(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 092 548 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.04.2001 Bulletin 2001/16

(51) Int. Cl.[7]: **B41J 2/175**

(21) Application number: **00308069.4**

(22) Date of filing: **15.09.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **11.10.1999 GB 9924029**

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  Designated Contracting States:
  BE CH DE DK ES FI FR GR IT LI LU MC NL PT SE AT

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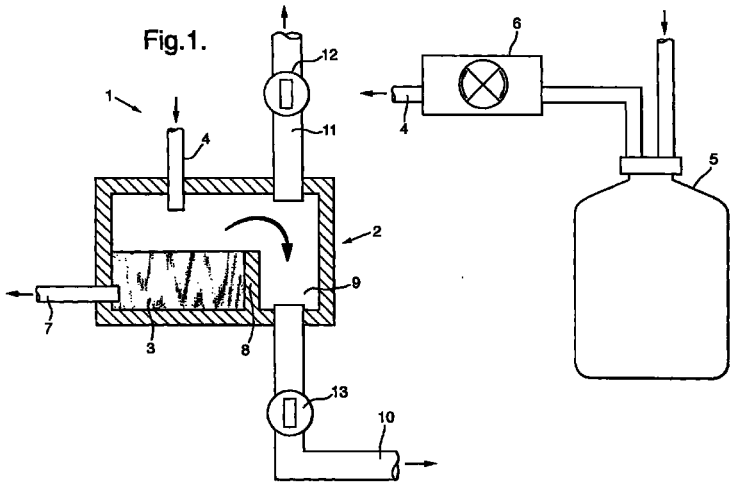
(54) An ink supply system

(57) An ink supply system for an ink jet printer comprising a buffering reservoir (2) having an outlet (7) communicating with a print engine, an ink feed means (4) communicating with an ink supply, and a weir means (8), wherein the ink feed means and the weir means cooperate to maintain a constant head of pressure within the reservoir.

Fig.1.



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Description

INTRODUCTION

[0001] The invention relates to an ink supply system for an ink jet print engine. In particular, the invention relates to an ink supply system for one or more piezoelectric print engines.

[0002] Print engines, and piezoelectric print engines in particular, are sensitive to ink supply pressure. Thus when ink is supplied to such an engine under pressure the performance of the engine will be less than optimal. In many cases the engines will leak due to ink under pressure bleeding from the engine. One known means of overcoming these difficulties is to provide each print engine with an ink supply in the form of a cartridge, which engages with the engine and provides ink thereto at a constant pressure. A problem with such a system is that ink cartridges are expensive and generally limited by their capacity and size. Hence, they need to be replaced frequently which is a costly and time-consuming exercise. A further problem with this known system is that each ink print engine supplier will have a particular form of ink filled cartridge and when a user wishes to use a different ink, it will be likely that the cartridge which carries the desired ink will not match the print engine.

[0003] EP-A-0510665 discloses an ink jet head cartridge in which a slope is provided inside an ink tank. Acceleration of the ink jet head cartridge scanned for recording and an inertia of ink are utilised to allow the ink to climb the slope, whereby the ink can be favourably supplied to the recording head.

[0004] US-A-4456916 discloses a disposable ink jet cartridge, which comprises a reservoir to contain ink divided into two compartments by a fixed height wall. The first compartment supplies ink to an on-demand ink jet nozzle and the second compartment contains an ink supply and a float which may be depressed into the ink thereby displacing the ink in the second compartment, forcing the ink over the wall into the first compartment. While this arrangement ensures there is a constant hydrostatic pressure to the ink jet nozzle after each priming operation depressing the float, between priming operations the level of ink in the first compartment decreases as printing takes place thereby reducing the hydrostatic pressure.

[0005] An additional problem with known systems, which problem is intimately associated with a preferable embodiment of the invention, is that when a printing system employs more than one print engine, the cartridges associated with the print engines take up a lot of space to the extent that it is in many cases physically impossible to arrange the print engines together in a required orientation. This problem is particularly acute with the more recent high-resolution ink jet printing systems, which use two, or more overlapping print engines.

[0006] It is an object of the invention to provide a solution to at least some of the above problems.

STATEMENTS OF INVENTION

[0007] According to the invention there is provided an ink supply system for an ink jet printer comprising a buffering reservoir having an outlet communicating with a print engine, an ink feed means communicating with an ink supply, and a weir means, wherein the ink feed means and the weir means cooperate to maintain a constant head of pressure within the reservoir.

[0008] The print engine is generally disposed with respect to the buffering reservoir such that ink is supplied to the print engine under little or no pressure, typically by means of capillary pressure. Thus in one preferable embodiment of the invention the buffering reservoir and the print engine will be at substantially the same or similar levels. If the engine is located at a sufficiently higher level to the reservoir, it is likely that the engine or an upper part of the engine will run dry. Likewise, when the engine lies sufficiently below the reservoir, the engine, or at least a lower part of the engine will bleed ink. Neither of these situations is desirable. In view of this is preferred that the system includes means for adjusting the height of the reservoir with regard to the print engine. Thus, for example, the reservoir may be movably mounted on a vertical frame and optionally include means for clamping the reservoir at a desirable height. It should be noted that in many cases the tolerances in height differences between the engine and the reservoir which allow operation of the system without leaking are to a large extent determined by the particular print engine used.

[0009] Thus, using the system of the invention, ink will be supplied to the print engine under a constant pressure. Furthermore, the provision of a buffering reservoir allows the use of an ink supply which may be spaced from the print engine and which is not limited in space, size and capacity

[0010] In one embodiment of the invention, excess ink, which flows over the weir, is returned to the ink supply, generally under the force of gravity. The invention also encompasses systems where the overflow ink is returned to the ink supply under pressure.

[0011] In a preferable embodiment of the invention, the ink is pumped from the ink supply to the buffering reservoir, ideally by a peristaltic pump. Typically, the pump will supply ink to the reservoir constantly during use of the printing system. However the invention also encompasses systems where ink is supplied to the reservoir intermittently during use. Thus, for example, the system may include some feedback means for actuating the pump only when ink is being drawn from the reservoir by the print engine.

[0012] In a particularly preferable embodiment of the invention, the buffering reservoir includes air vent means. The air vent may simply vent the headspace above the reservoir to the atmosphere or ambient air.

This arrangement has been found to be particularly suitable for the removal of air bubbles from the ink within the reservoir. In one embodiment of the invention the air vent comprises a conduit extending out of the reservoir housing, which conduit is transparent and includes a valve.

[0013] In a particularly preferred embodiment of the invention, the system includes a plurality of buffering reservoirs each feeding a print engine. In this way, a plurality of print engines may be arranged in close proximity to each other with the ink supply spaced a suitable distance away. Generally with such a multiple buffering reservoir system a single ink supply will feed all the reservoirs. In such an arrangement it has been found to be advantageous to have each reservoir fed by an individual pump means as this has been found to reduce the incidence of individual ink feed lines into the reservoir becoming clogged due to air bubbles. Thus for example the peristaltic pump may have an internal manifold separating the ink feed into a number of separate feeds, wherein each individual ink feed will pass through a separate pumping chamber having a pumping impeller. Typically, all the impellers will be actuated by a common drive means.

[0014] The invention also provides a buffering reservoir for an ink jet printer ink supply system, the reservoir comprising an outlet communicating with a print engine, an ink feed means communicating with an ink supply, and a weir means, wherein the ink feed means and the weir means cooperate to maintain a constant head of pressure within the reservoir.

DETAILSED DESCRIPTION OF THE INVENTION

[0015] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings in which:-

Fig. 1 is a schematic view of an ink supply system according to the invention; and

Fig. 2 is a schematic view of an ink supply system according to an alternative embodiment of the invention.

[0016] Referring to the drawings, and initially to Fig. 1, there is illustrated an ink supply system according to the invention and indicated generally by the reference numeral 1which comprises a buffering reservoir housing 2 having an ink inlet 4, which feeds ink to the reservoir 3 from a bulk ink supply 5 via a peristaltic pump 6, and an ink outlet 7 which feeds ink under little or no pressure to a print engine (not shown). The reservoir housing 2 includes a weir 8, which functions to maintain a constant head of pressure in the reservoir 3 by separating it from an ink drain 9. Thus, once the reservoir has been primed to its fill level, excess ink flowing into the reservoir 3 from bulk supply 5 will spill over the weir 8 into the drain 9 from which it will be returned to the bulk supply 4 by means of a gravity feed system 10 (shown only partially). In addition, the system 1 includes an air vent line 11 having a tap 12.

[0017] In use the system is first primed with ink. This is done by closing a tap 13 on the drain 9, and switching on the peristaltic pump 6 until the reservoir housing 2 is full with ink. At this stage ink will begin to fill the air vent line 11 at which point tap 12 is closed. In this manner, the print engine feed line will be primed whereupon the drain tap 13 and the air vent trap 12 are opened allowing excess ink within the reservoir housing 2 be drained but leaving the head of ink within the reservoir 3.

[0018] Referring to Fig. 2 an alternative system is described (having four buffering reservoirs) in which parts similar to that described with reference to the previous embodiment are given the same reference numerals. In this embodiment the peristaltic pump 6 includes an inlet manifold 6a which divides the ink feed into four separate feeds which are each fed into an individual pump housing from which they are pumped via ink feeds 4 to the four buffering reservoirs 2a, 2b, 2c, 2d, each of which is constructed according to the embodiment shown and described with reference to Fig. 1. As can be seen from the schematic illustration in Fig. 1, each of the buffering reservoirs 2a to 2d feeds a print engine 15a to 15d, the reservoirs 2a to 2d being each adjusted in height so that they may be positioned at the same approximate height as their associated print engine 15a to 15d. This particular system also includes a drain manifold system which collects the excess ink from each reservoir before returning the pooled ink to a cachement reservoir 16 where the ink may be filtered before being returned to the bulk ink supply 5.

[0019] In this specification the term "ink jet printer" is taken to encompass all types of ink jet printers such as for example continuous ink jets such as binary, multi level deflection and hertz types and drop on demand types such as thermal and bubble ink jet, piezo and electrostatic types.

[0020] The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail without departing from the spirit of the invention

Claims

1. An ink supply system for an ink jet printer comprising a buffering reservoir having an outlet communicating with a print engine, an ink feed means communicating with an ink supply, and a weir means, wherein the ink feed means and the weir means cooperate to maintain a constant head of pressure within the reservoir.

2. A system as claimed in claim 1 in which excess ink,

which flows over the weir, is returned to the bulk ink supply.

3. A system as claimed in claim 2 in which the ink is returned to the bulk ink supply under gravity.

4. A system as claimed in any preceding claim in which the ink is pumped from the bulk supply to the buffering reservoir.

5. A system as claimed in any preceding claim in which the print engine is disposed with respect to the buffering reservoir such that ink is supplied to the print engine under little or no pressure.

6. A system as claimed in any preceding claim in which the buffering reservoir includes air vent means.

7. A system as claimed in any preceding claim in which the weir height is adjustable.

8. A system as claimed in any preceding claim in which the print engine is a piezoelectric print engine.

9. A system as claimed in any preceding claim in which there are provided a plurality of buffering reservoirs each feeding a print engine.

10. A system as claimed in claim 9 in which each buffering reservoir is fed from the same bulk ink supply.

11. A system as claimed in any preceding claim including a bulk ink supply.

12. A system as claimed in any preceding claim including one or more print engines

13. A buffering reservoir having an outlet communicating with a print engine, an ink feed means communicating with an ink supply, and a weir means, wherein the ink feed means and the weir means cooperate to maintain a constant head of pressure within the reservoir.

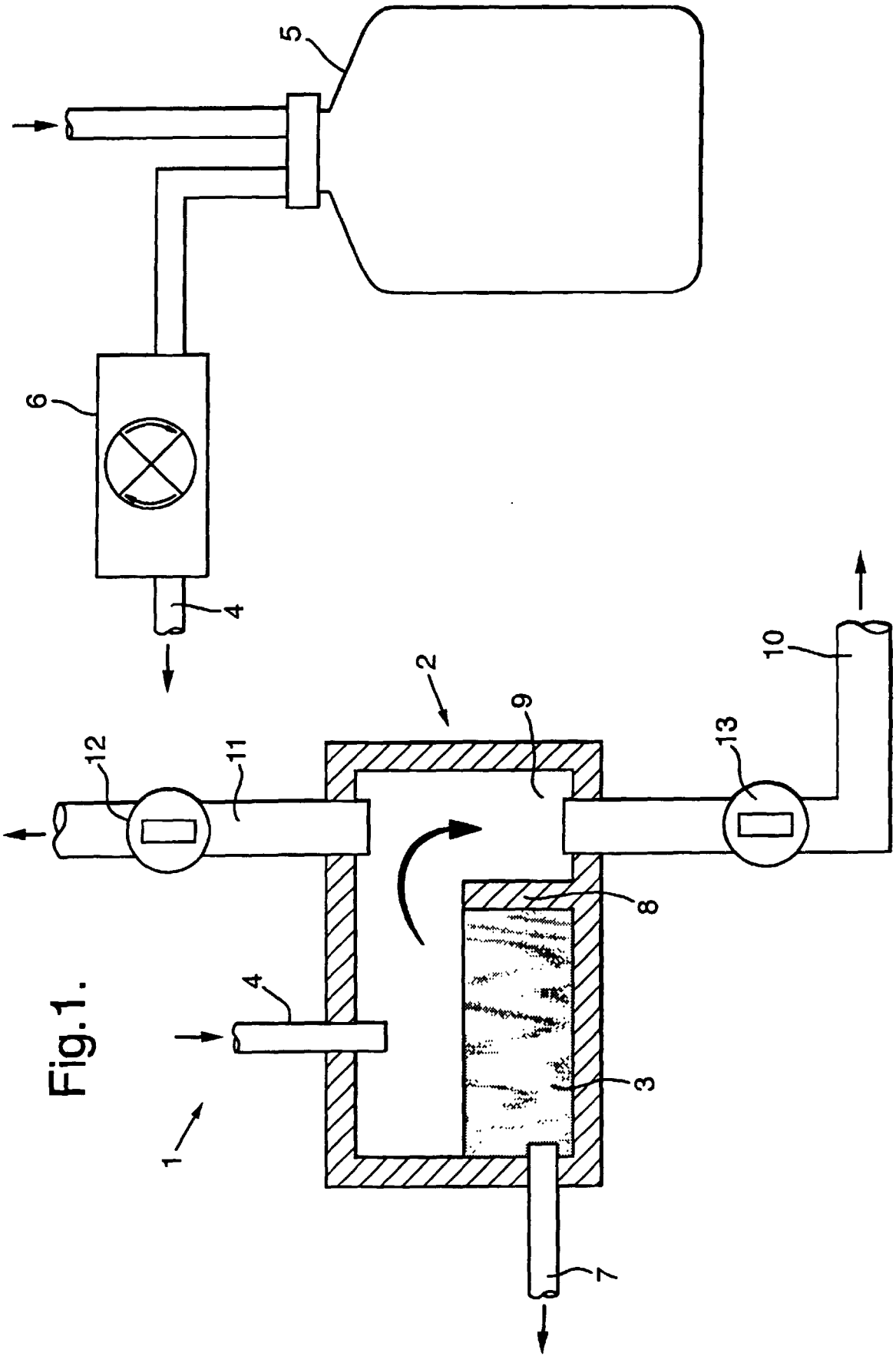

Fig.1.

Fig.2.