrimination at the step S402 indicates a shortage of the ink, the displaying device of the operating portion 213 is flickered orange in the step S405, and in step S406, the LED 101 of the ink container 1 containing the insufficient amount of the ink is flickered or switched on (abnormal ending). When the recording device is connected with a host PC which controls the recording device, the ink remaining amount may be displayed on the display of the PC, simultaneously.

25

3.Other Embodiments (Figure 32 - Figure 40):

In the first embodiment described in the foregoing, the first engaging portion 5 provided on the ink container rear side is inserted into the first locking portion 155 provided at the rear side of the holder, and the ink container 1 is rotated about the rotational pivot which is the inserted portion, while pushing the ink container front side down. When such a structure is employed, the position of the substrate 100 is, as described hereinbefore, the front side which is away from the rotational pivot, and the first light receiving portion 210, and the first light emitting portion 101 for directing the light toward the first light receiving portion 210, toward the user's eyes are integral with the substrate 100, accordingly.

However, in some cases, the preferable position of the substrate and the position required by the light emitting portion are different from each other, depending on the structures of the ink container and/or the mounting portion thereof. In such a case, the substrate and the light emitting portion may be disposed at proper positions. In other words, they are not necessarily integral with each other.

Figure 32 illustrates structures of an ink container and a mounting portion thereof according to another embodiment of the present invention((a) - (c)).

As shown by (a) in Figure 32, the ink container

501 of this embodiment of the present invention, is provided on the top side adjacent the front side with a substrate 600 which has a light emitting portion 601 such as LED, which has a pad 602 at the top rear
5 portion. When the light emitting portion 601 is actuated, the light is emitted toward the front side. A light receiving portion 620 is disposed at a position for receiving the light directed leftward in the Figure adjacent an end of a scanning range of the
10 carriage. When the carriage comes to such a position, the light emitting portion 601 is controlled, so that recording device side can obtain predetermined information relating to the ink container 501 from the content of the light received by the light receiving
15 portion. When the carriage is at the center portion of the scanning range, for example, the light emitting portion 601 is controlled, by which the user is able to see the state of lightening so that predetermined information relating to the ink container 501 can be
20 recognized by the user.

As shown by (c) in Figure 32, the recording head unit 605 comprises a holder 650 for detachably holding a plurality of ink containers (two, in the example of the Figure), a recording head 605
25 provided at the bottom side thereof. By mounting the ink container 501 in the holder 650, an ink introduction opening 607 of the recording head side

located in the inner bottom portion of the holder is connected with an ink supply port 507 located in the bottom portion of the ink container, so that ink fluid communication path is established therebetween. The
5 holder 650 is provided on a rear side thereof with a locking portion 656 for locking the ink container 501 at the complete mounting position with the engaging portion 655 (rotational center) at the front side. Adjacent the locking portion 656, there is provided a
10 connector 652 connected with a pad 502 of the substrate 500.

When the ink container 501 is mounted to the recording head unit 605, the user brings the ink container 501 to the front side of the holder 650, as
15 shown by (b) in Figure 32, presses the lower edge portion of the ink container rear side to the rear side of the holder 650 to bring the ink container front side into engagement with the engaging portion 655 of the holder 650. With this state, the upper
20 portion of the front side of the ink container 501 is pressed toward the rear side, by which the ink container 501 is mounted in the holder while rotating in the direction indicated by an arrow about the engaging portion 655. Indicated by (a) and (c) in
25 Figure 32 is the ink container 501 which has been completely mounted, wherein the ink supply port 507 and the ink introduction opening 607 are connected to

each other, and the pad 602 and the connector 652 are connected with each other. In addition, the pad 602 and the connector 652 are located at a position as far as possible from the rotational center upon the mounting operation, and immediately before completion of the mounting of the ink container 501, they are contacted to each other so that satisfactory electrical connection property is established therebetween upon the completion of mounting.

The structures of the engaging portion 655 of the holder 650 and the locking portion 656 and the corresponding structure of the ink container 501 side, may be properly determined by one skilled in the art. In the example shown in the Figure, the substrate 600 is provided on the top surface of the ink container 501, and extends in parallel with the top surface, but this is not limiting, and it may be inclined as in the first embodiment. Furthermore, the holder 650 and the structural members relating to it is not necessarily provided in the head unit.

Figure 33 shows a modified example of Figure 32 structure, and shows two recording head units (liquid containing cartridge s) each of which comprises an ink container 501 and a recording head 605 ' which are integral with each other. In this embodiment, one of the units is a cartridge for black ink, and the other is a cartridge for yellow, magenta and cyan inks.

The holder 650 may be provided with similar structures corresponding to such a structure. In this embodiment, the control circuit for the light emitting portion 601 disposed on the front side may be provided at a proper position on the head unit. For example, a control circuit is provided on the driving circuit substrate having an integral recording head 605 ', and the wiring is extended to the light emitting portion 601. In such a case, a driving circuit for the recording head 605 ' and the control circuit for the light emitting portion 601 are connected with an electrical contact portion on the carriage through an unshown electrical contact portion.

Figure 34 is a perspective view of a printer to which the ink container according to said another embodiment of the present invention. The same reference numerals as in Embodiment shown in Figure 17 and Figure 18 are assigned to the elements having the corresponding functions in this embodiment, and the detailed description thereof is omitted for simplicity.

As shown in Figure 34, an ink container 501K containing black ink, and an ink containers 501CMY having integral accommodating chambers containing cyan, magenta and yellow inks separately, are mounted in the holder of the recording head unit 605 on the carriage 205. In each of the ink container, as described hereinbefore, the LED 601 is provided as a separate

member from the substrate, and the user can see the LEDs 601 at the front side when the ink container is mounted at the exchange position. Corresponding to the position of the LEDs, a light receiving portion 210 is
5 provided in the neighborhood of one of the end portions of the movement range of the carriage 205.

Figure 35 is a schematic side view (a) and a schematic front view (b) of an ink container according to a further embodiment of the present invention,
10 wherein the first embodiment is modified by placing the substrate and the light emitting portion at different positions.

In this embodiment, substrates 100 - 2 each having a light emitting portion 101 such as a LED is
15 provided on the top portion of ink container front side. Similarly to the foregoing embodiment, the substrate 100 is provided on an inclined surface portion since doing so is preferable from the standpoint of satisfactory connection with the
20 carriage side connector 152, the protection from the ink, and the substrate 100 is connected with the substrate 100-2 or the light emitting portion 101 by wiring portion 159- 2 so that electric signal can be transmitted therebetween. Designated by 3H is a hole
25 formed in a base portion of a supporting member 3 to extend the wiring portion 159- 2 along the ink container casing.

In this embodiment, when the light emitting portion 101 is actuated, the light is directed toward the front side. A light receiving portion 210 is disposed at a position for receiving the light which is directed to the right in the Figure adjacent an end of the scanning range of the carriage, and when the carriage faces such a position, the light emission of the light emitting portion 101 is controlled, so that recording device side can obtain the predetermined information relating to the ink container 1 from the content of the received light by the light receiving portion. When the carriage is at the center portion of the scanning range, for example, the light emitting portion 101 is controlled, by which the user is more easily able to see the state of lightening so that predetermined information relating to the ink container 1 can be recognized by the user.

Figure 36 is a schematic side view (a) and a schematic front view (b) of an ink container according to a modified embodiment of Figure 35. In this embodiment, the light emitting portion 101 and the substrate 100-2 supporting it, are provided on a back side of the operating portion 3M at the ink container front side, the operating portion 3M being the portion manipulated by the user. The functions and advantageous effects of this embodiment are the same as the foregoing embodiments. When the carriage is

placed at the center portion of the scanning range,
for example, the light emitting portion 101 is
actuated, and therefore, the operating portion 3M of
the supporting member 3 is also illuminated, so that
5 user can intuitively understand the required
manipulation, for example, exchange of the ink
container. The operating portion 3M may be provided
with a portion for transmitting or scattering a proper
amount of the light to facilitate recognition of the
10 illuminated state of the operating portion 3M.

Figure 37 is a schematic side view of a
modified example of the structure of Figure 35. In
this embodiment, the substrate 100- 2 having the light
emitting portion 101 is disposed on a front side of
15 the operating portion 3M of the supporting member 3.
The substrate 100, the substrate 100- 2 and the light
emitting portion 101 are connected with each other
through a hole 3H formed in the base portion of the
supporting member 3 by a wiring portion 159- 2
20 extending along the supporting member 3. According to
this example, the same advantageous effects as with
Figure 36 can be provided.

In the structure shown in Figure 35 - Figure 37,
flexible print cable (FPC) may be used, by which the
25 substrate 100, the wiring portion 159- 2 and the
substrate 100- 2 may be one integral member.

In the foregoing embodiment, the liquid supply

system is so-called continuous supply type wherein an amount of the ink ejected out is substantially continuously supplied to the printing head with the use of an ink container separably mounted to the recording head which reciprocates in a main-scanning direction. However, the present invention is applicable to another liquid supply system, wherein the ink container is integrally fixed to the recording head. Even with such a system, if the mounting position is not correct, the recording head receives data for another color, or the order of different color ink ejections is different from the predetermined order with the result of deteriorated recording quality.

The present invention is applicable to another continuous supply type, wherein the ink containers are separate from the recording heads, are provided at fixed positions in the recording device, and the fixed ink containers and the associated recording heads are connected by tubes to supply the inks to the recording heads. Intermediary containers which is fluidically between the ink container and the recording head may be carried on the recording head or carriage.

Figure 38 is a perspective view of a printer having such a structure according to a further embodiment of the present invention.

In this Figure, designated by 702 is a sheet

feeding tray in the form of a cassette, and the recording materials are stacked thereon and is singled out during operation. It is fed along a folded-back feeding path to a recording region (unshown) where the recording head is carried on a carriage 803, then to a sheet discharge tray 703. The carriage 803 is supported, guided by a guiding shaft 807, reciprocates along the guiding shaft 807, during which the recording head effects scanning and recording operations.

The carriage 803 carries a recording heads of respective colors. The recording heads have intermediary containers 811K, 811C, 811M and 811Y containing black ink, cyan ink, magenta ink and yellow ink, respectively. The intermediary containers are supplied with the ink from relatively large capacity fixed containers 701K - 701Y, respectively, which are detachably mounted at a fixed portion of the apparatus. Designated by 850 is a flexible follower which moves following the movement of the carriage 803. The follower includes electric wiring portion for transmitting electric signals to the respective recording heads carried on the carriage, and a group of ink supply tubes extending from the fixed containers to the intermediary containers. The group of the supply tubes is in fluid communication with the group of the fixed containers through unshown

communicating tubes.

The recording operation in this embodiment is similar to that of the foregoing embodiment. In this embodiment, however, the light emitting portions 801
5 having the function similar to the above-described light emitting portions 101 are provided on the respective fixed containers 701K - 701Y. Correspondingly, a light receiving portion 810 for detecting a state of light emission during the
10 main-scanning operation, is provided on the carriage 803. With such a mechanism, the presence or absence of the ink, the presence or absence of the mounted ink container and/or the properness of the mounting of each of the fixed containers 701K - 701Y is detected
15 in the manner similar to those described in the foregoing, and the predetermined control operations are carried out. The user can observe the state of light emission of the light emitting portion 801, and therefore the information relating to each of the
20 fixed container. The fixed container may be of a semi-permanent type which is not ordinarily detachable, and in such a case, the ink is replenished into the ink containers when the ink is short in the containers.

Such structures are applicable to an
25 intermittent supply type or so-called pit-stop-supply type as well as to the continuous supply type using the tube. In the pit-stop-supply type, the recording

head is provided with an accumulator for retain a relatively small amount of the ink, there is provided a supply system for intermittently supplying the ink at appropriate timing to the accumulator portion from
5 an associated supply source which is fixed in the apparatus and which contain a relatively large amount of the ink.

The ink supply system may be connected only when the ink supply is necessary to the intermediary
10 container from the fixed container. Alternatively, the intermediary container and the supply source container may be connected with each other through a solenoid valve or the like, which is controlled to be open and close to connect and disconnect them at proper timing.
15 Another pit-stop type is usable wherein the intermediary container portion is provided with a gas-liquid separator film which passes gas but not liquid, the air in the container is suctioned through the film to supply the ink into the intermediary
20 container.

Figure 39 is a circuit diagram of a substrate having a controller and the like, according to a further embodiment of the present invention. As shown in this Figure, the controller 103 comprises an I/O
25 control circuit (I/O- CTRL) 103A and a LED driver 103C.

The I/O control circuit 103A actuates the LED 101 in response to the control data supplied from the

control circuit 300 provided in the main assembly side through the flexible cable 206.

A LED driver 103C functions to apply a power source voltage to the LED 101 to cause it to emit
5 light when the signal supplied from the I/O control circuit 103A is at a high level. Therefore, when the signal supplied from the I/O control circuit 103A is at a high level, the LED 101 is in the on-state, and when the signal is at a low level, the LED 101 is in
10 the off-state.

This embodiment is different from the first embodiment in that there is not provided a memory array 103B. Even if the information (color information, for example) is not stored in the memory array, the
15 ink container can be identified, the LED 101 of the identified ink container can be actuated or deactuated. newpa Referring to Figure 40, this will be described.

An I/O control circuit 103A of the controller 103 of the ink container 1 receives start code plus
20 color information, control code is supplied with clock signal CLK, from the main assembly side control circuit 300 through a signal line DATA (Figure 20). The I/O control circuit 103A includes a command discrimination portion 103D for recognizing a
25 combination of the color information plus the control code as a command, for determining actuation or deactuation of the LED driver 103C. The ink containers

1K, 1C, 1M and 1Y are provided with respective
controllers 103 which have different command
discrimination portions 103D, and the commands for
controlling the ON and OFF of the LED, for the
5 respective colors have the arrangements shown in
Figure 40. Thus, the respective command discrimination
portions 103D have the respective individual
information (color information) in this sense, and the
information is compared with the color information of
10 the inputted command, various operations are
controlled. When, for example, the main assembly
transmits together with the start code the color
information plus control code 000100 indicative of
K- ON for turning on the LED of the ink container 1K,
15 only the command discrimination portion 103D of the
ink container 1K accept it, so that only the LED of
ink container 1K is switched on. In this embodiment,
the controllers 103 have to have structures which are
different depending on the colors, but are
20 advantageous in that provision of the memory array
103B is not necessitated.

The command discrimination portion 103D, as
shown in Figure 40, may have a function of
discriminating not only the commands indicative of
25 turning-on and -off of a particular LED 101 but also a
command ALL- ON or ALL- OFF indicative of turning-on
and -off of the LEDs 101 of all of the ink containers,

and/or a CALL command causing a particular color controller 103 to output a reply signal.

As a further alternative, the command including the color information and the control code sent from the main assembly side control circuit 300 to the ink container 1 may not be directly compared with the color information (individual information) in the ink container. In other words, the inputted command is converted or processed in the controller 103, and the value provided as a result of the conversion is compared with the predetermined value stored in the memory array 103B or the command discrimination portion 103D inner, and only when the result of the comparison corresponds to the predetermined relation, the LED is actuated or deactuated.

As a further alternative, the signal sent from the main assembly side is converted or processed in the controller 103, and the value stored in the memory array 103B or the command control portion 103D is also converted or processed in the controller 103. The converted ones are compared, and only when the result of the comparison corresponds to the predetermined relation, the LED is actuated or deactuated.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or

changes as may come within the purpose of the
improvements or the scope of the following claims.

The claims defining the invention are as follows:

1. A liquid container detachably mountable to a recording apparatus to which a plurality of liquid containers are detachably mountable, wherein said
5 recording apparatus includes apparatus electrical contacts corresponding to the liquid containers, respectively, photoreceptor means for receiving light, and an electric circuit connected with a line which is commonly connected with said apparatus electrical
10 contacts, said liquid container comprising:
 - a container electrical contact electrically connectable with one of said apparatus contacts;
 - an information storing portion capable of storing at least individual information of said liquid
15 container;
 - a light emitting portion;
 - a controller for controlling emission of light of said light emitting portion in response to a correspondence between a signal indicative of
20 individual information supplied through said container electrical contact and said information stored in said information storing portion.
- 25 2. A liquid container detachably mountable to a recording apparatus to which a plurality of liquid containers are detachably mountable at different

positions, wherein said recording apparatus includes apparatus electrical contacts corresponding to the liquid containers, respectively, photoreceptor means for receiving light, and an electric circuit connected
5 with a line which is commonly connected with said apparatus electrical contacts, said liquid container comprising:

a container electrical contact electrically connectable with one of said apparatus contacts;

10 an information storing portion storing at least individual information of said liquid container;

a light emitting portion for emitting light toward said position detecting means;

a controller for controlling emission of light
15 of said light emitting portion when information indicated by a signal indicative of individual information supplied through said container electrical contact and said information stored in said information storing portion, are the same.

20

3. A liquid container according to Claim 2, wherein said liquid container has a plurality of such electrical contacts.

25

4. A liquid container according to Claim 1, 2 or

3, wherein the line which is commonly connected with said apparatus electrical contacts transmits the signal indicative of individual information.

5

5. A liquid container according to Claim 1, 2, 3 or 4, wherein said liquid container contains ink.

10

6. A liquid supplying system comprising:

a recording apparatus including,

a carriage,

apparatus electrical contacts corresponding to the liquid containers, respectively,

15

photoreceptor means for receiving light,

an electric circuit connected with a line

which is commonly connected with said apparatus electrical contacts; and

a liquid container detachably mountable to said

20

carriage, said liquid container including,

a container electrical contact electrically connectable with one of said apparatus contacts,

an information storing portion storing at least individual information of said liquid container,

25

a light emitting portion for emitting light toward said position detecting means,

a controller for controlling emission of light

of said light emitting portion when information indicated by a signal indicative of individual information supplied through said container electrical contact and said information stored in said
5 information storing portion are the same.

7. A liquid supplying system according to Claim 6, wherein the line which is commonly connected with said
10 apparatus electrical contacts transmits the signal indicative of individual information.

8. A manufacturing method for manufacturing a
15 liquid container detachably mountable to a recording apparatus to which a plurality of liquid containers are detachably mountable at different positions, wherein said recording apparatus includes apparatus electrical contacts corresponding to the liquid
20 containers, respectively, photoreceptor means for receiving light, and an electric circuit connected with a line which is commonly connected with said apparatus electrical contacts, said liquid container comprising the steps of:

25 preparing a liquid container including a substrate, said substrate having a container electrical contact electrically connectable with one

of said apparatus contacts; an information storing
portion storing at least individual information of
said liquid container, a light emitting portion for
emitting light toward said position detecting means, a
5 controller for controlling emission of light of said
light emitting portion when information indicated by a
signal indicative of individual information supplied
through said container electrical contact and said
information stored in said information storing means,
10 are the same; and
injecting ink into said liquid container.

9. A manufacturing method according to Claim 8,
15 wherein the line which is commonly connected with said
apparatus electrical contacts transmits the signal
indicative of individual information.

20 10. A circuit board for a liquid container which
container is detachably mountable to a recording
apparatus to which a plurality of liquid containers
are detachably mountable at different positions,
wherein said recording apparatus includes apparatus
25 electrical contacts corresponding to the liquid
containers, respectively, photoreceptor means for
receiving light, and an electric circuit connected

with a line which is commonly connected with said apparatus electrical contacts, said circuit board comprising:

- 5 a container electrical contact electrically connectable with one of said apparatus contacts;
- an information storing portion storing at least individual information of said liquid container;
- a connecting portion for connection to a light emitting portion for directing light to said position
- 10 detecting means; and
- a controller for controlling emission of light of said light emitting portion when information indicated by a signal indicative of individual information supplied through said container electrical
- 15 contact and said information stored in said information storing portion, are the same.

20 11. A circuit board according to Claim 10, wherein the line which is commonly connected with said apparatus electrical contacts transmits the signal indicative of individual information.

25 12. A circuit board Claim 10 or 11, wherein said light emitting portion is provided on said circuit board.

13. A recording apparatus comprising a carriage
5 for carrying said liquid container as defined in Claim 1
or 2, and a light receiving portion for receiving the
light from said light emitting portion.

10 14. A recording apparatus according to Claim 13,
wherein the line which is commonly connected with said
apparatus electrical contacts transmits the signal
indicative of individual information.

15 15. A recording apparatus according to Claim 13, wherein
said carriage is movable to a position where said
light receiving portion and said light emitting
portion are opposed to each other.

20 16. A liquid container cartridge detachably
mountable to a recording apparatus to which a
plurality of liquid containers are detachably
25 mountable at different positions, wherein said
recording apparatus includes apparatus electrical
contacts corresponding to the liquid containers,

respectively, photoreceptor means for receiving light, and an electric circuit connected with a line which is commonly connected with said apparatus electrical contacts, said liquid container comprising:

5 a recording head for effecting recording by ejecting liquid;

 a container electrical contact electrically connectable with one of said apparatus contacts;

 an information storing portion storing at least
10 individual information of said liquid container;

 a light emitting portion for emitting light toward said position detecting means;

 a controller for controlling emission of light of said light emitting portion when information
15 indicated by a signal indicative of individual information supplied through said container electrical contact and said information stored in said information storing portion, are the same.

20

17. A liquid container cartridge according to Claim 16, wherein the line which is commonly connected with said apparatus electrical contacts transmits the signal indicative of individual information.

25

18. A liquid container detachably mountable to a

recording apparatus to which a plurality of liquid containers are detachably mountable at different positions, wherein said recording apparatus includes apparatus electrical contacts corresponding to the liquid containers, respectively, photoreceptor means for receiving light, and an electric circuit connected with a line which is commonly connected with said apparatus electrical contacts, said liquid container comprising:

- 10 ink contained in said accommodating container;
- a container electrical contact electrically connectable with one of said apparatus contacts;
- an information storing portion capable of storing at least individual information of the ink
- 15 contained in said liquid container;
- a light emitting portion for emitting light toward said position detecting means;
- a controller for controlling emission of light of said light emitting portion when information
- 20 relating to ink supplied through said container electrical contact and said information relating to the ink contained in said liquid container and stored in said information storing portion, are the same.

25

19. A liquid container according to Claim 18, wherein the line which is commonly connected with said

apparatus electrical contacts transmits the signal indicative of individual information.

20. A liquid container substantially as described herein with reference to any one of the embodiments as illustrated in the accompanying Figures.

21. A liquid supplying system substantially as described herein with reference to any one of the embodiments as illustrated in the accompanying Figures.

22. A manufacturing method for manufacturing a liquid container substantially as described herein with reference to any one of the embodiments as illustrated in the accompanying Figures.

23. A circuit board for a liquid container substantially as described herein with reference to any one of the embodiments as illustrated in the accompanying Figures.

24. A liquid container cartridge substantially as described herein with reference to any one of the embodiments as illustrated in the accompanying Figures.

DATED this Twenty-second Day of December, 2004

Canon Kabushiki Kaisha

Patent Attorneys for the Applicant

SPRUSON & FERGUSON

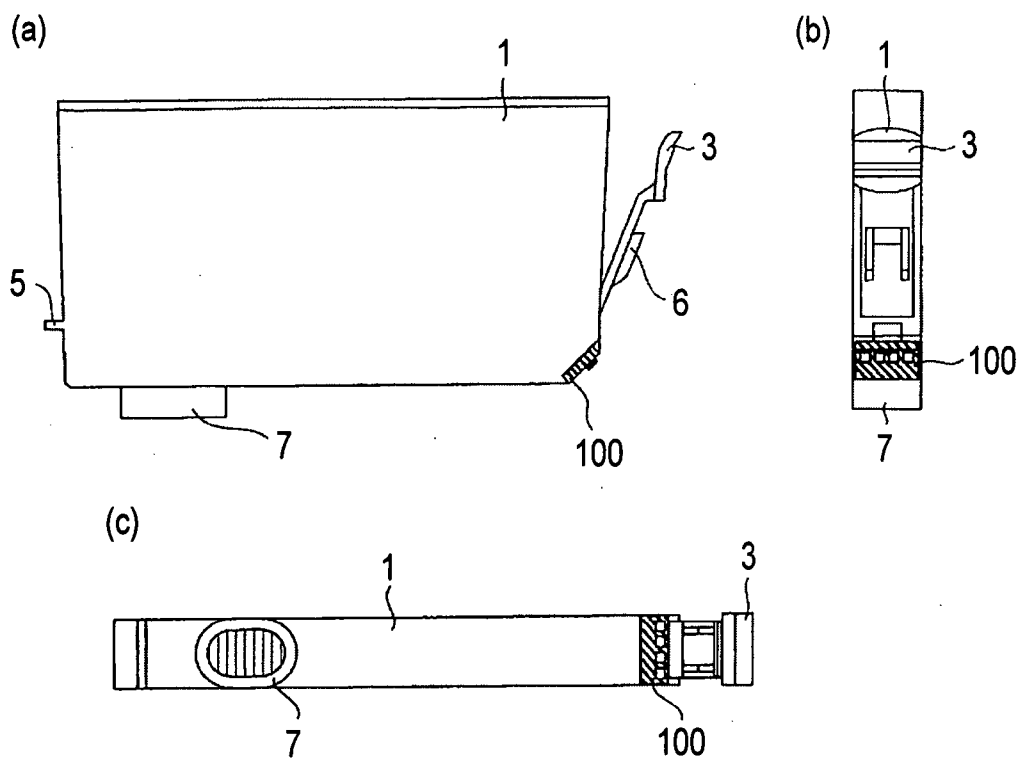


FIG. 1

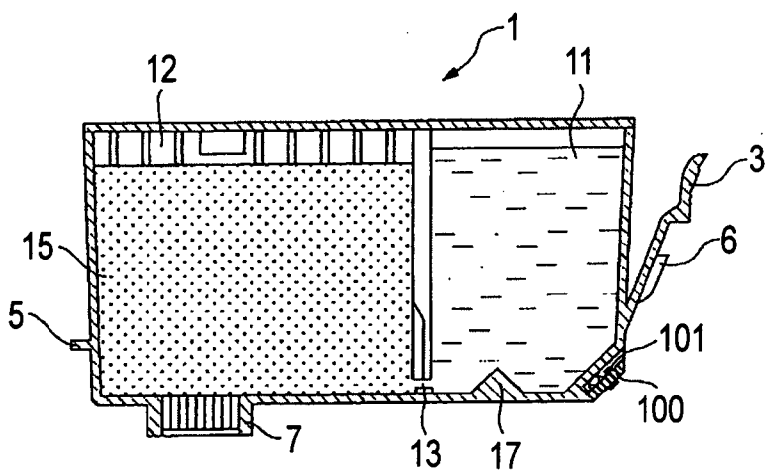


FIG. 2

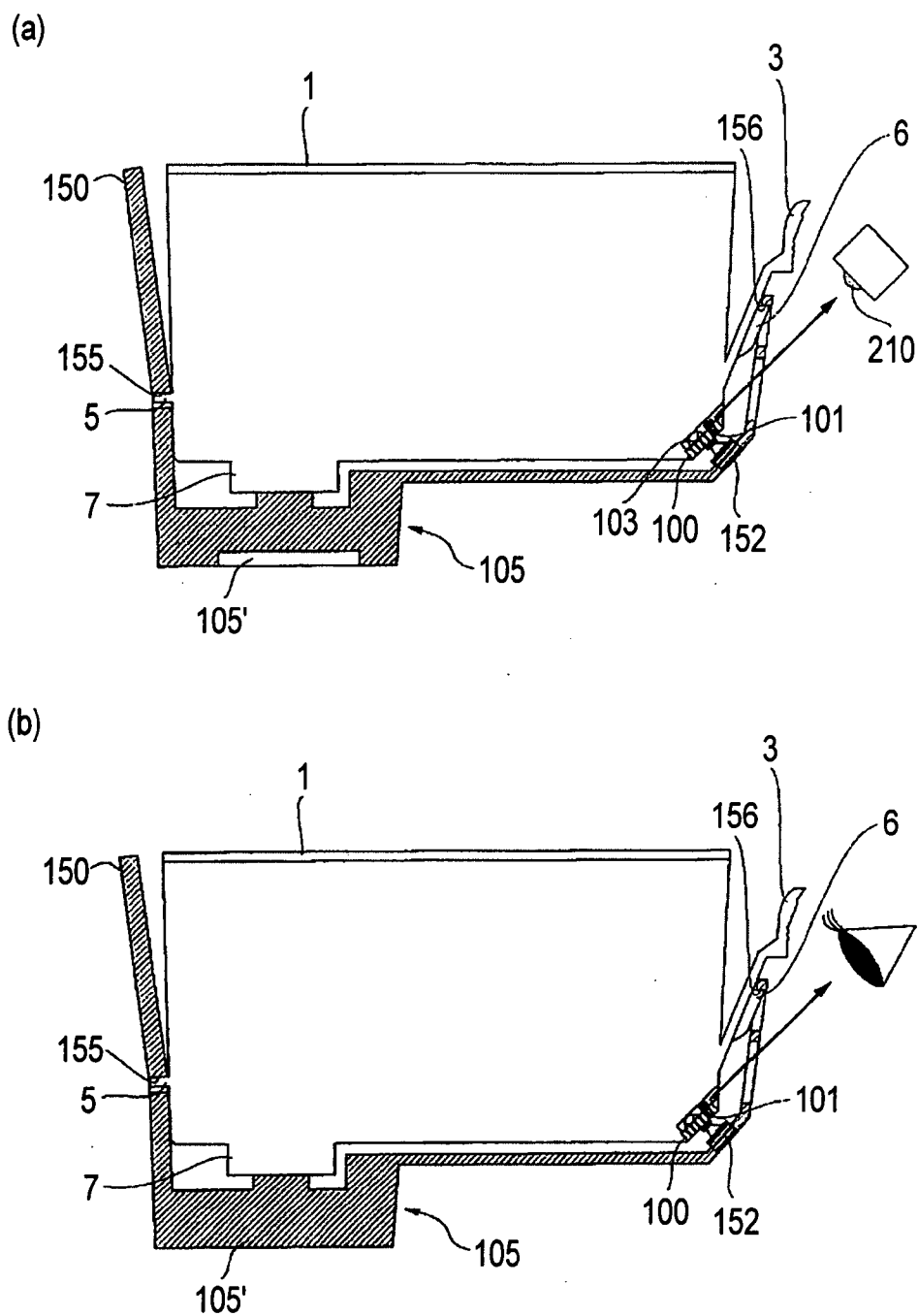
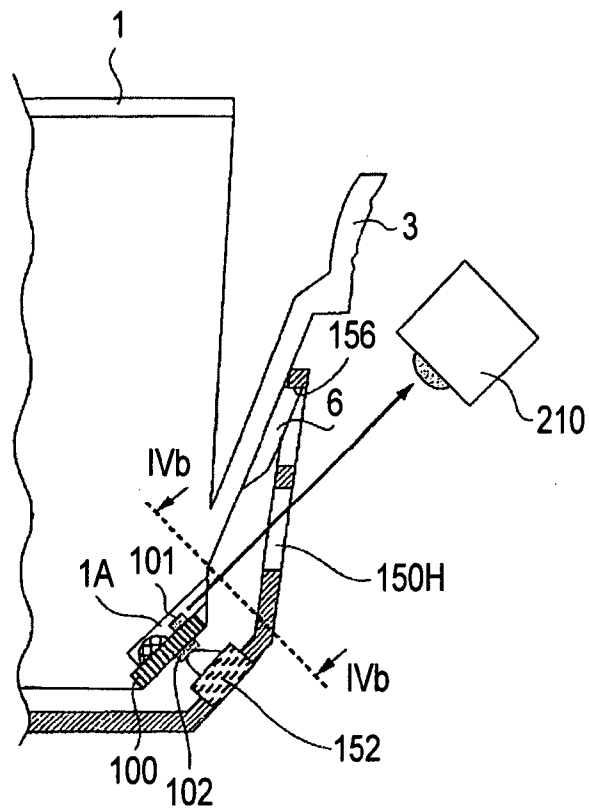


FIG.3

(a)



(b)

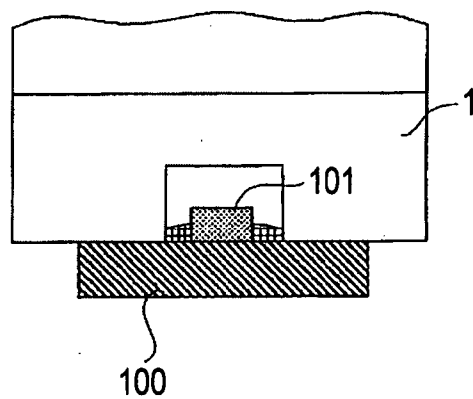


FIG.4

4/35

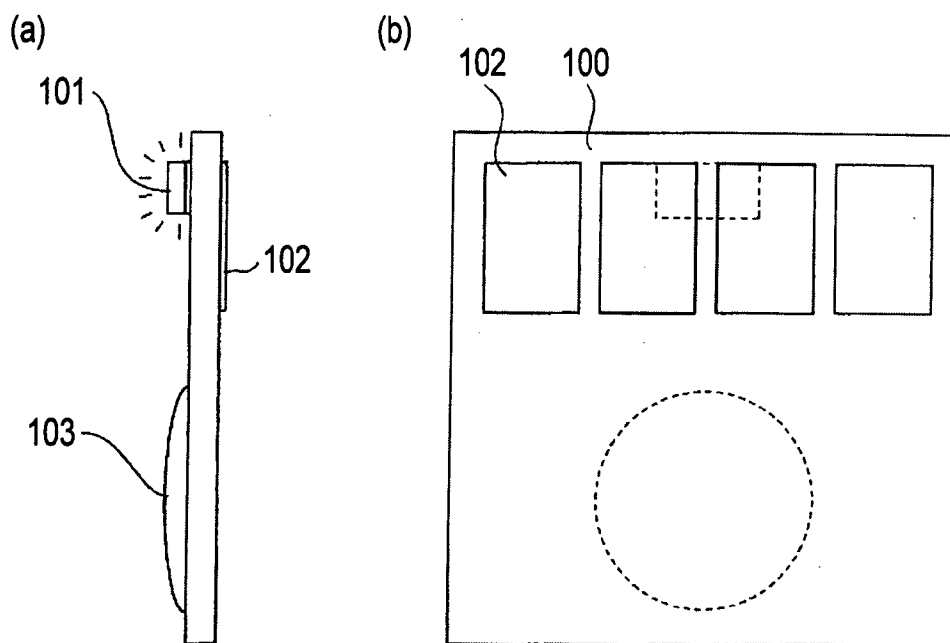


FIG. 5

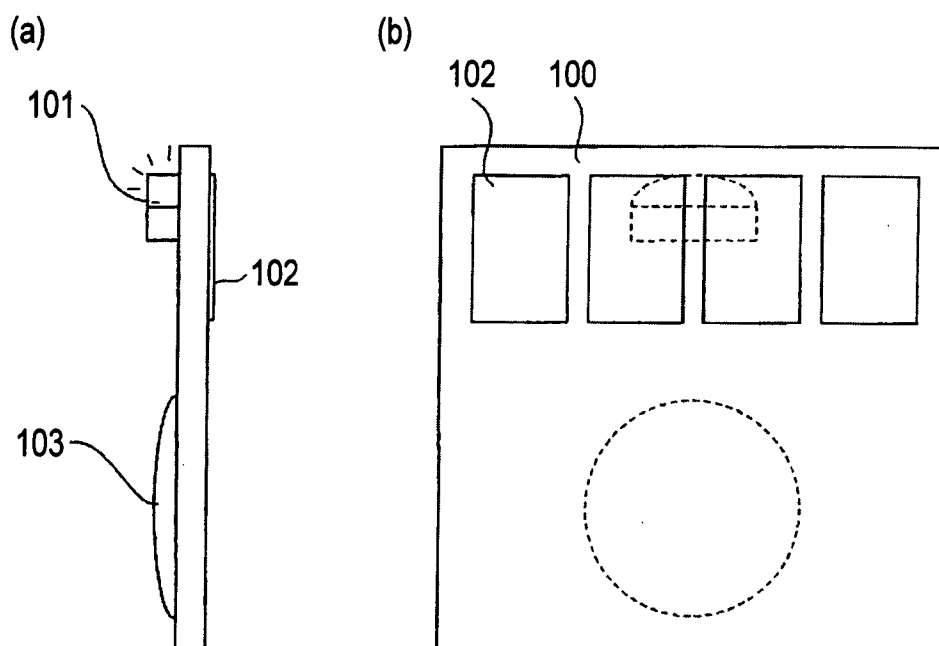


FIG. 6

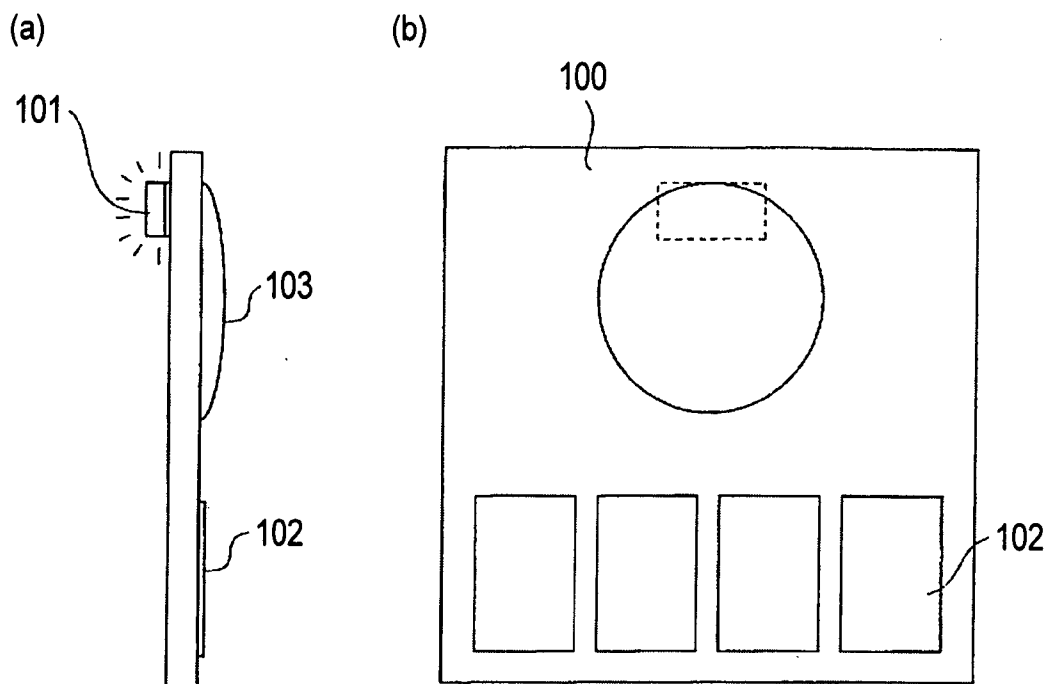


FIG. 7

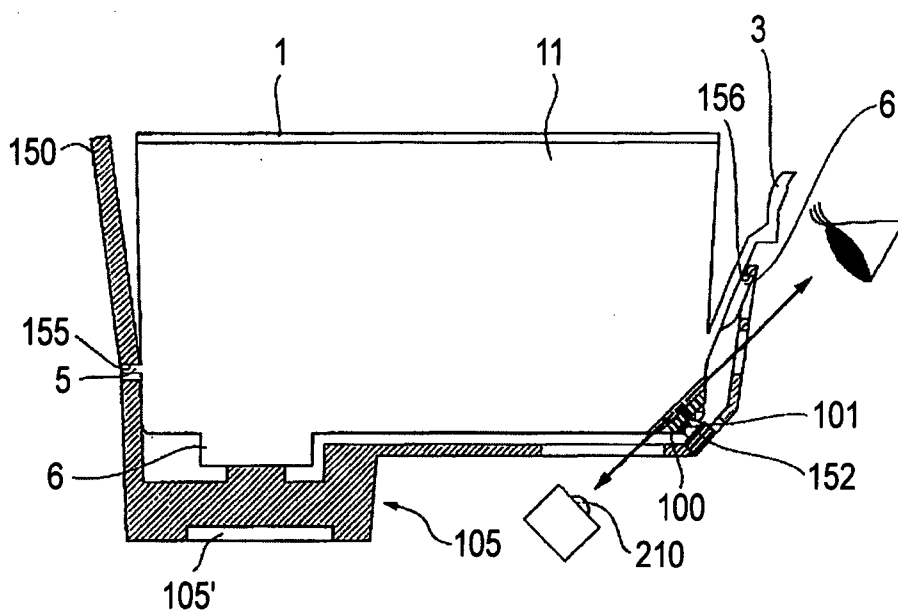


FIG. 8



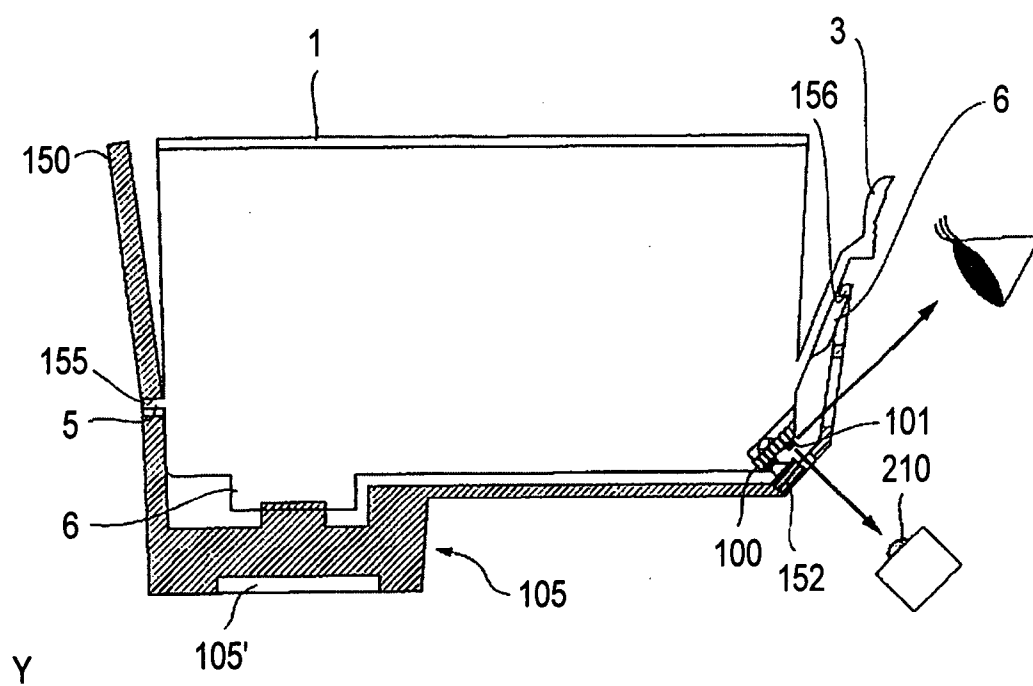
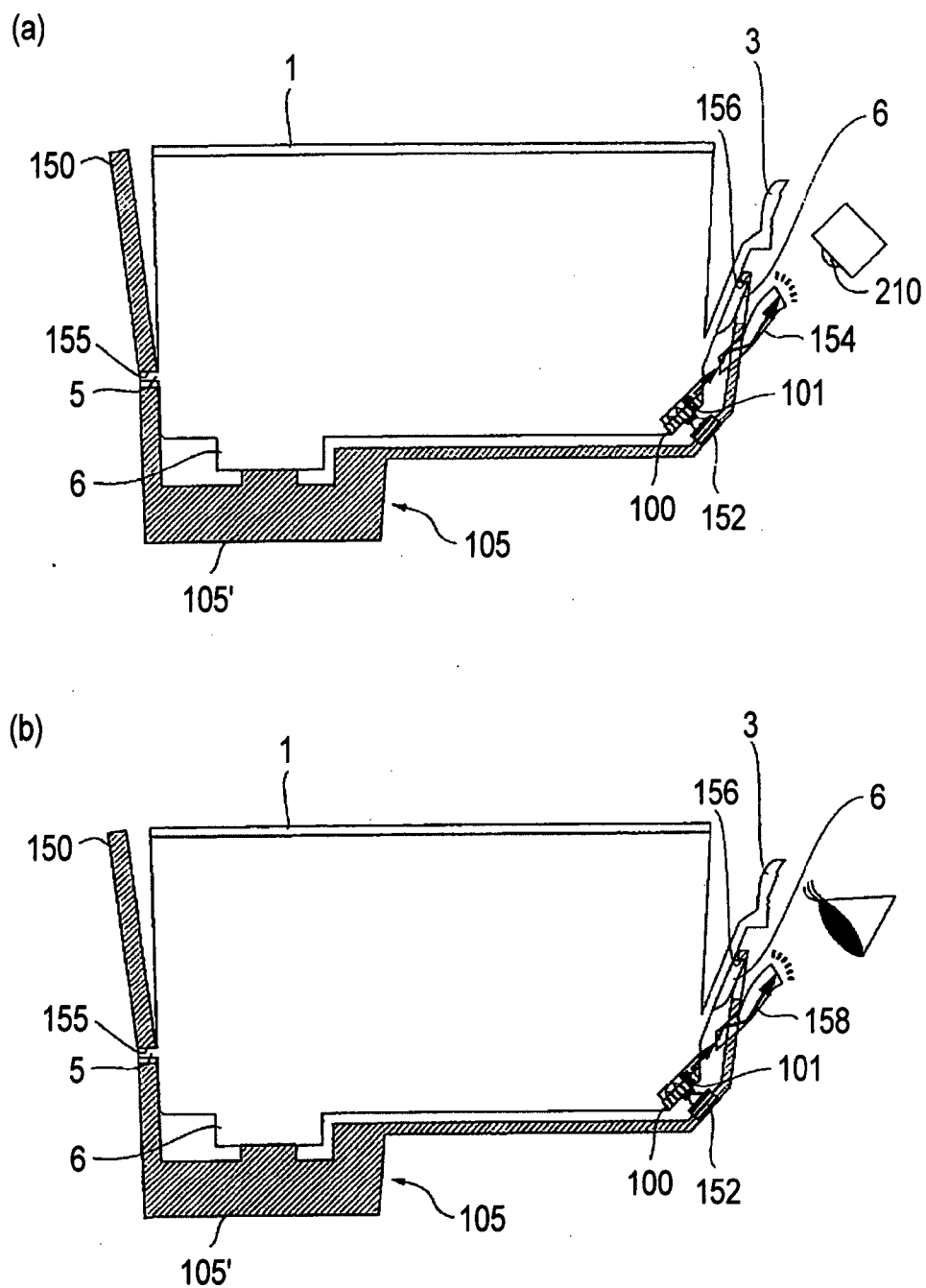


FIG.11



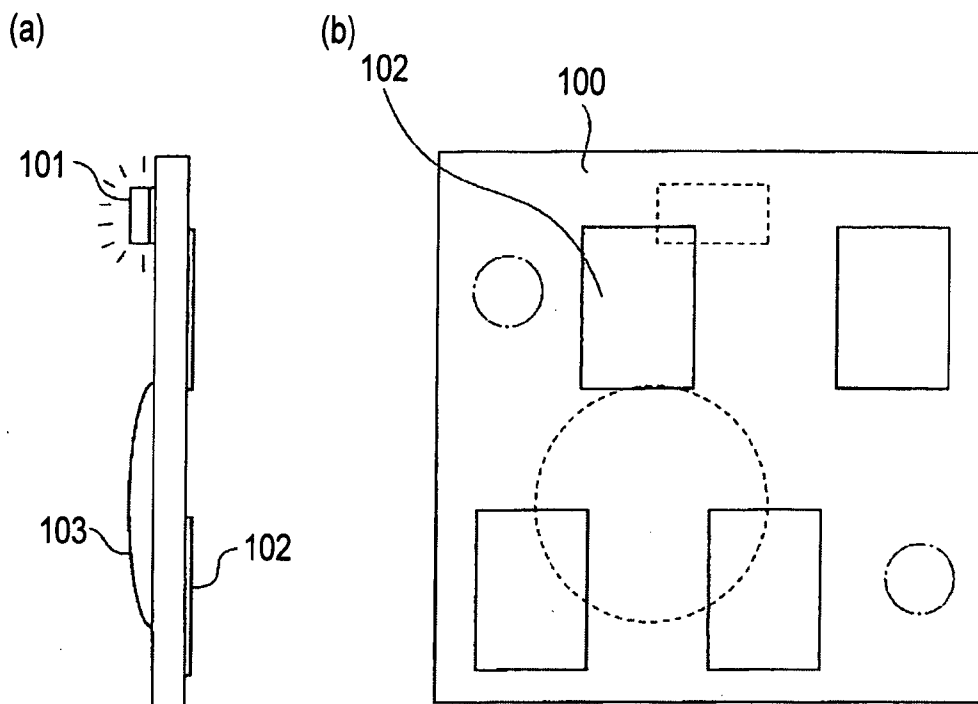


FIG.13

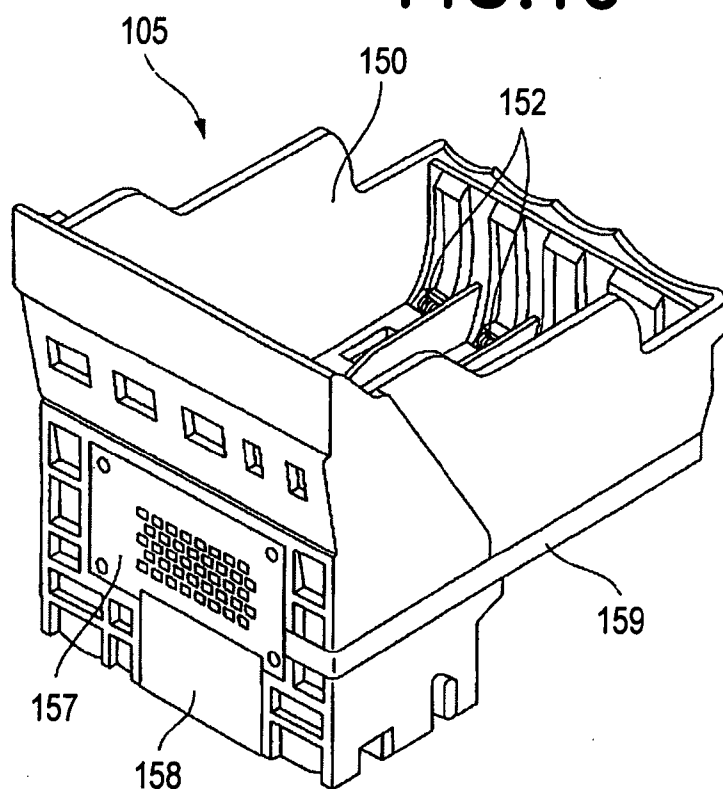


FIG.14

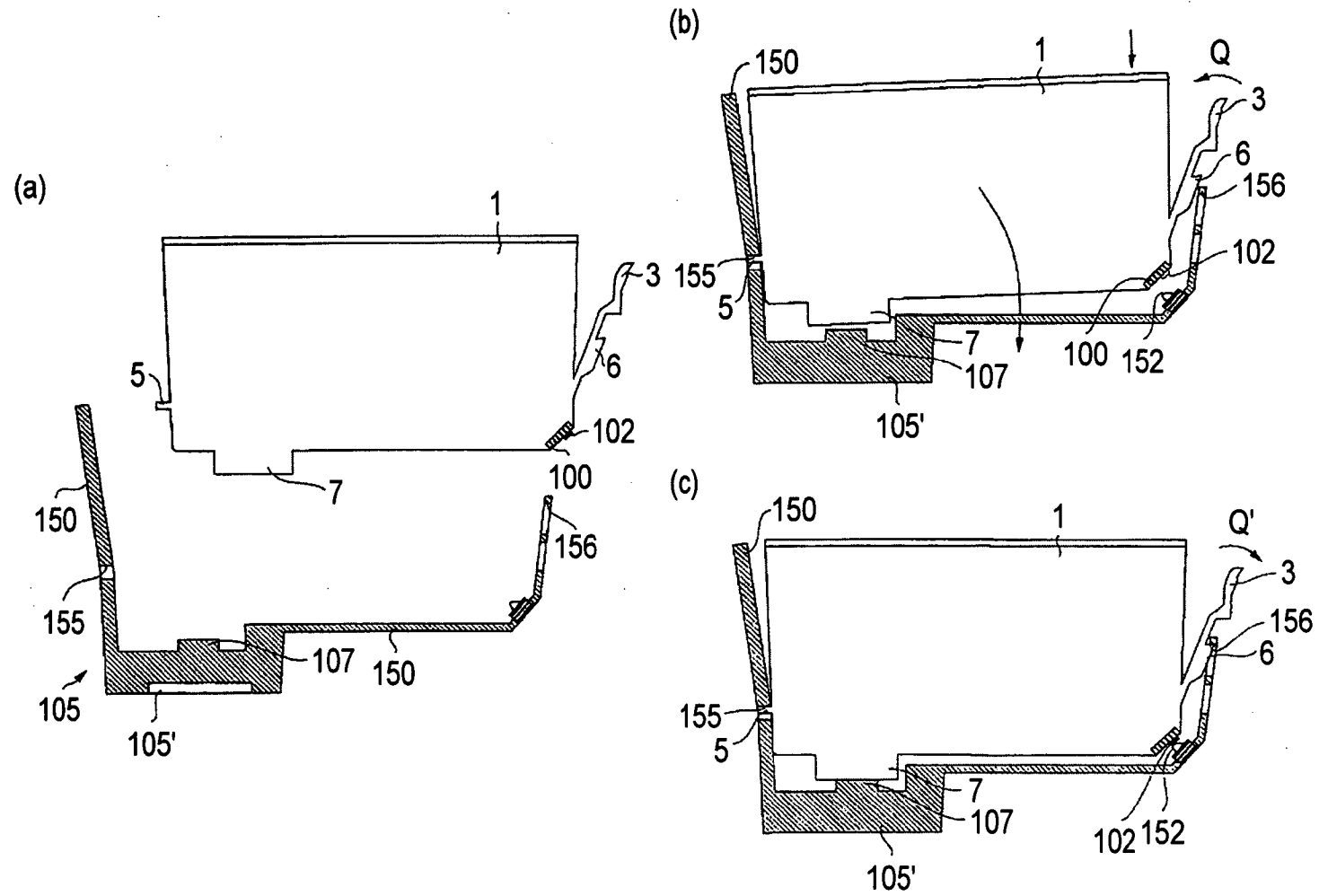
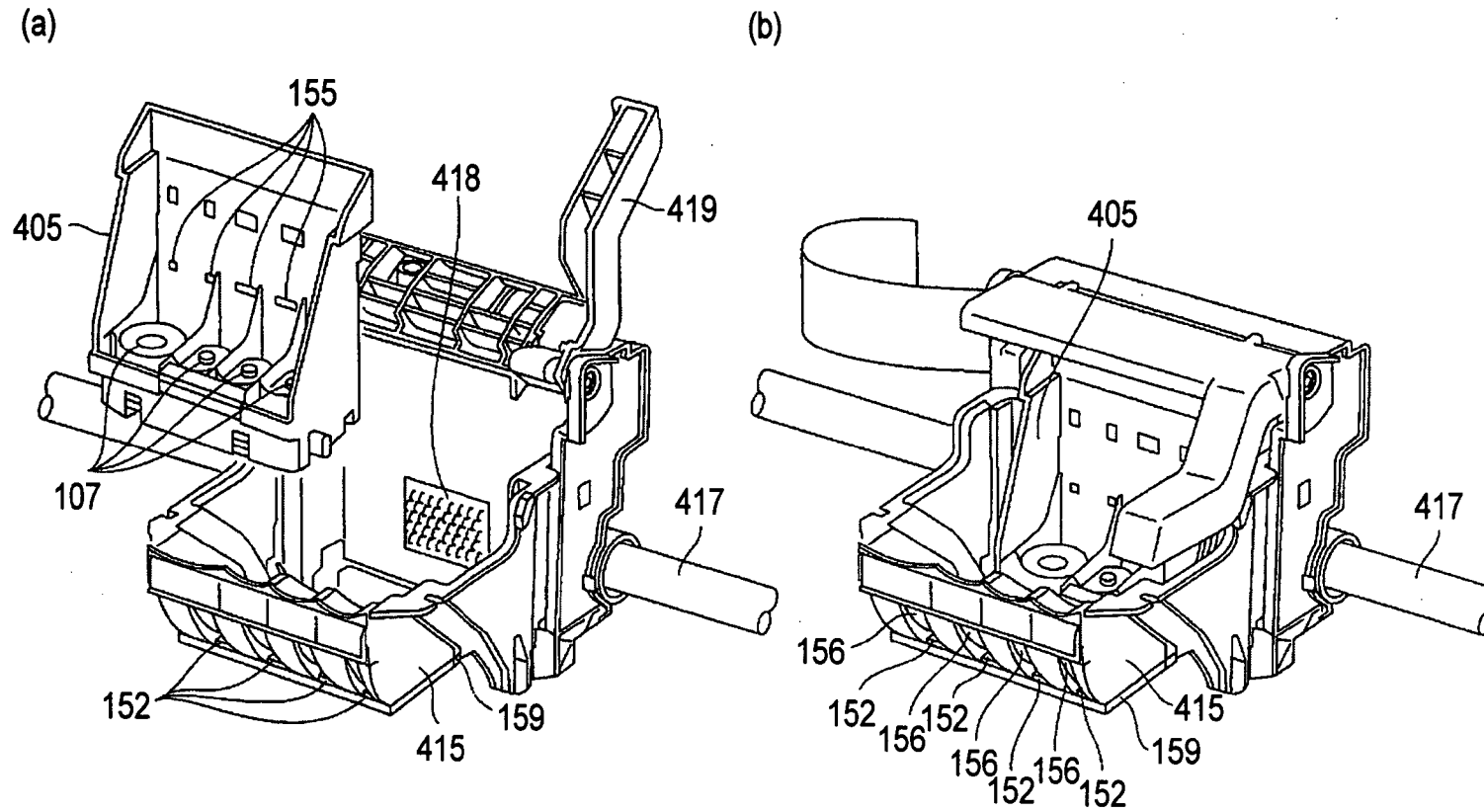


FIG.15



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FIG.16

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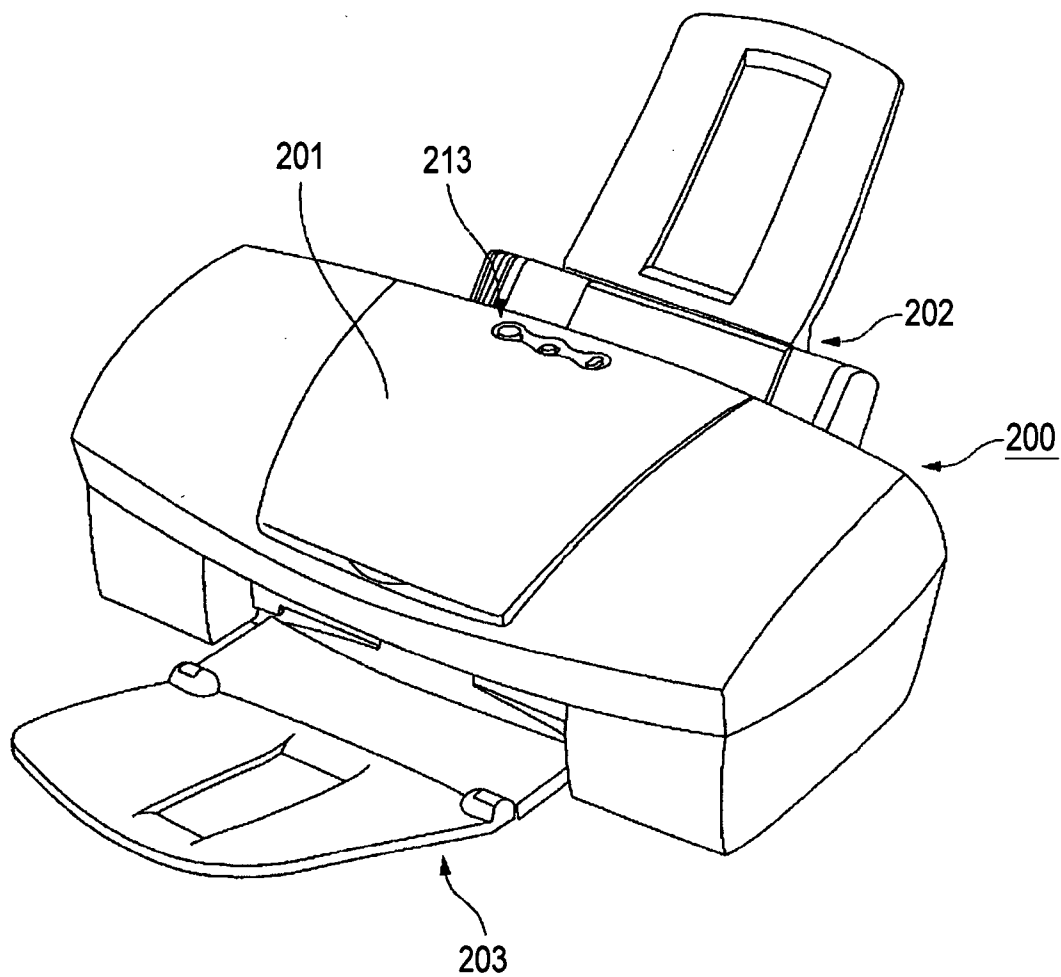


FIG.17

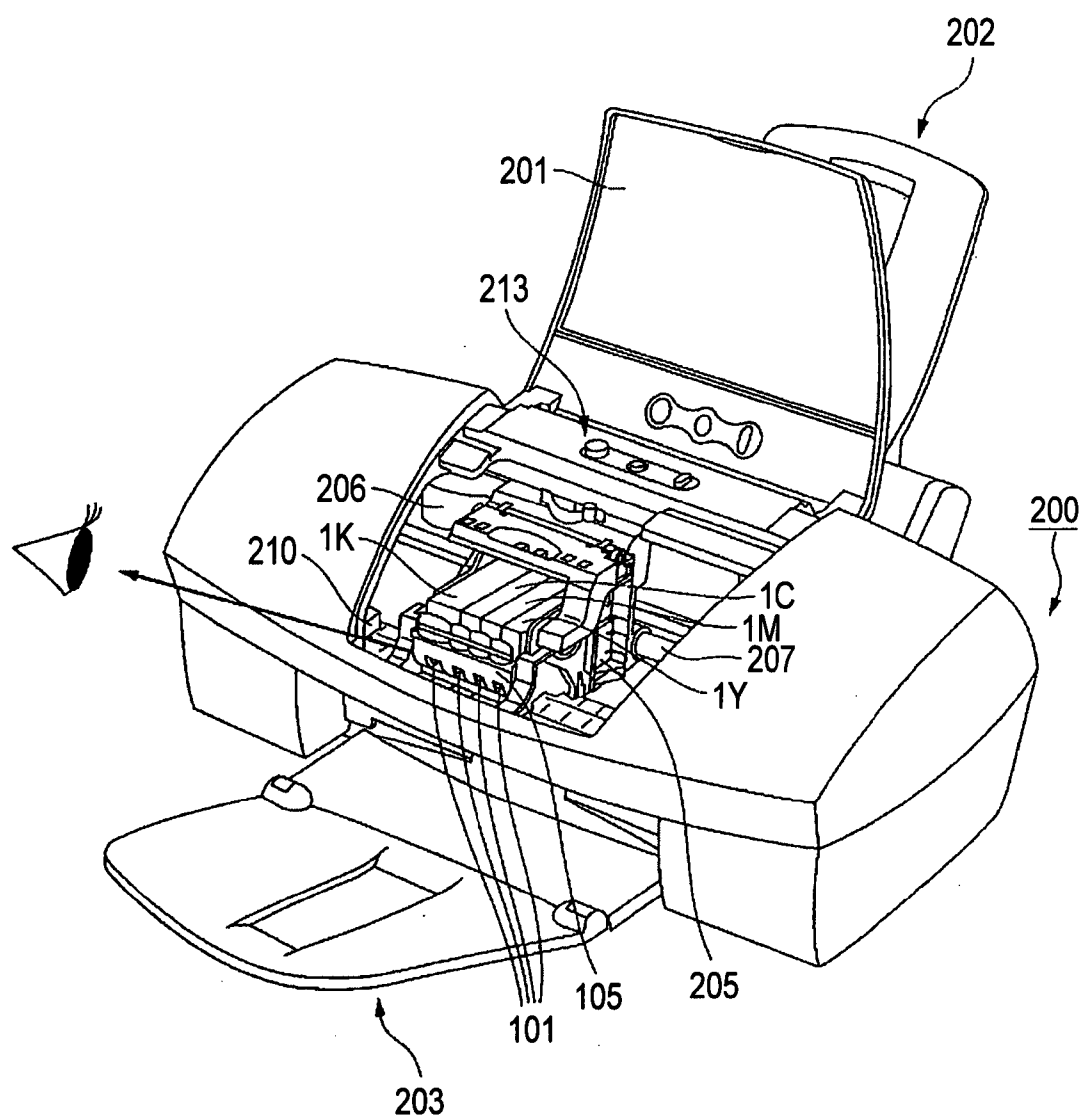
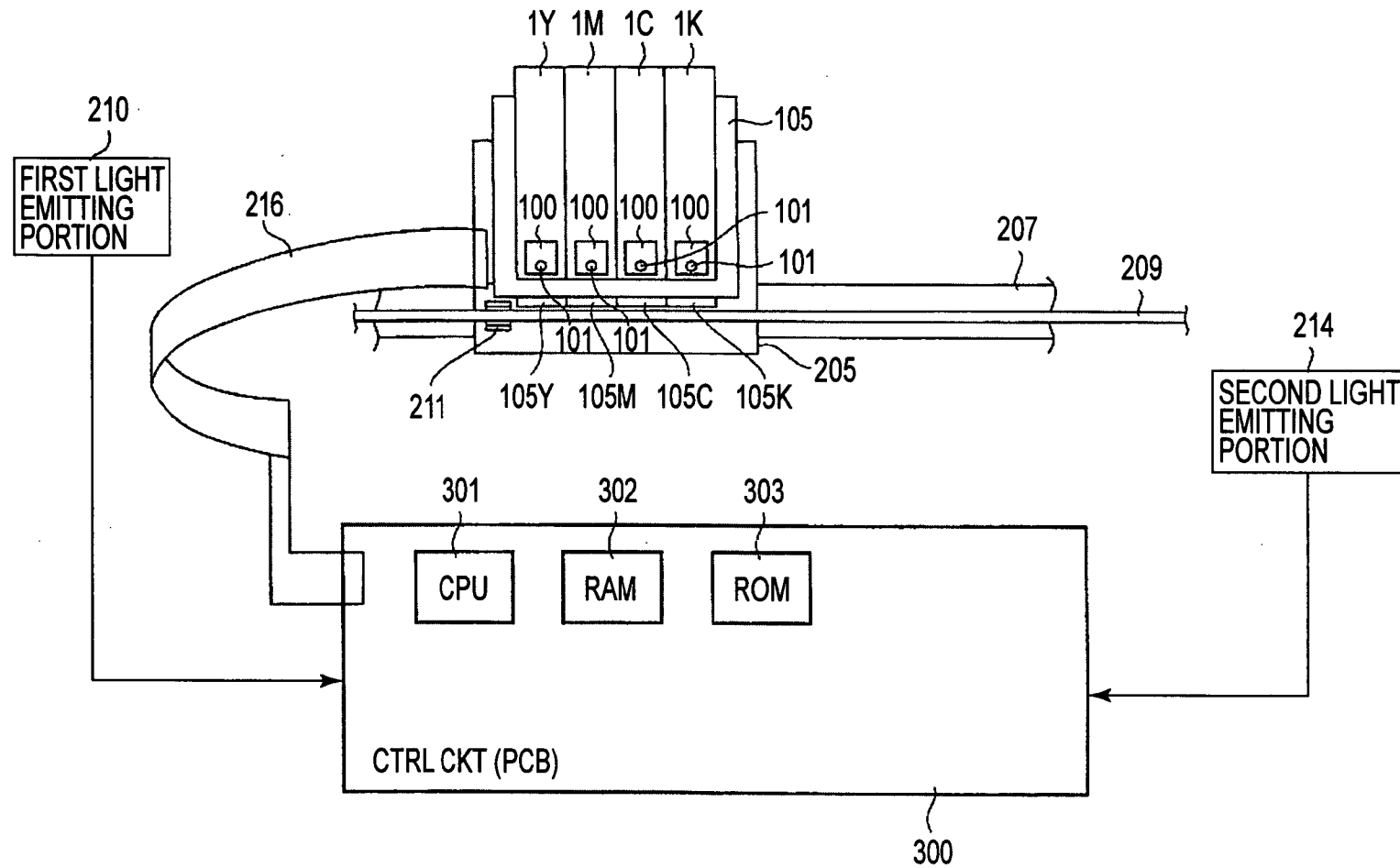


FIG.18



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FIG.19

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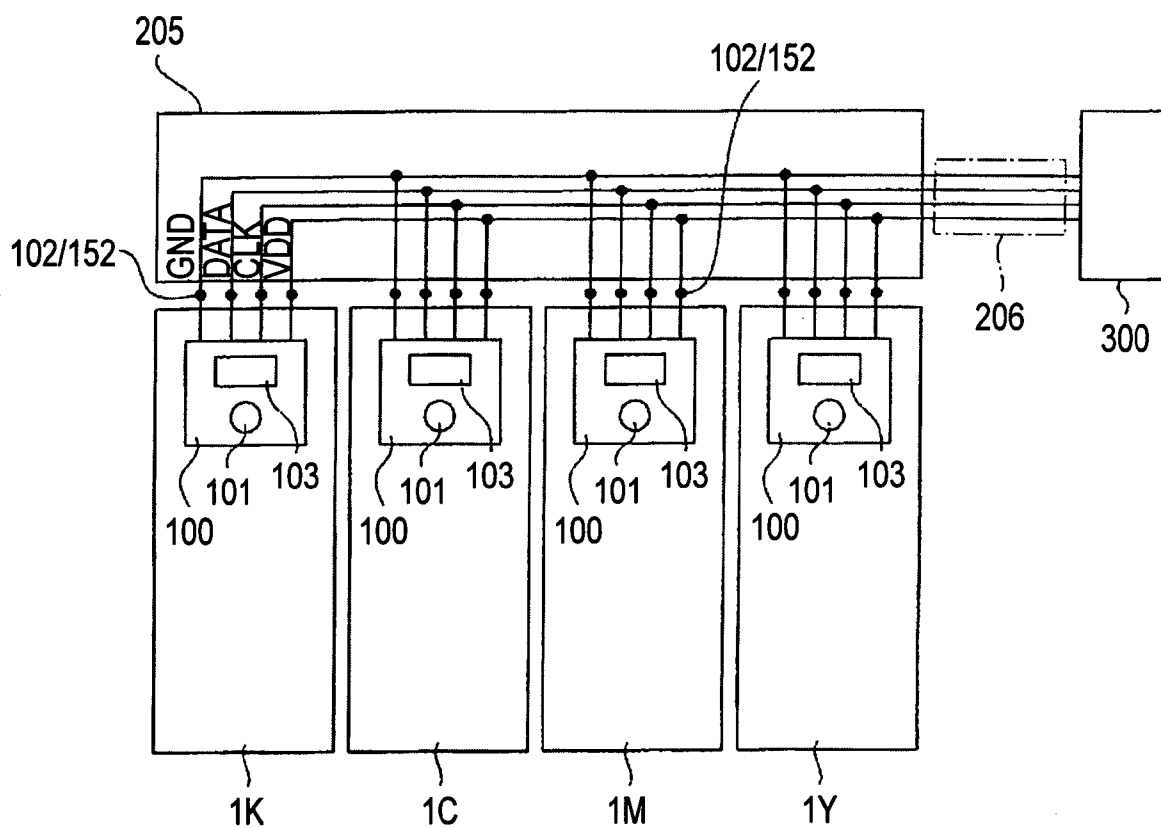


FIG.20

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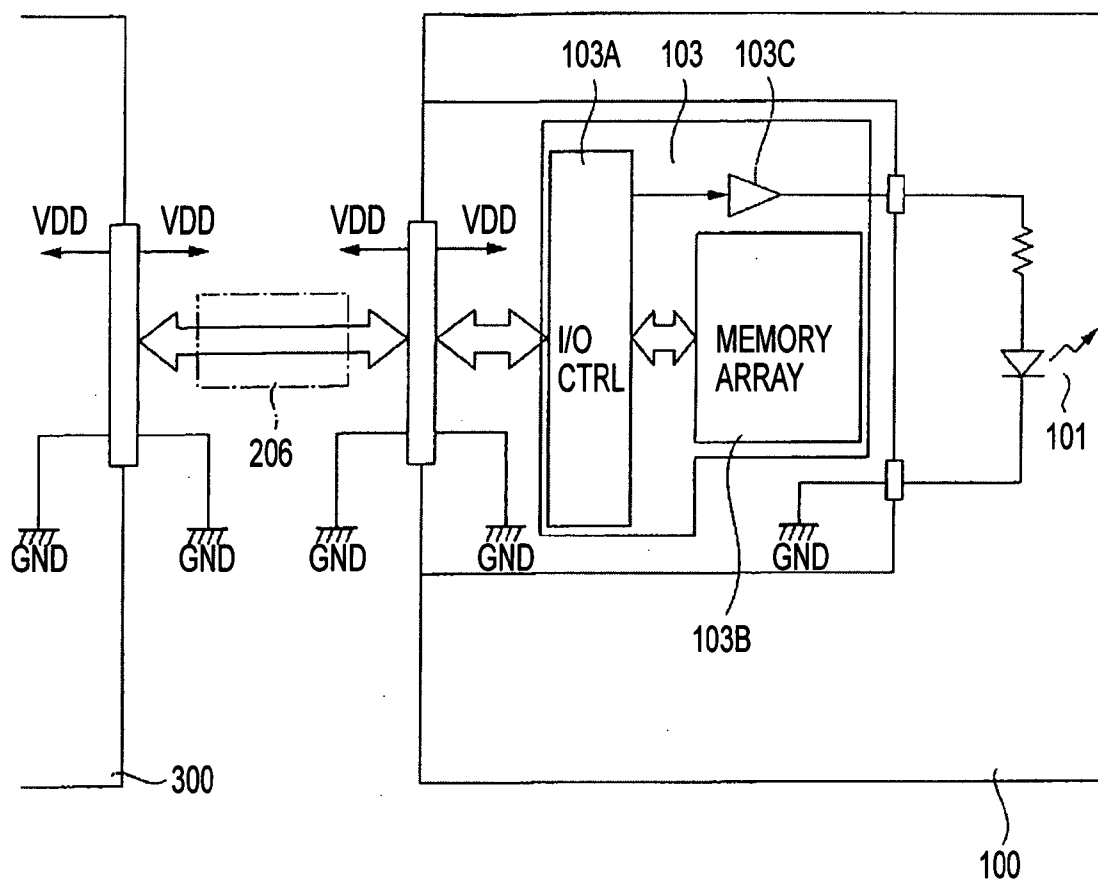


FIG.21

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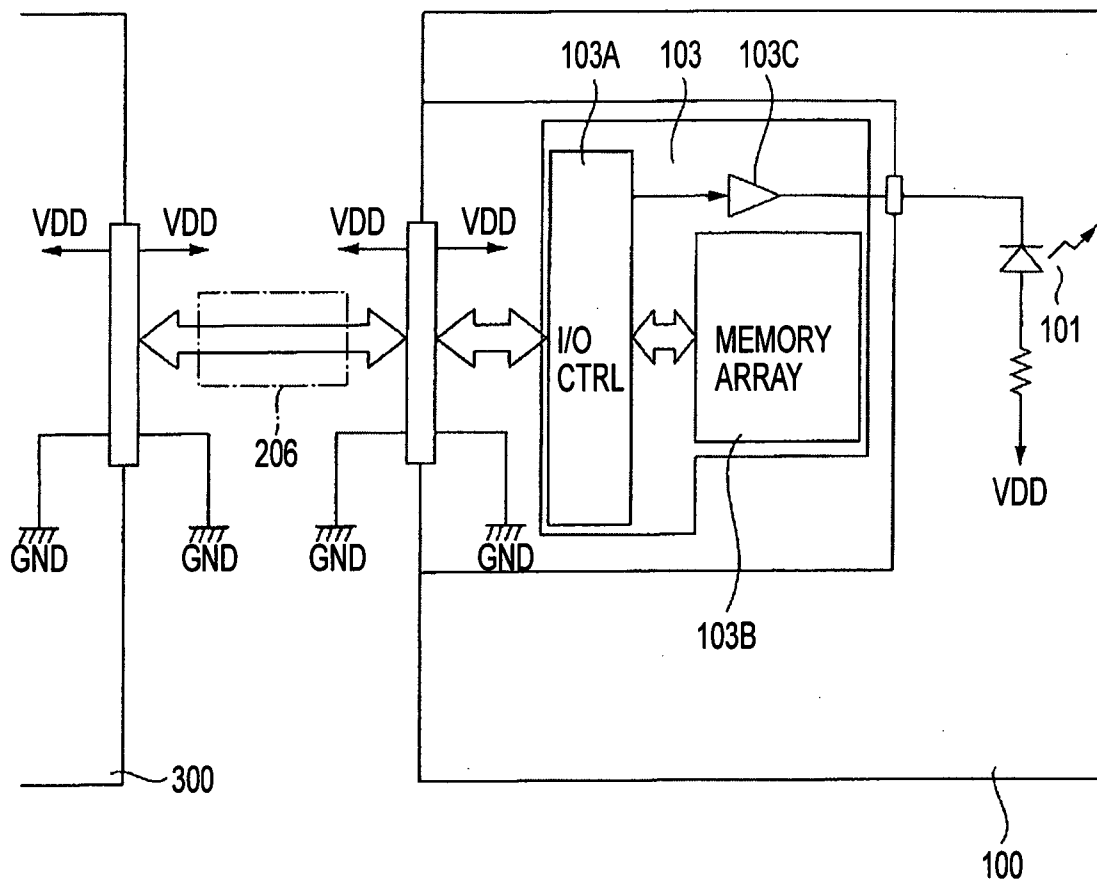


FIG.22

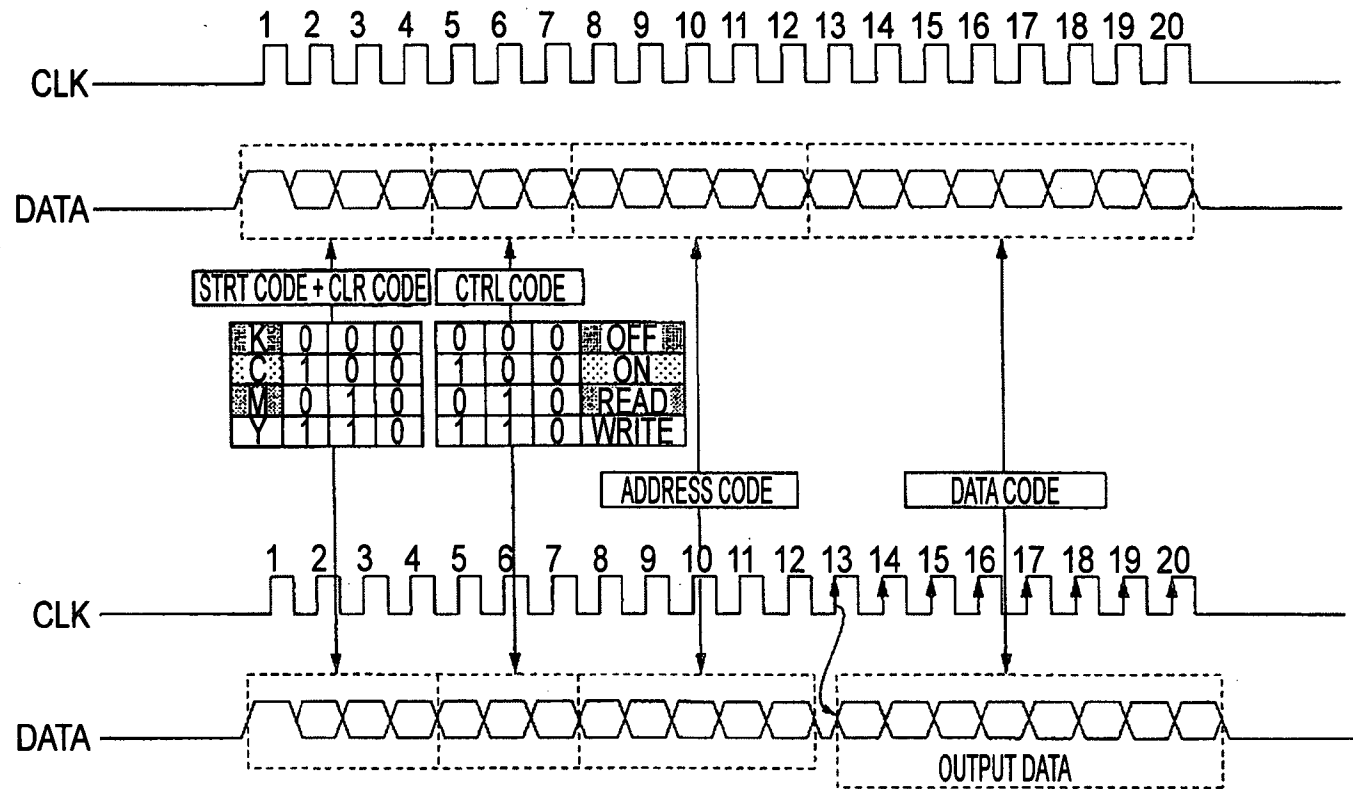


FIG.23

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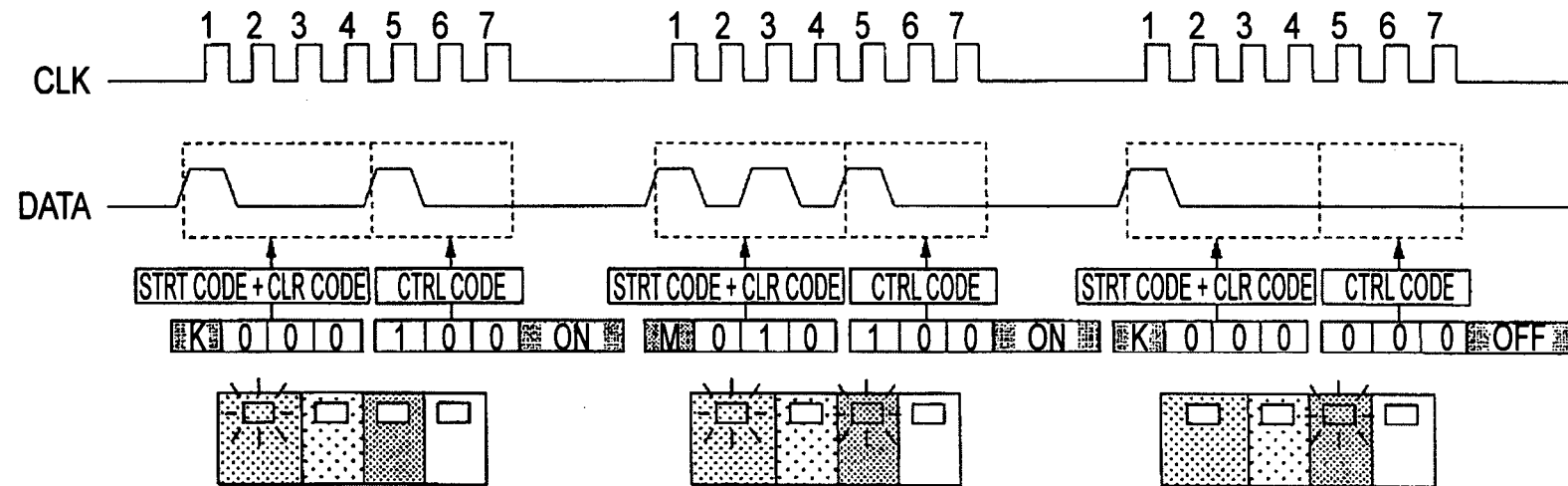


FIG.24

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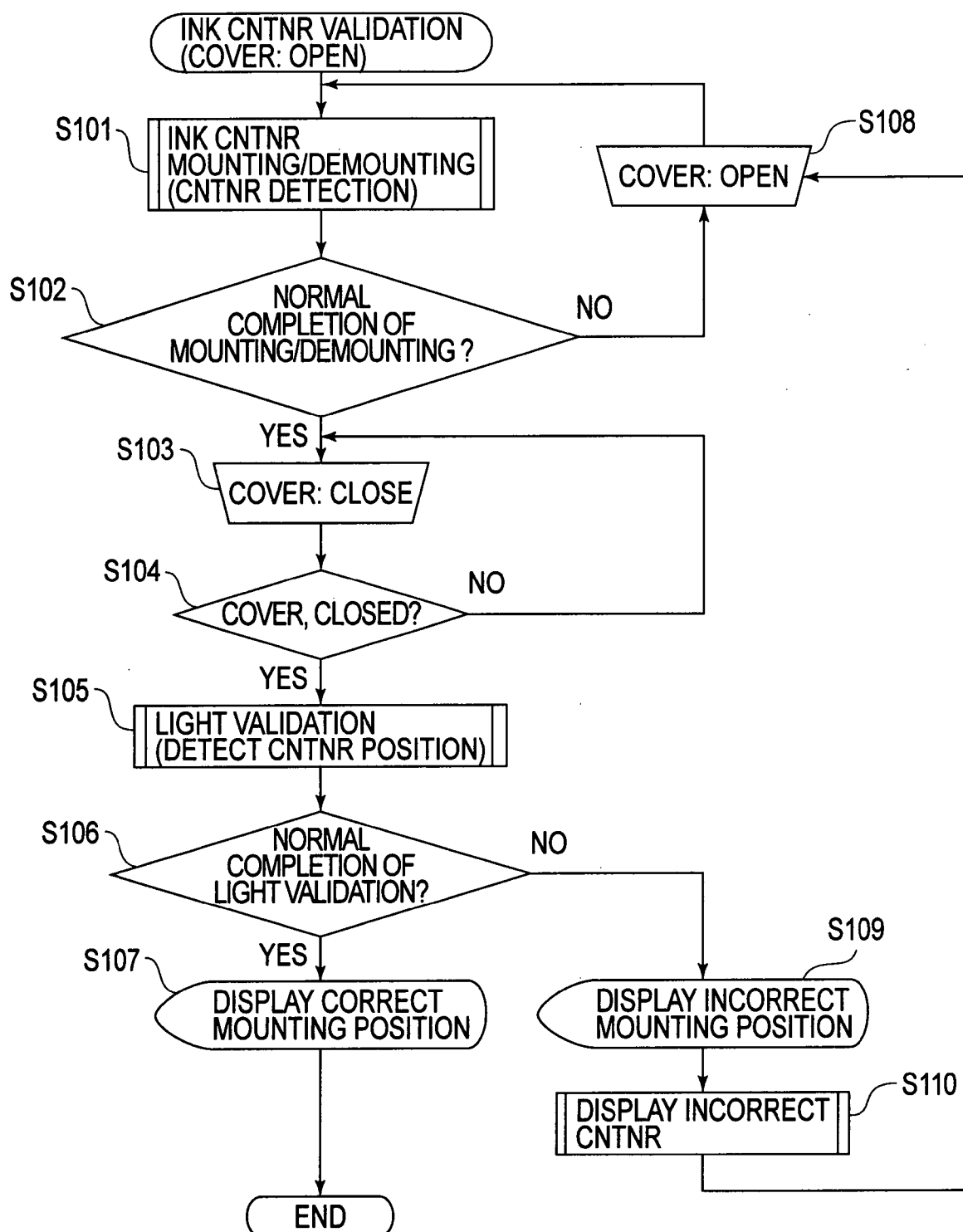


FIG.25

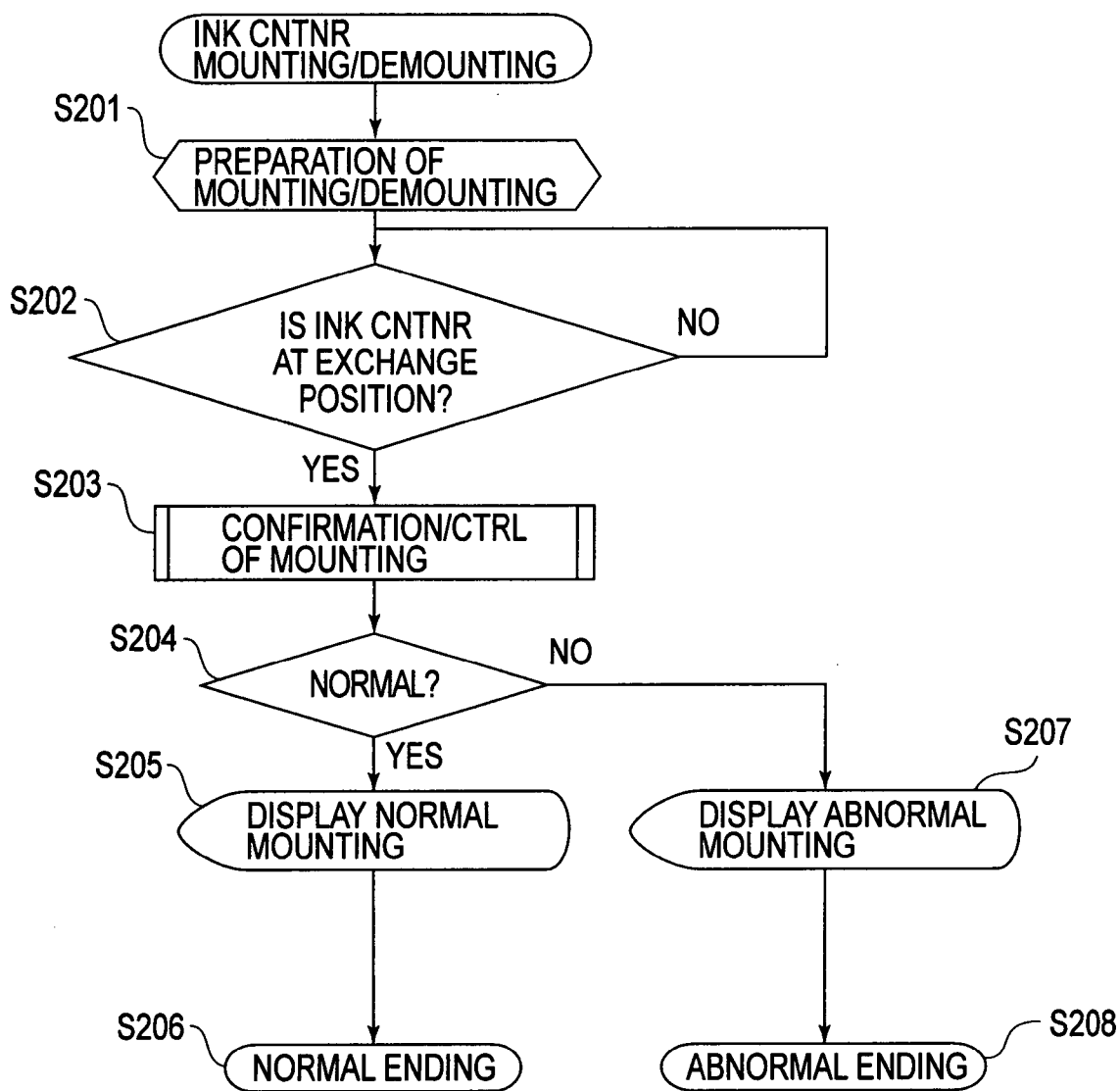


FIG.26

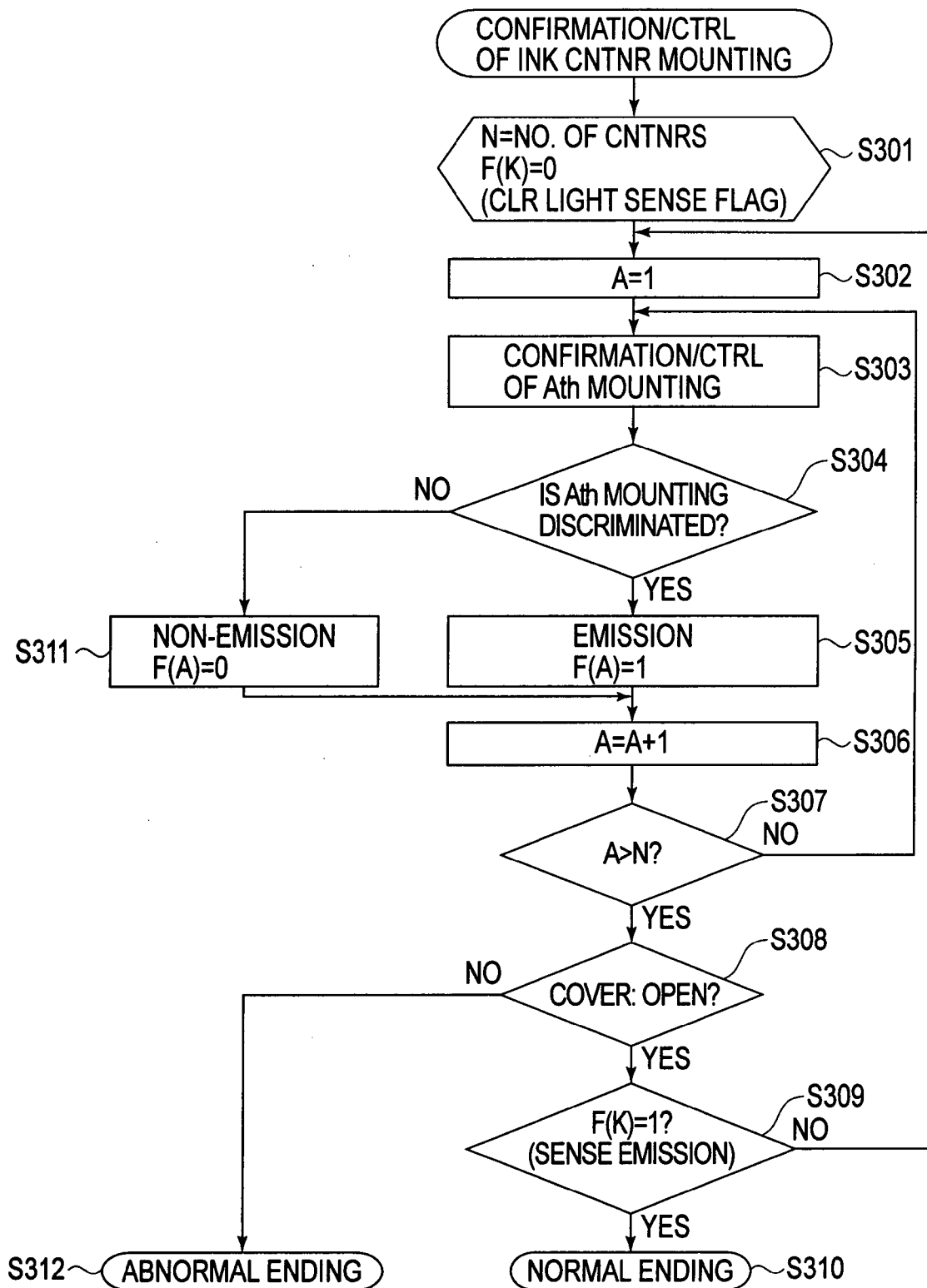


FIG.27

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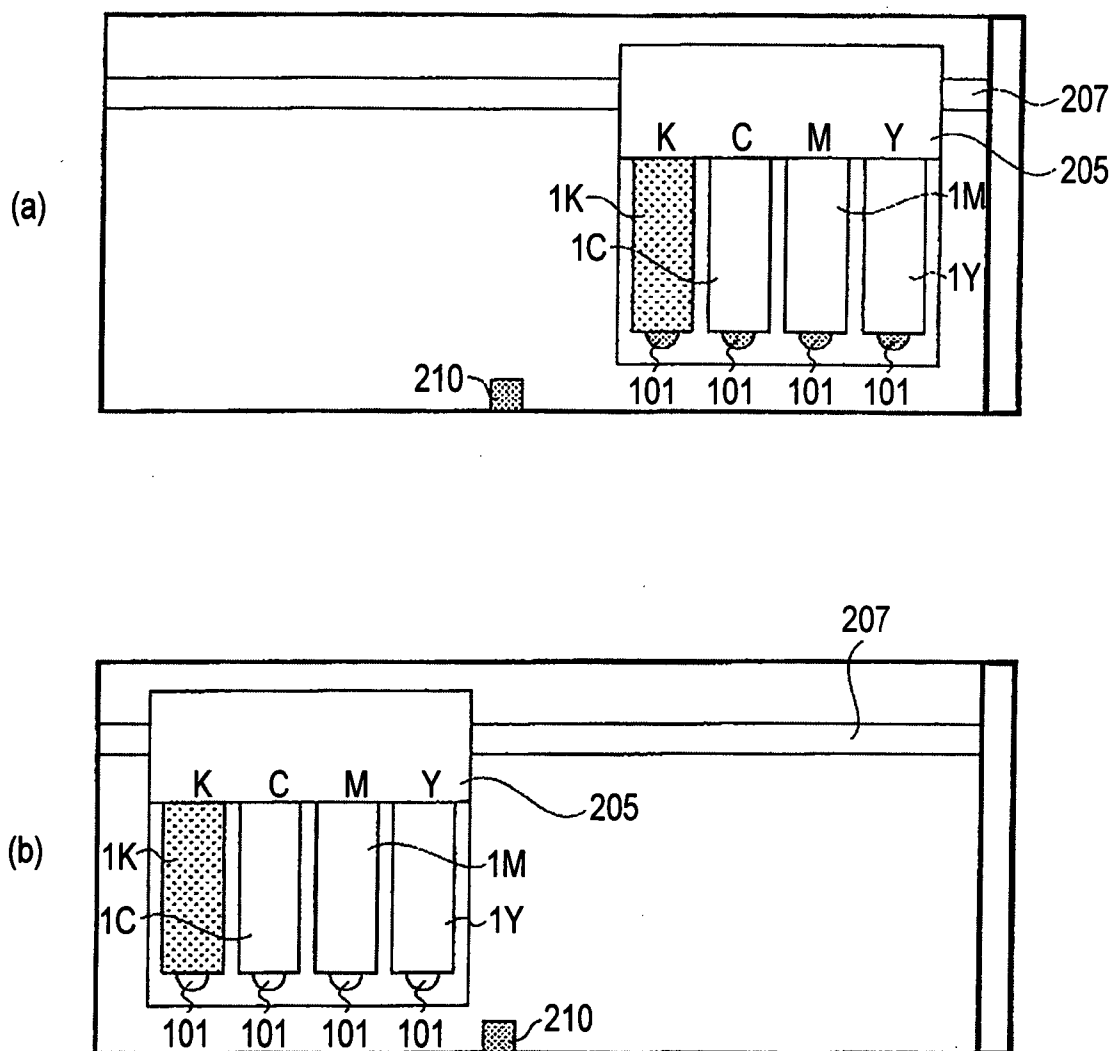


FIG.28

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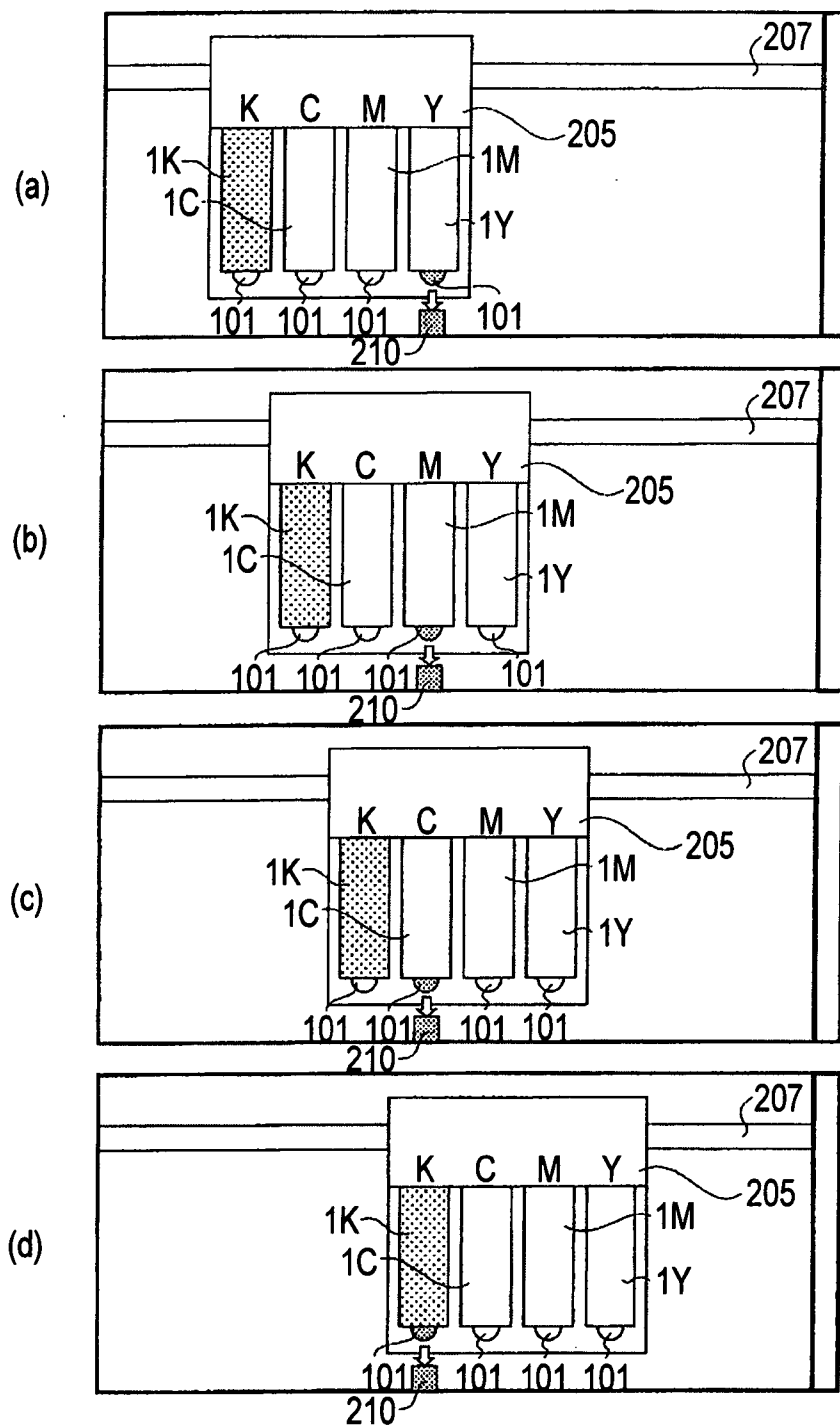


FIG.29

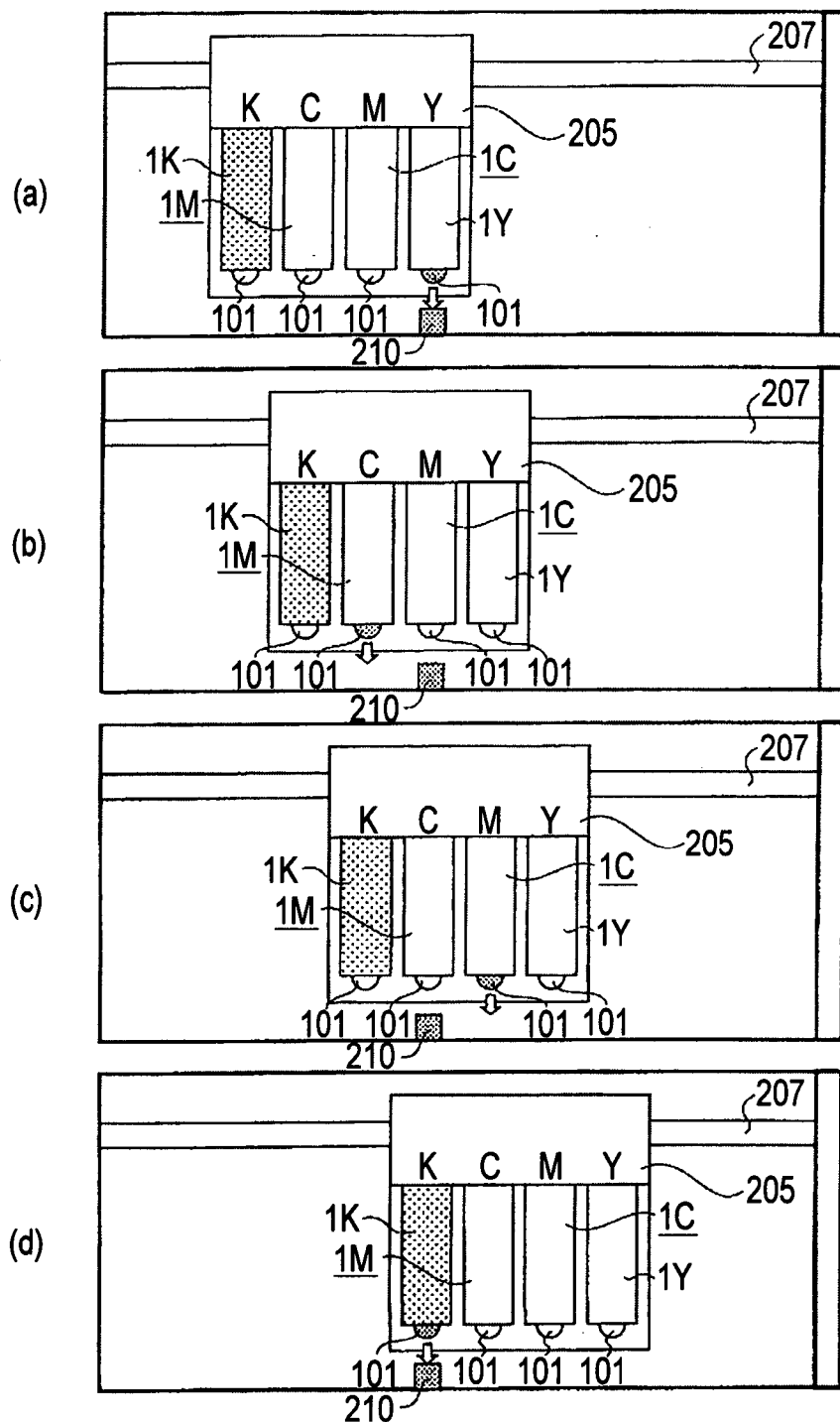


FIG.30

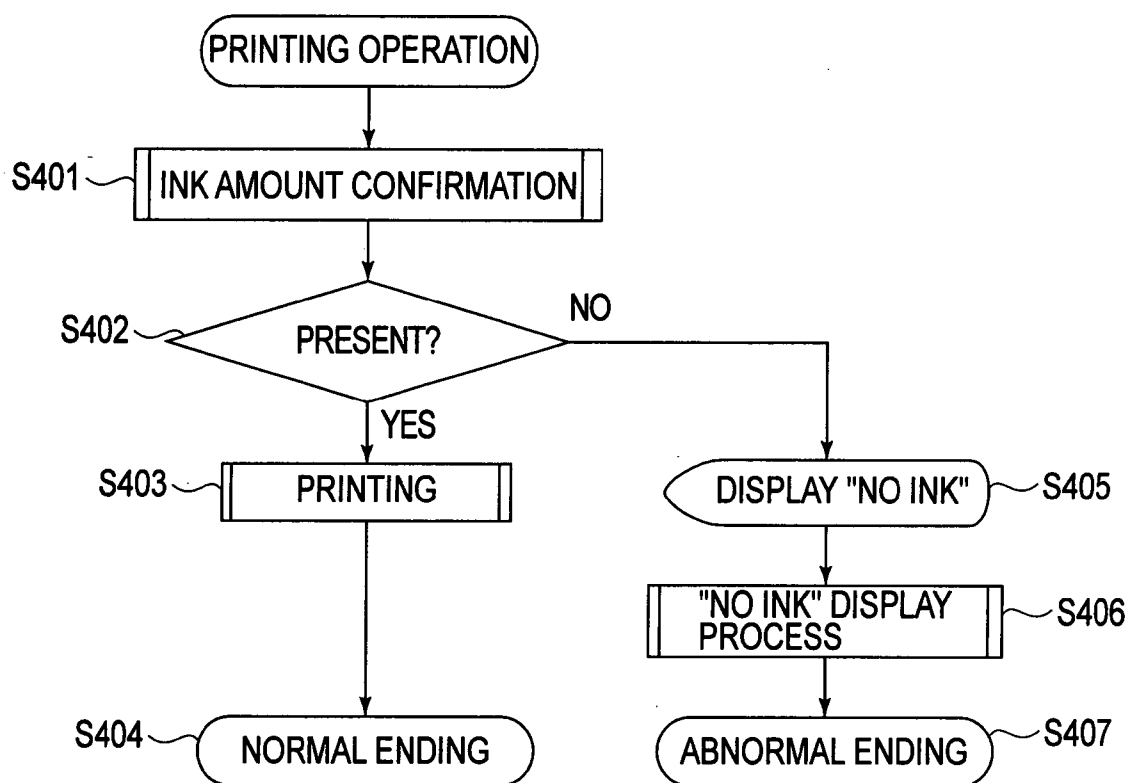


FIG.31

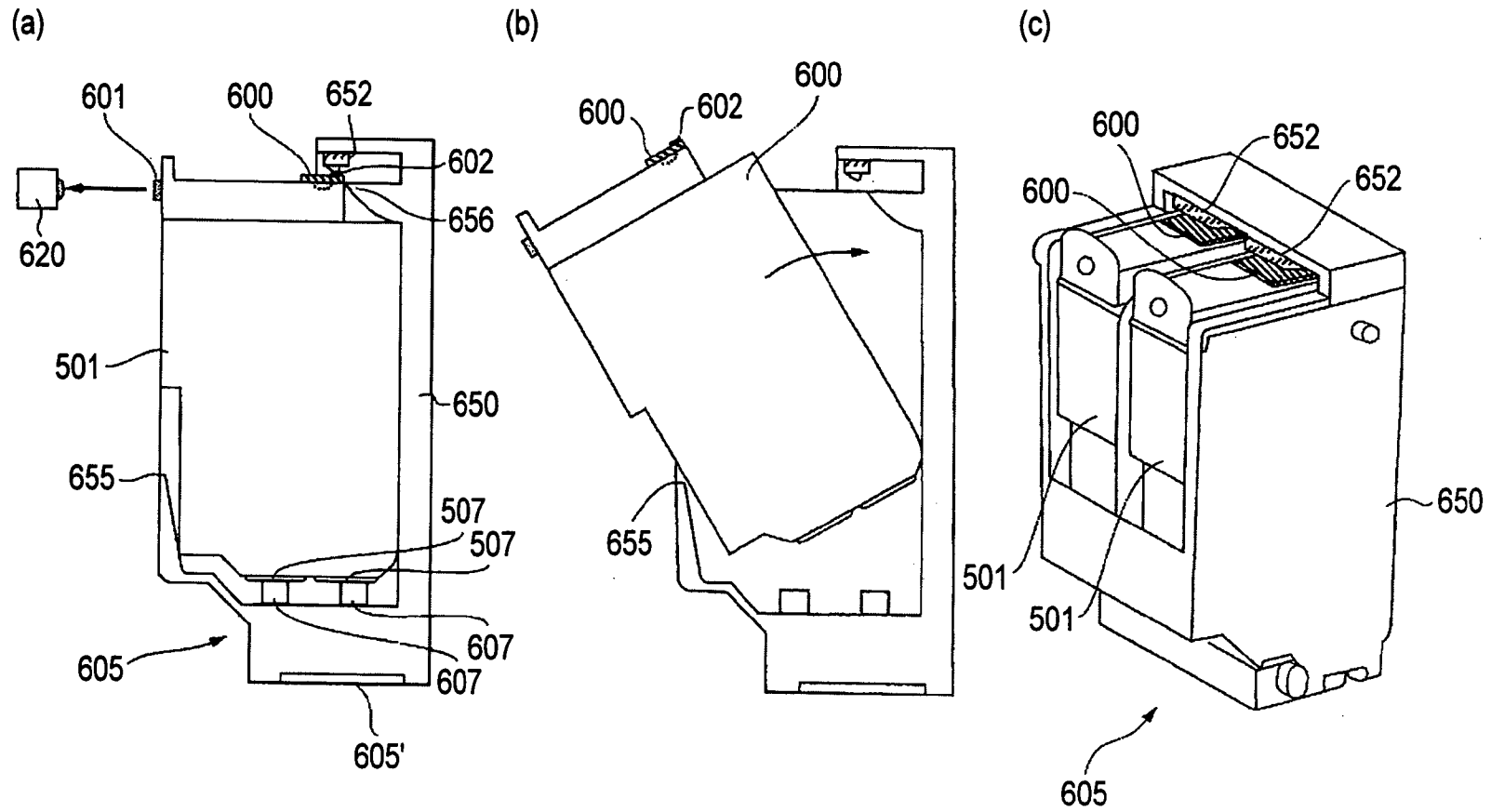


FIG. 32

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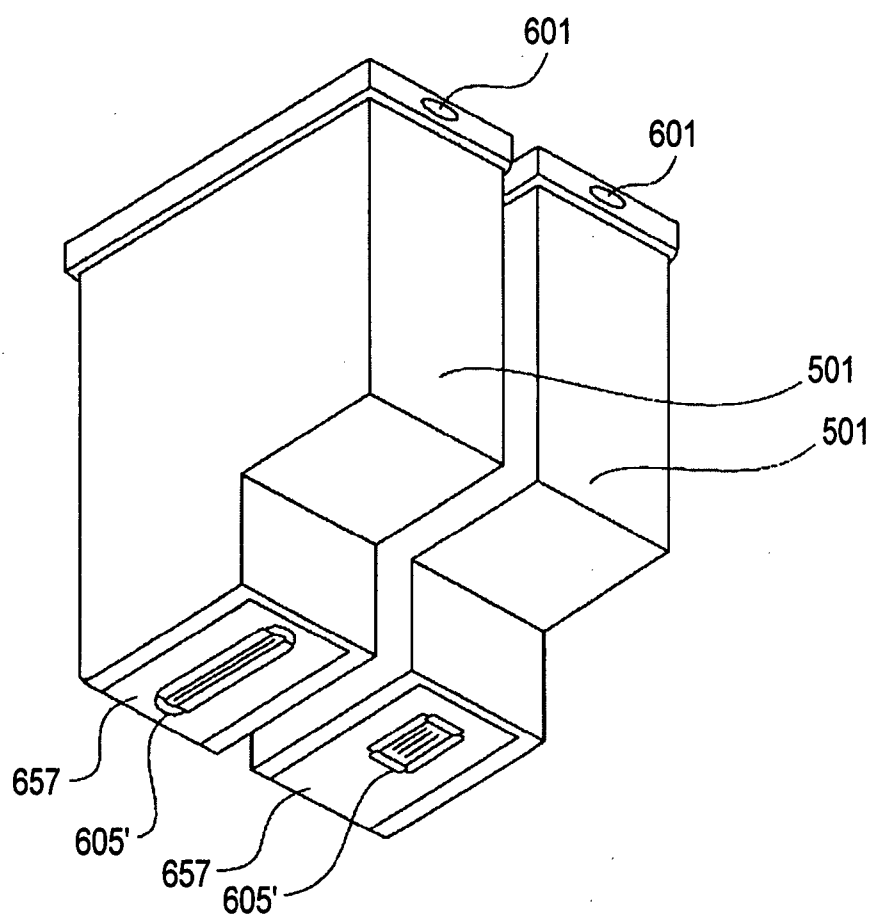


FIG. 33

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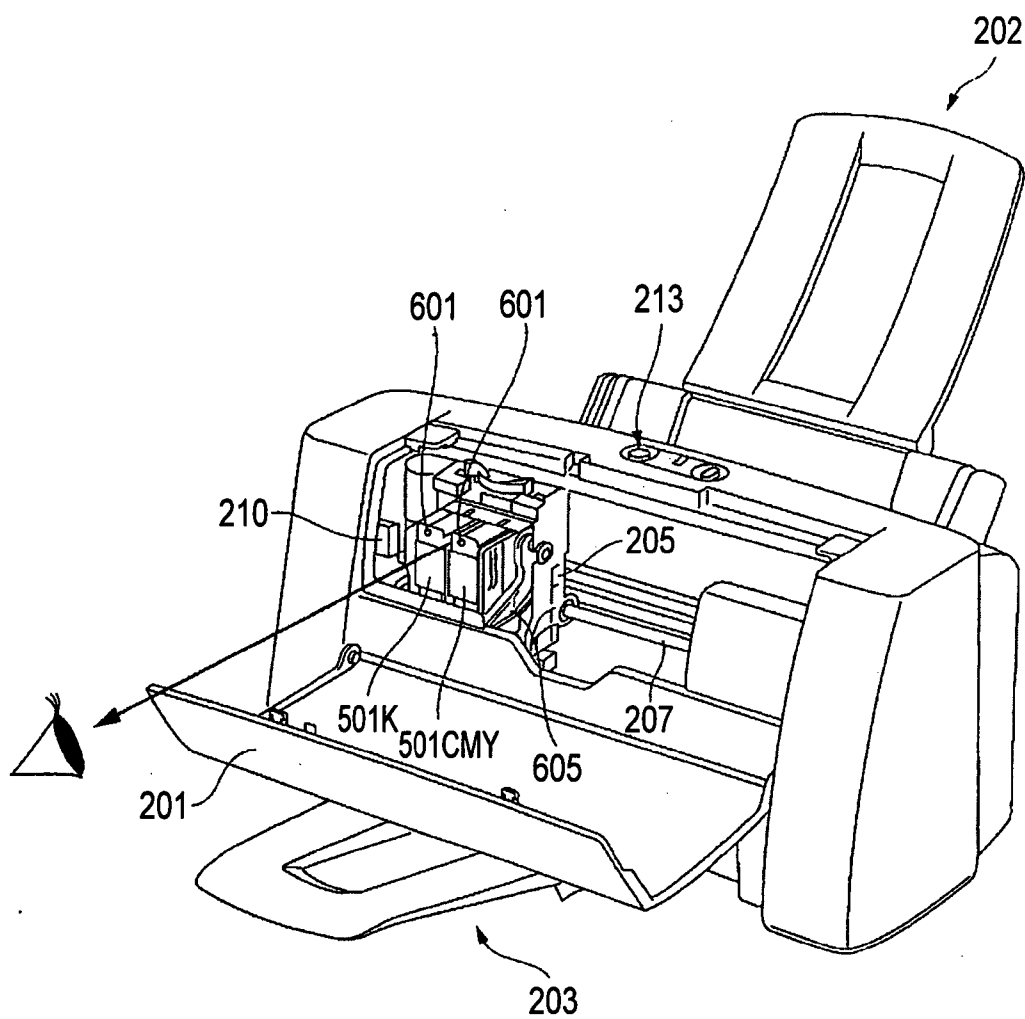


FIG.34

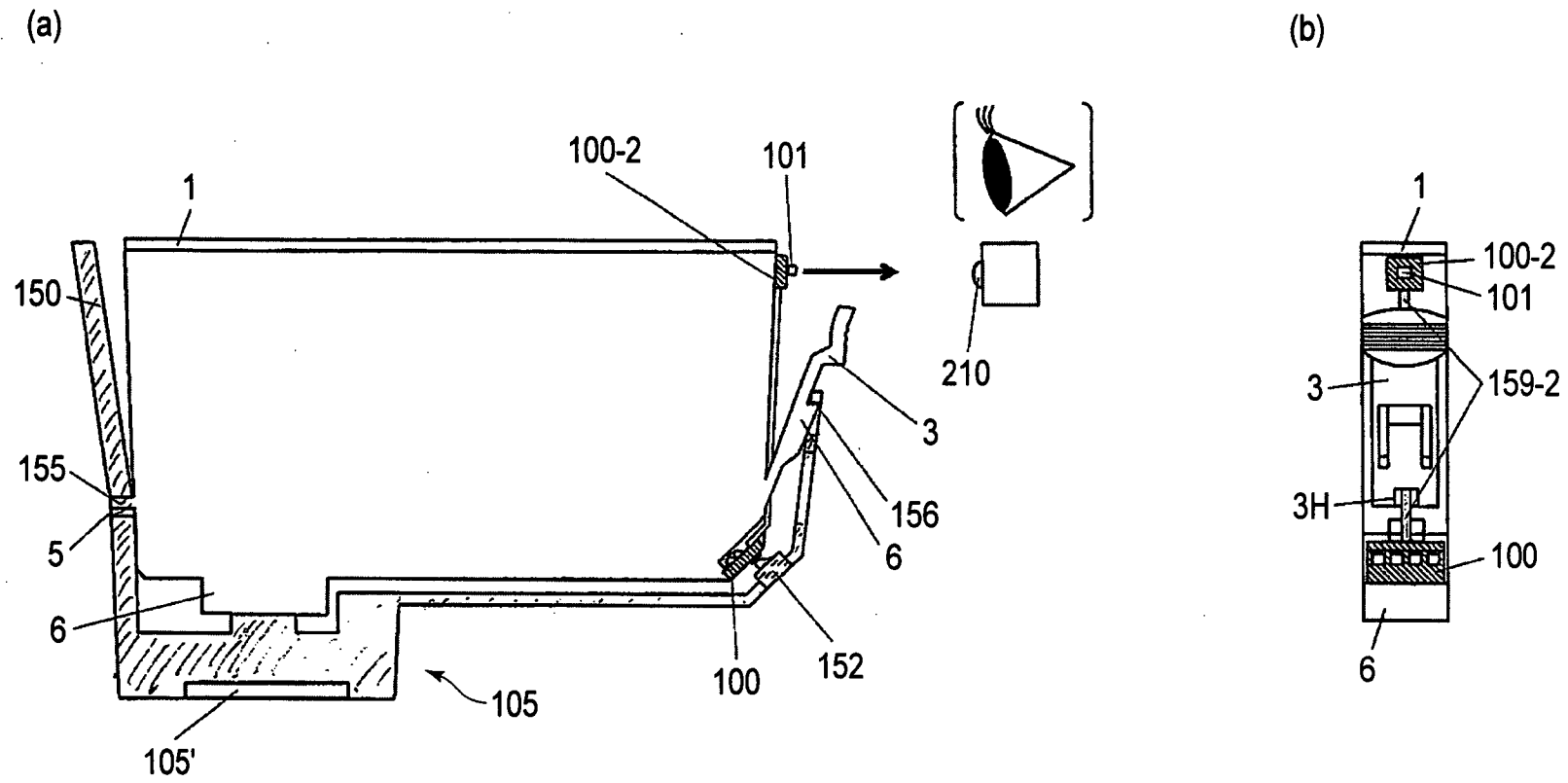


FIG.35

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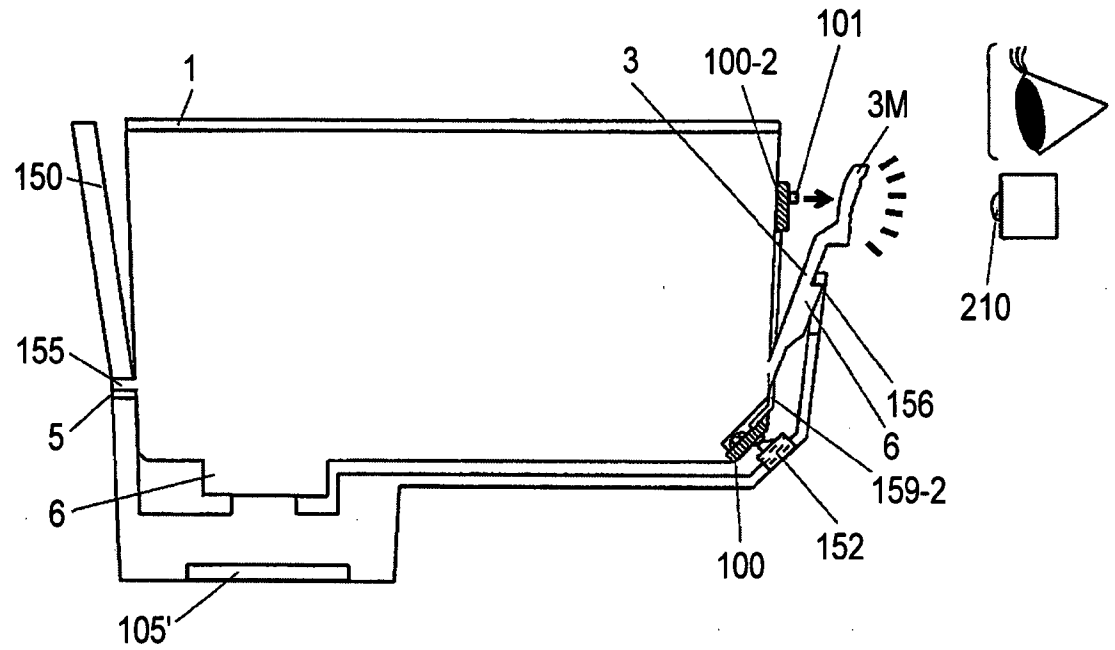


FIG. 36

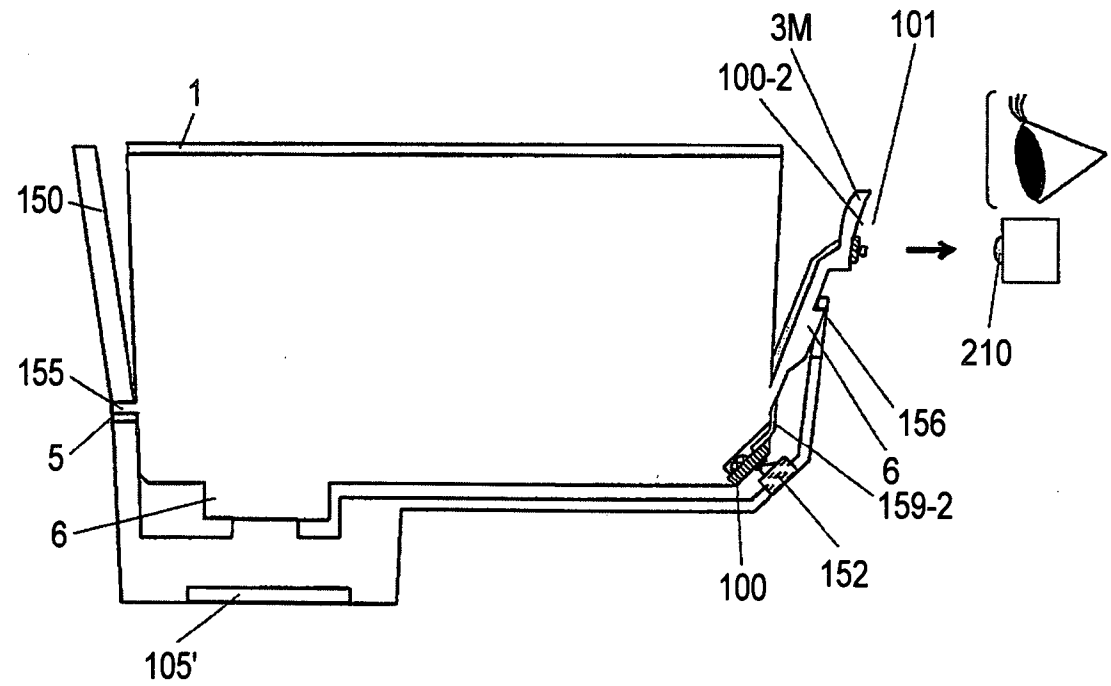


FIG. 37

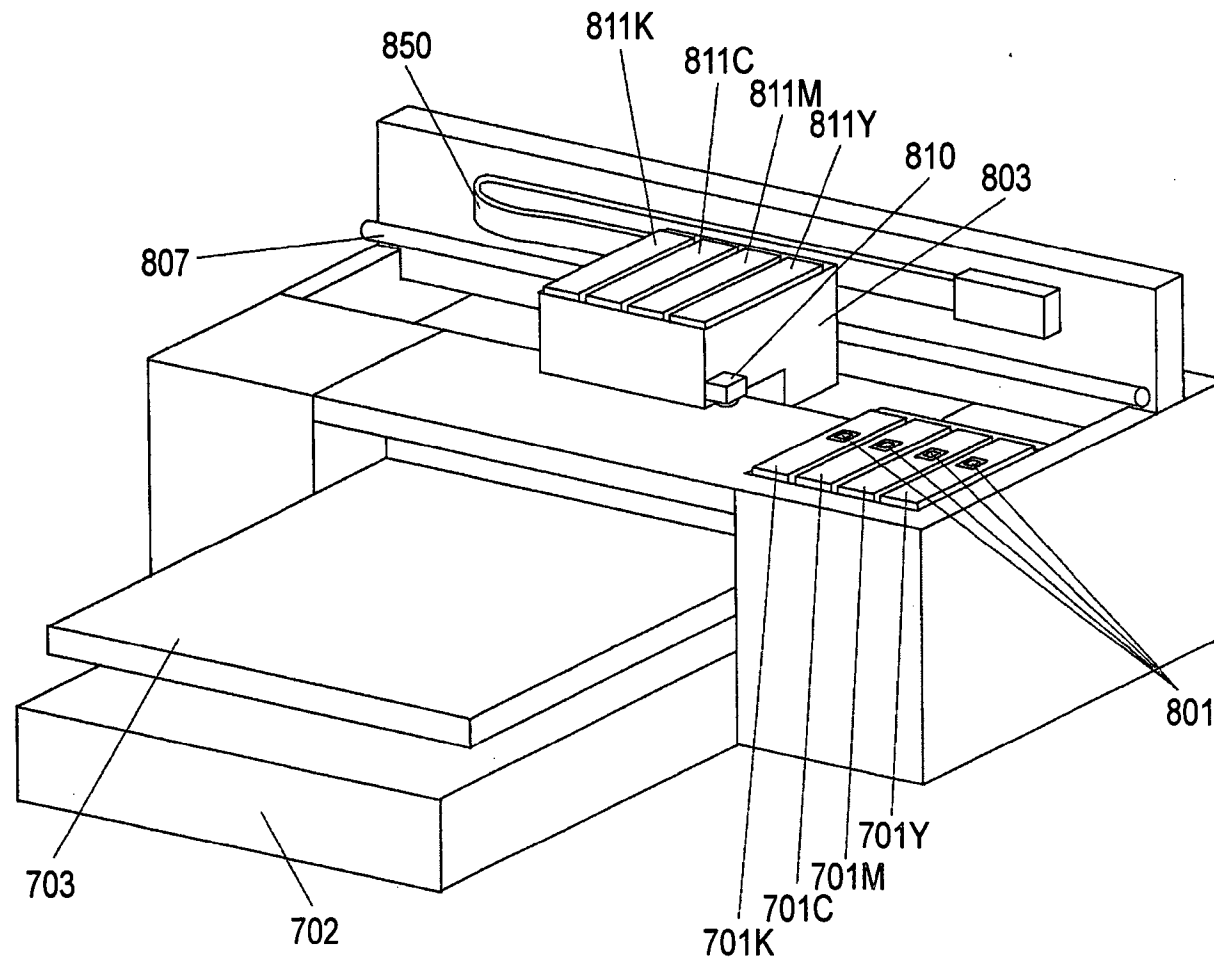


FIG. 38

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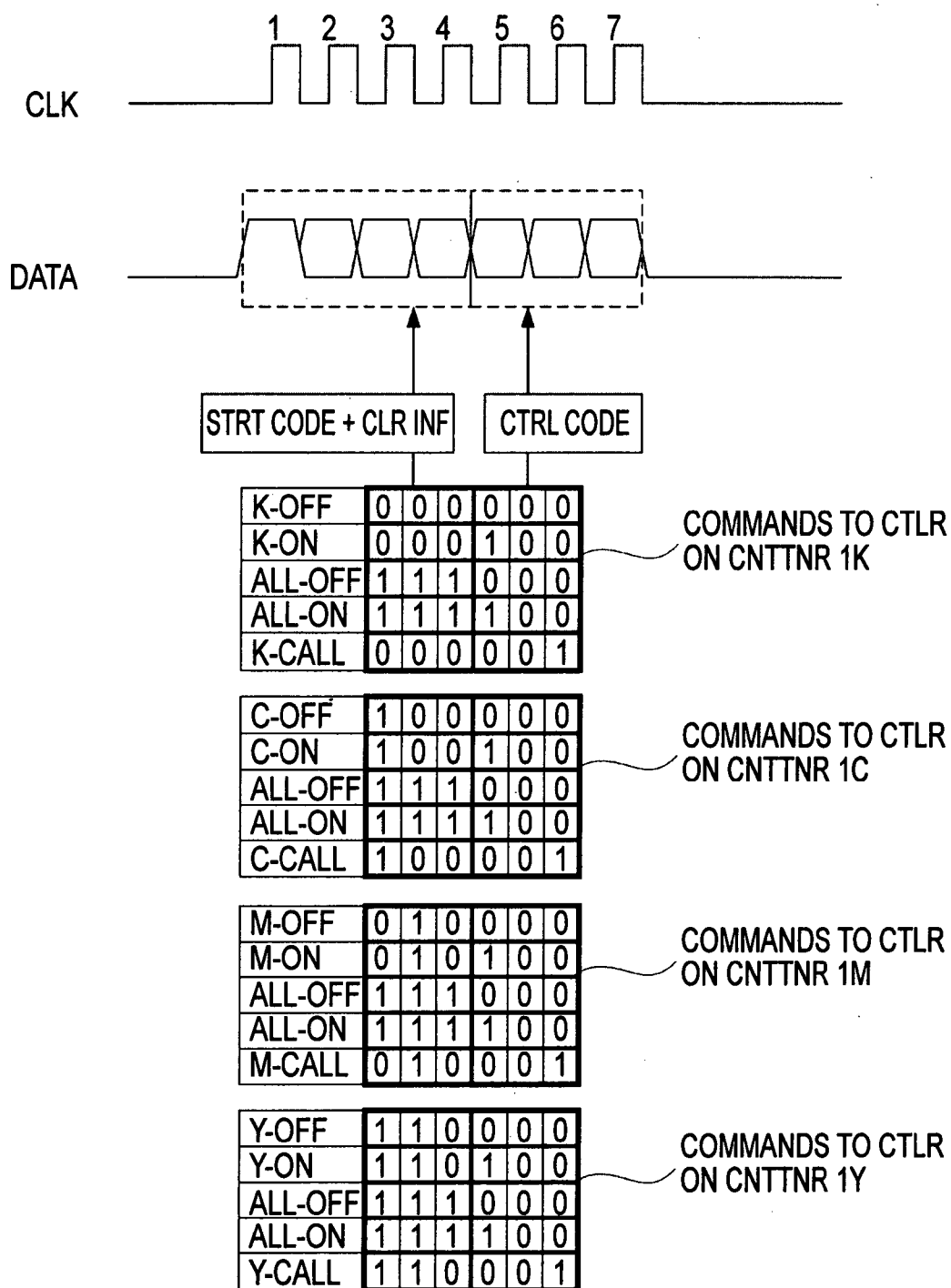


FIG. 40