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Ink reservoir cartridge system
Farbstoffpatrone mit Vorratsbehälter
Cartouche d'encre à réservoir

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The present invention relates generally to ink cartridges for high speed computer-driven printers such as ink jet printers and plotters. More particularly, the invention relates to an ink cartridge allowing a high flow rate and more accurate monitoring of an ink level in a ink reservoir within the cartridge adjacent a print head, and replenishment of ink in such a cartridge.

The ink reservoir of a print head ink cartridge is ordinarily maintained at a sub-atmospheric or "negative" pressure so that ink will not leak or drool from the print head. Various types of ink reservoirs are commonly used, including refillable ink reservoir cartridges which are "on-board" i.e. mounted on the movable printer carriage, throwaway replaceable cartridges, and remote or "off-board" ink reservoirs from which ink is drawn to the print head by tubing. In the latter case it is desirable to have some ink reservoir capacity "on-board" the printer carriage, to allow continuous printing regardless of variations in flow and pressure of ink to the print head from the off-board ink supply. Further information regarding on-board cartridges can be found in U.S. Patent Nos.: 5,280,300 issued January 18, 1994 to Fong, et al.; 5,325,119 issued June 28, 1994 to Fong; and 5,359,353 issued October 25, 1994 to Hunt, et al.

It has been found desirable to provide an on-board ink reservoir cartridge having a relatively high flow rate to the print head from the on-board reservoir. It has also been found to be desirable to monitor the volume of ink in such an on-board ink reservoir to effect appropriate replenishment of the on-board ink reservoir from an off-board ink supply. These features give rise to a system which can print at high speeds and employ an off-board ink supply, as the on-board reservoir provides high ink flow capacity for short intervals, and the ink volume in the on-board reservoir can be kept at an adequate amount.

EP-A- 0604118 discloses an ink reservoir cartridge system for a computer-driven printer having: a rigid housing with first and second sides, an interior ink chamber and an ink channel in fluid communication with a print head and a viewing location, an ink level indicator, and a spring for biasing said movable walls, a present position of said ink reservoir within the cartridge adjacent a print head, and replenishment of ink in such a cartridge.

The present invention seeks to provide a carriage-borne ink reservoir for a computer-driven printer comprising a housing with a viewing location, through which there is a sight path from a first to a second side of the housing, and through which a position of an ink level indicator is observable at said viewing location from a position outside of said housing.

According to the present invention, there is provided a carriage-borne ink reservoir cartridge system for a computer-driven printer characterized by:

- a rigid housing having first and second sides, an interior ink chamber and an ink channel in fluid communication with a print head, and a viewing location; an ink level indicator comprising a movable wall supported by said housing and movable with respect to said housing and in fluid communication with said interior ink chamber;
- a present position of said ink indicator wall being observable at said viewing location from outside of said housing, said present position being related to the present volume of ink in said carriage-borne ink reservoir cartridge system, the system being characterized by:
  - a spring for biasing said movable wall to enlarge the volume of said interior ink chamber and in that said viewing location comprises a first opening on said first side where light can pass through said first side of housing and a second opening on said second side
  - where light can pass through said second side of said housing whereby a line of sight is afforded through said housing through said first side and said second side allowing in observation through said housing from said first side to said second side; by a connector facilitating connection of a fluid supply conduit in fluid communication with an off-board ink supply; and
  - a flow limitation in said connector limiting pressure fluctuations in said carriage-borne ink reservoir cartridge system due to pressure variations in said fluid supply conduit in fluid communication with said off-board ink supply.

FIGURE 1 is a perspective view of a computer controlled printer, illustrating the environment of the present invention;
FIG. 2 is a perspective view of a print head ink cartridge for a thermal ink jet printer incorporating an ink reservoir of the invention;
FIG. 3 is an exploded perspective view of the
ink cartridge of FIG. 2 containing a collapsible ink reservoir structure;
FIG. 4 is an elevational cross section of the cartridge of FIG. 2, taken along line 4-4 in FIG. 2; FIG. 5 illustrates a further embodiment of the invention, being an elevational cross section of the cartridge of FIG. 6 partially in cut-out, taken along line 5-5 in FIG. 6; and FIG. 6 is an elevational view of the cartridge of FIG. 5, as seen from the right side of the cartridge as viewed in FIG. 5.

[0010] With reference to FIG. 1, a computer-driven ink jet printer 10 includes a carriage 12 slidably supported on supports 14 and 15, and an encoder bar 16 which in conjunction with an optical scanner (not shown) monitors the position of the carriage. On-board print head and ink reservoir cartridges 17, 18, 19, and 20, are mounted on the carriage and each contain one of the colors (cyan, magenta, or yellow for example) customarily used in color printing, or black ink, enabling color printing, black composite and black only printing. For purposes of this discussion reference will be made to a single ink cartridge 20, but it will be apparent that the discussion is applicable to any or all of the ink cartridges shown.

[0011] An ink cartridge of the invention is seen in FIG. 2 to comprise a molded rigid plastic resin outer housing 22, having a cover plate 24 intended to be affixed, as by cementing or welding, to the remainder of the housing. The cartridge has an ink discharge aperture in its lowermost end wall (not shown) to which is affixed an electrically driven print head 26. A viewing location 28 is defined by a discontinuity in the housing 22 defined by a first slot 30 in a first side 32, and, as can be seen in FIG. 3, a second slot 34 aligned with the first slot, which allows a line of sight through the housing from the first side to a second, opposite, side 36.

[0012] With reference now to both FIGS. 2 and 3, an ink supply line 38 can be connected to the cartridge 20 via a connector, which in this exemplary embodiment comprises a septum 40 formed of an elastomeric material and disposed in an opening 42 in the housing 22, and a needle 44 adapted to pierce the septum. This connector gives a connection capability free of contamination by air or other impurities. A capillary tube comprising the inner lumen (not shown) through the needle also acts as a flow limiter and a pressure and flow fluctuation limiter or damper with respect to ink replenishment of the on-board reservoir from the flexible supply line 38. The septum can be pre-slit to allow connection of a needle with a relatively blunt point, and the septum can be compressively loaded to effect a seal of the slit or any opening formed therethrough by insertion of the needle 44 when the needle is withdrawn.

[0013] An air accumulator 46 can be incorporated in the ink supply line 38 adjacent the connector needle 44 to trap any air that may transit the ink supply line 38, and comprises a riser 48 and an air valve 50 formed of a porous membrane which allows air to pass therethrough, but will not allow ink or other liquids to pass through. A layer 51 of liquid over the membrane prevents air from entering the accumulator in the reverse direction, even if a sub-atmospheric pressure exists within the accumulator. A relatively viscous non-volatile liquid, such as glycol for example, is used to cover over the membrane in this way. A cover plate 52, incorporating a small opening 54 to allow escape of air, closes the top of the riser 48. Alternatively, or in addition, to the provision of the layer 51 of liquid, a check valve (not shown), such as a flapper or duckbill valve, biased to a closed position, can be provided. The check valve controls the opening 54 on the cover plate to allow escape of air from the riser and prevent air from being drawn into the riser if the pressure in the riser drops below atmospheric. In a further alternate embodiment (not shown), in place of the membrane one-way air valve a float valve could be employed, and, as will be apparent, a biased closed check valve such as described above must also be used therewith to prevent introduction of air into the riser when a vacuum is drawn on the interior of the riser sufficient to overcome the buoyancy of the float of such a valve.

[0014] Again referring to the illustrated embodiment, a ribbed tubular connection portion 56 of the riser 48 allows connection of the flexible ink supply line 38 to the riser. The needle 44 can advantageously be formed of the same material as the riser 48, for example of a polymeric resin, but can also be formed of a different material, such as a metal for example. Since it is essential that the riser remain relatively upright for the air accumulator to function properly in trapping air, a ledge 58 can be incorporated in the housing to prevent rotation of the air accumulator around a central axis of the needle connector, or the carriage 12 can be made to cooperate with the cartridge 20 to prevent such rotation.

[0015] With reference now to FIGS. 3 and 4, an inner ink reservoir structure formed within the housing 22 is comprised of a relatively rigid plastic frame formed in this case by the housing, and a flexible impervious ink bag membranous sheet 60, attached thereto by heat bonding peripheral edges of the membranous sheet to an inner periphery of the housing. An outermost ledge 62 of a series of three concentric ledges is provided around the interior of the housing for this purpose. The inner ink reservoir structure preferably contains a pressure regulator 64 which in turn is comprised of a pair of spaced substantially parallel plates 66, 68 urged apart by a spring 70 into engagement with the flexible membranous sheet 60 and a further concentric ledge 71. A chamber of variable volume is thus formed within the housing, which chamber is in fluid communication with the connector septum 40 via a channel 72 formed in the housing, and the print head via a further channel 74. An entrance to said further channel to the print head is defined by an innermost concentric ledge 76, and a filter
78 is supported thereby and attached thereto at its peripheral edges preventing impurities from entering. The configuration of the invention allows a filter of relatively large cross-sectional area to be employed, giving rise to commensurately relatively higher ink flow capacities therethrough. The lowermost portion of the outer housing 22 (as viewed in FIG. 4) is provided with an ink discharge aperture 80 through which ink is downwardly discharged from the channel 74 leading from the filter 78 to the print head 26.

[0016] The pressure regulator side plates 66, 68, best seen in FIG. 3, are of generally rectangular configuration with rounded corners to avoid damaging the flexible ink bag membranous sheet 60. One or more openings 82 is provided in each plate to allow ink to flow therethrough to the filter 78 in the assembled ink reservoir. The pressure regulator is reversible, facilitating assembly.

[0017] When assembling the cartridge 20, after installing the septum 40 and print head 26, the filter 78, pressure regulator 64, membranous sheet 60, and cover plate 24 are attached in that order. As will be apparent, the concentric ledges 62, 71, and 76 and stacked component arrangement make the inner ink reservoir very easy to assemble. Prior to or simultaneous with attachment of the membranous sheet 60, to the housing 22, the regulator 30 is placed in position and pre-loaded by collapsing it partially against the spring force such that it initially occupies in a prestressed collapsed condition a volume inside the inner ink reservoir bag formed by the housing 22 and membranous sheet 60. The amount of this pre-stressing and, as will be apparent, a biasing force on the flexible membranous sheet is readily controllable by the designer by selecting the desired degree of compression of the spring regulator 64.

[0018] The flexible membranous sheet 60 and a side plate 66 of the regulator 64 forms a movable wall 82 of the inner ink reservoir, and this movable wall gradually moves towards the housing 22 as the reservoir is evacuated of ink. The movable wall is visible along a line of sight comprising a light pathway through the slots 30, 34 defining the discontinuity in the housing forming the viewing location 28. The membranous sheet 60 is sized with enough extra membranous sheet material near their edges of attachment to the outermost concentric ledge 62 of the housing 22 that the wall is freely movable with the side plate between full and empty positions as best indicated in FIG. 4. It will be appreciated that when an inner ink reservoir formed by the housing 22 and the inner membranous sheet 60 is filled with ink, the movable wall 82 and the inner ink reservoir will appear as an ink level comprising an opaque obstruction in a line of sight through the housing at the viewing location 28.

[0019] Ideally, both side plates 66, 68 and the spring 70 are made of a noncorrosive metal such as stainless steel sheet and the housing 22 and ink bag membranous sheet 60 are made of inert plastics which do not react with print ink.

[0020] By observation of the movable wall 82 at the viewing location 28, a present ink volume in the inner ink reservoir can be determined. Although the position of the movable wall and ink volume are related, and that functional relationship is nonlinear. As will be apparent, ink volumes corresponding to relative locations of the movable wall and the cartridge housing 22 are easily obtained for a particular size and configuration of ink cartridge 20 by measuring the volume of liquid in the reservoir at various points along the range of movement of the movable wall with respect to the housing, and from that collected data the functional relationship of relative wall location to volume is synthesized. Alternatively, the relationship can be mathematically modeled, for example by use of computer-aided modeling techniques.

[0021] This functional relationship, subsequently embodied in stored processing steps of a printer controller (not shown), or a “look-up table” in permanent memory of such a controller, for example, or by other known means incorporated in the printer, allows monitoring of ink volume in the inner ink reservoir of an ink cartridge. For example, a photosensor (not shown) adjacent the first side 32 of the ink cartridge 20 detecting light projected through the viewing location from adjacent the second side 36 of the cartridge could indicate the location of the movable wall 82 with respect to the ink cartridge 20 at a present time instant at which the movable wall passes through and interrupts the projected light as the carriage 12 moves the ink cartridge past the light and photosensor. The position of the ink cartridge 20 can be inferred from the position of the carriage, which is determined continuously in relation to the encoder bar 16 in normal printer operation. The relative positions of the ink cartridge housing 22 and the movable wall 82 being known for the same time instant, the corresponding ink volume at that time instant is determined by a controller according to the prior-determined functional relationship. Alternatively, or in addition, to this exemplary method of sensing the ink level in the ink cartridge, the direction and speed of carriage motion is monitored in conjunction with the length of time segments when the photosensor detects projected light, and when it does not, as the ink cartridges 17, 18, 19, 20 pass by. The relative positions of the movable wall 82 and the cartridge 20 are derived from this data, and the ink volume subsequently determined. Replenishment of ink in the on-board reservoir can then be appropriately effectuated.

[0022] While an embodiment with one movable wall 82 has been described, it will be apparent that a cartridge 20 having two opposed movable walls (not shown) can also be used. Such an alternate embodiment will also necessarily have two viewing locations, one for each movable wall, and the volume of stored ink will be related to the distance between opposed walls.

[0023] With reference to FIGS. 5 and 6, a further alternate embodiment of the ink cartridge 20 of the invention is provided by orienting the movable wall 82 horizontally. Here like reference numbers refer to corre-
sponding elements in the previously described embodiment, and in general the above discussion applies to the description and operation of this second embodiment. However, the movable wall now moves vertically, and hence orthogonally to an axis of motion of the carriage 12 and the mounted ink cartridge 20. In this embodiment the position of the movable wall can be detected with a linear array of discrete photosensors (not shown) oriented vertically.

[0024] Or, in another exemplary embodiment, a single photosensor is located so as to trip when the movable wall drops below a predetermined level corresponding to a minimum ink volume to be maintained. The sensing of a low volume in turn triggers replenishment of the on-board reservoir with a predetermined volume of ink corresponding to the difference between the minimum volume and a "full" volume when the on-board reservoir would be completely full but for a reserve capacity (to accommodate, for example, unintended variations in replenishment volume).

[0025] From the forgoing it will be apparent that a carriage-borne, or "on-board," ink reservoir is provided which can be monitored with regard to an ink level and/or the ink volume contained therein. This facilitates appropriate replenishment of the on-board ink supply.

[0026] Persons skilled in the art will readily appreciate that various modifications can be made from the presently preferred embodiments of the invention disclosed herein and that the scope of protection is intended to be defined only by the limitations of the appended claims.

Claims

1. A carriage-borne ink reservoir cartridge system (20) for a computer-driven printer (10) comprising:

- a rigid housing (22) having first and second sides (32, 36), an interior ink chamber (73) and an ink channel (74) in fluid communication with a print head (26), and a viewing location (28); an ink level indicator comprising a movable wall (82) supported by said housing (22) and movable with respect to said housing (22) and in fluid communication with said interior ink chamber;
- a present position of said ink indicator wall (82) being observable at said viewing location (28) from outside of said housing (22), said present position being related to the present volume of ink in said carriage-borne ink reservoir cartridge system (20), the system being characterized by:
  - a spring (70) for biasing said movable wall (82) to enlarge the volume of said interior ink chamber (73) and in that said viewing location (28) comprises a first opening (30) on said first side (32) where light can pass through said first side of housing and a second opening (34) on said second side (36) where light can pass through said second side of said housing whereby a line of sight is afforded through said housing through said first side and said second side allowing an observation through said housing from said first side to said second side; by a connector (40, 44) facilitating connection of a fluid supply conduit (38) in fluid communication with an off-board ink supply; and a flow limitation in said connector (40, 44) limiting pressure fluctuations in said carriage-borne ink reservoir cartridge system (20) due to pressure variations in said fluid supply conduit (38) in fluid communication with said off-board ink supply.

2. The ink reservoir cartridge system (20) of claim 1, characterized by:

- a flexible impervious membranous sheet (60) having peripheral edges sealingly bonded to an inner periphery (62) of said housing (22), forming said interior ink chamber of variable volume including said movable wall;
- a pressure regulator (64) disposed within said interior ink reservoir chamber (73) between said housing (22) and said membranous sheet (60), said pressure regulator (64) further comprising first and second side plates (66, 68) biased apart by said spring (70) disposed between said plates (66, 68), at least one of said plates (66 or 68) being configured to allow fluid flow past when positioned between said housing (22) and membranous sheet (60); said pressure regulator (64) being held in a compressed state where said spring (70) exerts pressure on said plates (66, 68), the first plate (68) being in force transmitting contact with said housing (22) and the second plate (66) being in force transmitting contact with said membranous sheet (60), whereby said ink chamber is biased to its greatest possible interior volume by said pressure regulator (64), giving rise to a sub-atmospheric pressure within said ink chamber.

3. The ink reservoir cartridge of claim 1 or 2, further characterized by a filter (78) disposed intermediate said ink reservoir chamber (73) and said ink channel (74) in communication with said print head (26), said filter (78) allowing filtered ink flow therethrough into the ink channel (74).

4. The carriage-borne ink reservoir cartridge system (20) of any preceding claim, characterized in that
said connector (40, 44) comprises a septum (40) adapted to receive a needle (44) in fluid communication with said fluid supply conduit (38).

5. The carriage-borne ink reservoir cartridge system (20) of claim 4, characterized in that said flow limitation comprises an inner lumen of the needle (44) of the needle and septum connector (40, 44) having a smaller cross-sectional area than the remainder of said fluid supply conduit (38).

6. The carriage-borne ink reservoir cartridge system (20) of any preceding claim, further characterized by an air trap accumulator (46) in fluid communication with said fluid supply conduit (38).

7. The carriage-borne ink reservoir cartridge system (20) of any preceding claim, further characterized by an air valve (50) in fluid communication with said air trap accumulator (46), said air valve (50) being configured to allow escape of air from said ink supply conduit (38) and prevent the escape of ink.

8. The carriage-borne ink reservoir cartridge system (20) of claim 7, characterized in that said air valve (50) comprises a porous membrane.

9. The carriage-borne ink reservoir cartridge system (20) of any preceding claim, characterized in that said housing (22) moves in either of two opposite directions parallel to, and commensurate with, movement of the carriage (12) on which it is carried, and in that said movable wall (82) moves in either of two opposite directions parallel to said directions of housing (22) and carriage (12) movement.

10. The carriage-borne ink reservoir cartridge system (20) of any of claims 1 to 8, characterized in that said housing (22) moves in either one of two opposite directions parallel to, and commensurate with, movement of the carriage (12) on which it is carried, and in that said movable wall (82) moves with respect to said housing (22) in either one of two opposite vertical directions transverse to said directions of housing (22) movement.

Revendications

1. Système de cartouche formant réservoir d'encre porté par un chariot (20) pour une imprimante (10) pilotée par un ordinateur, comprenant :

   un boîtier rigide (22) ayant un premier et un deuxième côté (32, 36), une chambre à encre intérieure (73) et un canal à encre (74) en communication fluidique avec une tête d'impression (26), et un emplacement permettant de voir (26) ;

   un indicateur de niveau d'encre comprenant une paroi amovible (82) soutenue par ledit boîtier (22) et mobile par rapport au dit boîtier (22) et en communication fluidique avec ladite chambre à encre intérieure ;

   une position actuelle de ladite paroi de l'indicateur d'encre (82), observable à l'emplacement permettant de voir de l'extérieur du boîtier (22), ladite position actuelle étant reliée au volume actuel d'encre dans ledit système de cartouche formant réservoir d'encre porté par un chariot (20), le système étant caractérisé par :

   un ressort (70) pour rappeler ladite paroi mobile (82) pour agrandir le volume de ladite chambre à encre intérieure (73) et en ce que ledit emplacement permettant de voir (28) comprend une première ouverture (30) sur ledit premier côté (32) où de la lumière peut passer à travers ledit premier côté du boîtier et une deuxième ouverture (34) sur le deuxième côté (36) où de la lumière peut passer à travers ledit deuxième côté dudit boîtier, en aménageant ainsi une ligne permettant de voir à travers ledit boîtier à travers ledit premier côté et ledit deuxième côté, en permettant une observation à travers ledit boîtier à partir dudit premier côté jusqu'au dit deuxième côté ;

   un connecteur (40, 44) facilitant un raccordement d'un conduit pour fournir un fluide (38) en communication fluidique avec un réservoir d'encre séparé ; et

   une limitation de la circulation dans ledit connecteur (40, 44) limitant les fluctuations de la pression dans ledit système de cartouche formant réservoir d'encre porté par un chariot (22), consécutives à des variations de pression dans ledit conduit pour fournir un fluide (38) en communication fluidique avec ledit réservoir d'encre séparé.

2. Système de cartouche formant réservoir d'encre (20) de la revendication 1, caractérisé par :

   une feuille formant une membrane impénétrable souple (60) ayant des bords périphériques soudés de manière étanche à une périphérie interne (62) dudit boîtier (22), formant ladite chambre à encre intérieure de volume variable comprenant ladite paroi mobile ;

   un régulateur de pression (64) disposé à l'intérieur de ladite chambre intérieure formant réservoir d'encre (73) entre ledit boîtier (22) et ladite feuille formant une membrane (60), ledit régulateur de pression (64) comprenant en outre
3. Cartouche formant réservoir d'encre de la revendication 1 ou de la revendication 2, caractérisée en outre par un filtre (78) disposé de manière intermédiaire entre ladite chambre formant réservoir d'encre (73) et ledit canal à encre (74) en communication avec ladite tête d'impression (26), ledit filtre (78) permettant une circulation d'encre filtrée à travers lui-même jusque dans la chambre à encre (74).

4. Système de cartouche formant réservoir d'encre porté par un chariot (20) conforme à l'une quelconque des revendications précédentes, caractérisé en ce que ledit connecteur (40, 44) comprend un diaphragme (40) adapté pour recevoir une aiguille (44) en communication fluidique avec ledit conduit pour fournir un fluide (38).

5. Système de cartouche formant réservoir d'encre porté par un chariot (20) de la revendication 4, caractérisé en ce que ladite limitation de la circulation comprend un lumen interne d'aiguille (44) de l'aiguille et du connecteur de diaphragme (40, 44) ayant une aire de section droite plus petite que le reste dudit conduit pour fournir un fluide (38).

6. Système de cartouche formant réservoir d'encre porté par un chariot (20) de l'une quelconque des revendications précédentes, caractérisé en outre par un accumulateur formant un piège à air (46) en communication fluidique avec ledit conduit pour fournir un fluide (38).

7. Système de cartouche formant réservoir d'encre porté par un chariot (20) de la revendication 6, caractérisé en outre par une valve à air (50) en communication fluidique avec ledit accumulateur formant piège à air (46), ladite valve à air (50) étant configurée pour permettre un échappement de l'air hors dudit conduit pour fournir de l'encre (38) et empêcher l'échappement de l'encre.

8. Système de cartouche formant réservoir d'encre porté par un chariot (20) de la revendication 7, caractérisé en ce que ladite valve à air (50) comprend une membrane poreuse.

9. Système de cartouche formant réservoir d'encre porté par un chariot (20) conforme à l'un des revendications précédentes, caractérisé en ce que ledit boîtier (22) se déplace dans l'une des deux directions opposées de manière parallèle et commensurable à un mouvement du chariot (12) sur lequel il est porté, et en ce que ladite paroi mobile (82) se déplace dans l'une des deux directions opposées de manière parallèle aux dites directions du mouvement du boîtier (22) et du chariot (12).

10. Système de cartouche formant réservoir d'encre porté par un chariot (20) conforme à l'une quelconque des revendications 1 à 8, caractérisé en ce que ledit boîtier (22) se déplace dans l'une des deux directions opposées, de manière parallèle et commensurable à un mouvement du chariot (12) sur lequel il est porté, et en ce que ladite paroi mobile (82) se déplace par rapport au dit boîtier (22) dans l'une quelconque parmi deux directions verticales opposées de manière transversale aux dites directions du mouvement du boîtier (22).

Patentansprüche

1. Ein an einem Wagen angebrachtes Tintenreservoir-Kassetensystem (20) für einen computerbetriebenen Drucker (10), das folgende Merkmale aufweist:

   - ein starres Gehäuse (22), das eine erste und eine zweite Seite (32, 36), eine innere Tintenkammer (73) und einen Tintenkanal (74), der sich in Fluidkommunikation mit einem Druckkopf (26) befindet, und eine Betrachtungsstelle (28) aufweist;

   - einen Tintenpegelindikator, der eine bewegliche Wand (82) aufweist, die durch das Gehäuse (22) gestützt ist, bezüglich des Gehäuses (22) beweglich ist und sich in Fluidkommunikation mit der inneren Tintenkammer befindet;

wobei eine gegenwärtige Position der Tintenindikatorwand (82) an der Betrachtungsstelle von außerhalb des Gehäuses (22) wahrnehmbar ist, wobei sich die gegenwärtige Position auf das gegenwärtige Tintenvolumen in dem an einem Wagen angebrachten Tintenreservoir-Kassetensystem (20) be-
zieht, wobei das System durch folgende Merkmale gekennzeichnet ist:

eine Feder (70) zum Vorspannen der beweglichen Wand (82), um das Volumen der inneren Tintenkammer (73) zu vergrößern, und insoweit, als die Betrachtungsstelle (28) eine erste Öffnung (30) auf der ersten Seite (32), an der Licht durch die erste Seite des Gehäuses passieren kann, und eine zweite Öffnung (34) auf der zweiten Seite (36) aufweist, an der Licht durch die zweite Seite des Gehäuses passieren kann, wodurch eine Sichtlinie durch das Gehäuse durch die erste Seite und die zweite Seite erhalten wird, die eine Beobachtung durch das Gehäuse von der ersten Seite zu der zweiten Seite ermöglicht;

einen Verbinder (40, 44), der eine Verbindung einer Fluidversorgungsleitung (38), die sich in Fluidkommunikation mit einer separaten Tintenversorgung befindet, ermöglicht; und

eine Flußbegrenzung in dem Verbinder (40, 44), die Druckschwankungen in dem an einem Wagen angebrachten Tintenreservoir-Kassetensystem (20) aufgrund von Druckvariationen in der Fluidversorgungsleitung (38), die sich in Fluidkommunikation mit der separaten Tintenversorgung befindet, begrenzt.

2. Das Tintenreservoir-Kassettensystem (20) gemäß Anspruch 1, gekennzeichnet durch folgende Merkmale:

-einen flexiblen undurchlässigen membranartigen Bogen (60), der periphere Kanten aufweist, die auf abdichtende Weise mit einer inneren Peripherie (62) des Gehäuses (22) verbunden sind, wobei es eine innere Tintenkammer eines variablen Volumens, die die bewegliche Wand umfaßt, bildet;

-einen Druckregler (64), der in der inneren Tintenreservorkammer (73) zwischen dem Gehäuse (22) und dem membranartigen Bogen (60) angeordnet ist, wobei der Druckregler (64) ferner eine erste und eine zweite Seitenplatte (68, 66) aufweist, die durch die zwischen den Platten (66, 68) angeordnete Feder (70) aus einandergepänpmt sind, wobei zumindest eine der Platten (66 oder 68) konfiguriert ist, um zu ermöglichen, daß ein Fluid vorbeiströmt, wenn sie zwischen dem Gehäuse (22) und dem membranartigen Bogen (60) positioniert ist; wobei der Druckregler (64) in einem komprimierten Zustand gehalten wird, bei dem die Feder (70) einen Druck auf die Platten (66, 68) ausübt, wobei sich die erste Platte (68) in einem kraftübertragenden Kontakt mit dem Gehäuse (22) befindet und sich die zweite Platte (66) in einem kraftübertragenden Kontakt mit dem membranartigen Bogen (60) befindet, und wodurch die Tintenkammer durch den Druckregler (64) zu ihrem größtmöglichen Innenvolumen vorgepünt wird, was zu einem subatmosphärischen Druck in der Tintenkammer führt.

3. Die Tintenreservorkassette gemäß Anspruch 1 oder 2, die ferner durch ein Filter (78) charakterisiert ist, das zwischen der Tintenreservorkammer (73) und dem Tintenkanal (74), der sich in Kommunikation mit dem Druckkopf (26) befindet, angeordnet ist, wobei das Filter (78) einen Fluß einer gefilterten Tinte durch dasselbe in den Tintenkanal (74) ermöglicht.

4. Das an einem Wagen angebrachte Tintenreservoir-Kassettensystem (20) gemäß einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Verbinder (40, 44) eine Trennwand (40) aufweist, die ausgelegt ist, um eine Nadelfassung (44), die sich in Fluidkommunikation mit der Fluidversorgungsleitung (38) befindet, aufzunehmen.

5. Das an einem Wagen angebrachte Tintenreservoir-Kassettensystem (20) der Fig. 4, dadurch gekennzeichnet, daß die Flußbegrenzung ein inneres Lumen der Nadelfassung (44) des Tintenreservoir-Kassettensystems (20) aufweist, das eine kleinere Querschnittsfläche aufweist als der Rest der Fluidversorgungsleitung (38).

6. Das an einem Wagen angebrachte Tintenreservoir-Kassettensystem (20) gemäß einem der vorhergehenden Ansprüche, das ferner durch einen Luftauffangakkumulator (46) gekennzeichnet ist, der sich in Fluidkommunikation mit der Fluidversorgungsleitung (38) befindet.

7. Das an einem Wagen angebrachte Tintenreservoir-Kassettensystem (20) gemäß Anspruch 6, das ferner durch ein Luftventil (50) gekennzeichnet ist, das sich in Fluidkommunikation mit dem Luftauffangakkumulator (46) befindet, wobei das Luftventil (50) konfiguriert ist, um ein Entweichen von Luft aus der Tintenversorgungsleitung (38) zu ermöglichen und das Entweichen von Tinte zu verhindern.

8. Das an einem Wagen angebrachte Tintenreservoir-Kassettensystem (20) gemäß Anspruch 7, dadurch gekennzeichnet, daß das Luftventil (50) eine poröse Membran aufweist.

9. Das an einem Wagen angebrachte Tintenreservoir-
Kassettensystem (20) gemäß einem der vorhergehenden Ansprüche, **durch gekennzeichnet, daß** sich das Gehäuse (22) in einer von zwei entgegengesetzten Richtungen bewegt, die zu einer Bewegung des Wagens (12), auf dem es getragen wird, parallel sind und mit derselben in Einklang stehen, und dadurch, daß sich die bewegliche Wand (82) in einer von zwei entgegengesetzten Richtungen bewegt, die zu den Richtungen der Bewegung des Gehäuses (22) und des Wagens (12) parallel sind.

10. Das an einem Wagen angebrachte Tintentankreservoir-Kassettensystem (20) gemäß einem der Ansprüche 1 bis 8, **durch gekennzeichnet, daß** sich das Gehäuse (22) in einer von zwei entgegengesetzten Richtungen bewegt, die zu der Bewegung des Wagens (12), auf dem es getragen wird, parallel sind und mit derselben in Einklang stehen, und dadurch, daß sich die bewegliche Wand (82) bezüglich des Gehäuses (22) in einer von zwei entgegengesetzten vertikalen Richtungen bewegt, die zu den Richtungen der Bewegung des Gehäuses (22) quer verlaufen.