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(54) An Ink Supply System for Printers

(57) An ink supply system for inkjet printers, comprising two storage reservoirs (2, 3) which are reciprocally connected by a delivery line (4), in which a printing head (7) provided with at least a dispensing nozzle (72) of the ink is inserted, and by a return line (5), in which a recycling pump (52) is inserted: a first storage reservoir (2) being open to the atmosphere through a breather mouth (20) and the second reservoir (3) being associated to pressure control means (6) which internally maintain a pressure level which is lower than an atmospheric pressure.

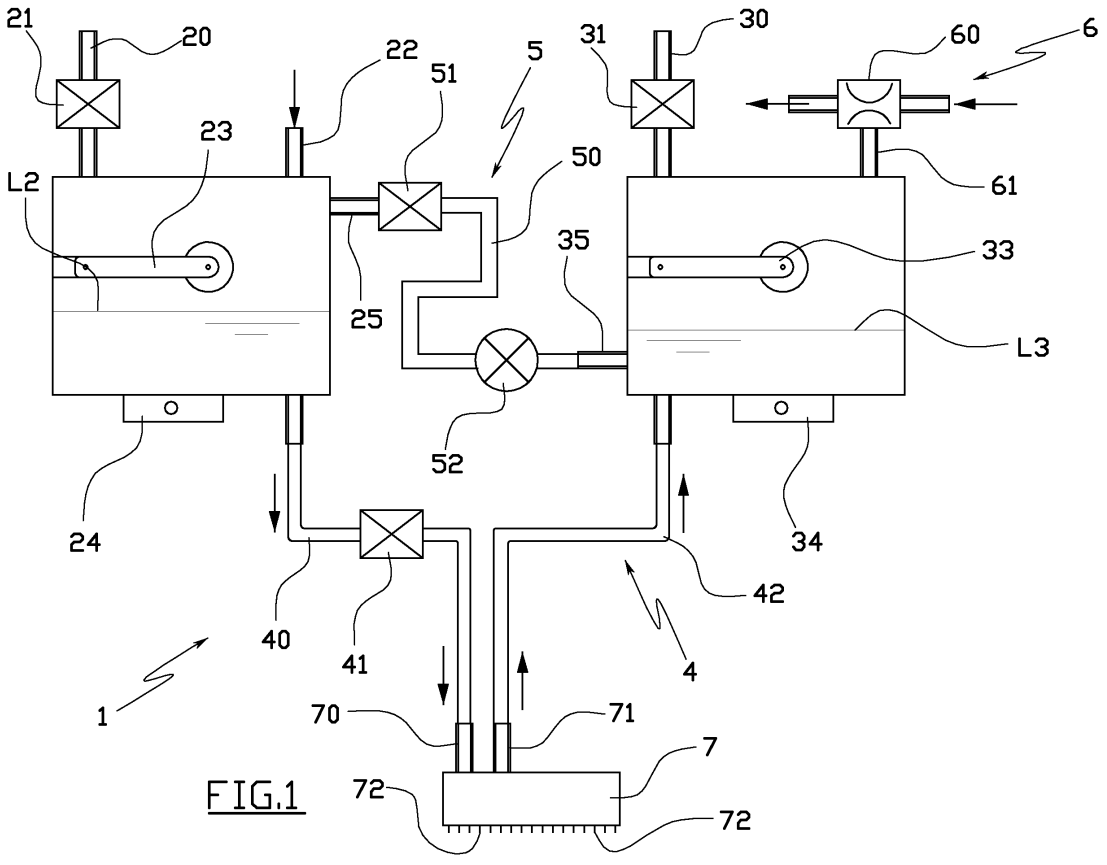

FIG.1

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Description

[0001] The invention relates an ink supply system for inkjet or glaze printers destined for decorating ceramic tiles.

[0002] In the following reference with be made to ink, though the term should be taken to refer also to ceramic glazes.

[0003] As is known, an inkjet printer exhibits a supply system of the ink which comprises at least a printing head, which is connected to a relative tank of ink, and is provided with a plurality of very small dispensing nozzles through which the ink is made to exit in a controlled way, in order to be applied on the surface to be printed on.

[0004] In traditional inkjet printers, the printing head is the terminal of a simple supply conduit, in which the ink runs in a single direction from the tank towards the dispensing nozzles.

[0005] The most up-to-date printing heads are inserted in a closed circuit in which, when the printing operations are stopped, the ink is made to circulate continually, such as to create a constant flow passing through the printing head without exiting from the dispensing nozzles. During this circulation, the ink is generally filtered each time before crossing the printing head, such as to eliminate the dirt and/or air bubbles which might be present in it.

[0006] In order to realise this system, printing heads comprise, apart from the above-mentioned dispensing nozzles, also an inlet conduit and an outlet conduit for the ink. The inlet conduit is connected to an upper storage reservoir, while the outlet conduit is connected to a lower storage reservoir, which is at a lower level than the first. Both tanks are kept at atmospheric pressure. The lower reservoir is in communication with the ink tank, and is connected to the upper reservoir through a recycling pump.

[0007] In this way, the height difference between the two tanks enables the ink to run from the upper reservoir to the lower reservoir, crossing the printing head, while the recycling pump pushes the ink which has accumulated into the lower reservoir, newly towards the upper reservoir.

[0008] Though being rather efficient, this ink supply system has exhibited some drawbacks relating to calibration and installation.

[0009] In particular, in order to overcome the circuit impedance and to guarantee a constant ink flow through the printing head, it is necessary for the upper and lower reservoirs to be separated by a considerable difference in level, which leads to a significant increase in the size of the system.

[0010] The level difference must also be accurately calibrated such as to create a constant slight depression at the printing nozzles of the printing head, so that the ink cannot accidentally exit due to the vibrations or to small impacts, thus introducing a series of not-irrelevant constructional difficulties.

[0011] With the aim of eliminating these drawbacks, closed-circuit ink supply systems have been developed, in which the circulation is not due to a height difference between the two tanks, but is obtained with two pressure control devices, which are associated to both the tanks, such as to impose a predetermined difference between them.

[0012] This solution enables the above-mentioned calibration and installation problems to be obviated, but however presents a considerable plant complication and thus a considerable hike in production costs.

[0013] The aim of the present invention is to resolve the drawbacks of supply systems based on a level difference, with a more rational, simple and relatively inexpensive solution with respect to those at present available. The aim is attained by the characteristics of the invention as reported in the independent claims. The dependent claims delineate preferred and/or particularly advantageous aspects of the invention.

[0014] In particular, an ink supply system is provided comprising two storage reservoirs which are reciprocally connected in a closed circuit by a delivery line, in which a printing head is inserted, which printing head is provided with at least an ink dispensing nozzle, and by a return line, in which a recycling pump is inserted.

[0015] According to the invention, a first reservoir is open to the atmosphere through a breather mouth, while the second reservoir is associated to pressure control means, which internally maintain a pressure level that is lower than atmospheric pressure.

[0016] Thanks to this solution, during pauses in printing, the recycling of the ink is created by the pressure difference between the tanks, caused by the depression imposed in the second tank.

[0017] The tanks can thus both be located at the same height, obviating the drawbacks in non-level systems, while the plant layout is much simpler and more economical than those at present available, as only one of the two tanks has to be provided with pressure control means.

[0018] Further, the pressure control means enable a precise calibration of the pressure difference between the two tanks, effectively preventing undesired ink leaks from the system during recycling.

[0019] Further characteristics and advantages of the invention will better emerge from a reading of the following description provided by way of non-limiting example, with the aid of the figures illustrated in the accompanying tables of drawings.

Figure 1 is a plant layout of the ink supply system of the invention, which is destined for an inkjet printer of a professional type.

Figure 2 is a schematic view in perspective elevation of a preferred embodiment of some components of the system of figure 1.

[0020] The ink supply system, denoted in its entirety by 1, comprises two storage reservoirs, respectively 2

and 3, which are positioned at a same height, and are reciprocally connected in a closed circuit by a delivery line 4 and a return line 5.

[0021] The reservoir 2 comprises a breather mouth 20 opening directly into the atmosphere, which is checked by a closing solenoid 21, and an inlet conduit 22, through which the ink contained in a tank (not illustrated) is supplied internally of the reservoir 2.

[0022] The reservoir 2 further comprises a level sensor 23, which detects the height of the level L2 of ink internally of the reservoir 2, and a heater 24, which regulates the temperature of the ink.

[0023] Similarly, the reservoir 3 comprises a breather mouth 30 which opens directly into the atmosphere, and which is checked by a closing solenoid 31, a level sensor 33 for detecting the height of the level L3 of the ink internally of the reservoir 3, and a heater 34, for regulating the temperature of the ink.

[0024] The level sensors 23 and 33 are not further described as they are of known type.

[0025] The heaters 24 and 34 are preferably realised in a single component, as illustrated in the constructional example of figure 2.

[0026] In particular, the reservoirs 2 and 3 are mounted side-by-side on a single support base 10, which exhibits a raised longitudinal wall 11 which is interposed contactingly between the reservoirs 2 and 3 and keeps them separate.

[0027] The support base 10 is realised in a material having a high heat conductivity, and is crossed by a longitudinally-developing electrical resistance 12, which is housed internally of the raised wall 11 and is connected to an electrical supply circuit (not illustrated).

[0028] In this way, the electrical resistance 12 is able to heat both the ink contained in the reservoir 2 and the ink contained in the reservoir 3, performing the function of both heaters 24 and 34 illustrated in figure 1.

[0029] The reservoir 3 further comprises pressure control and regulation means, denoted in their entirety by 6, which set internally thereof a predetermined pressure value, lower than atmospheric pressure.

[0030] In the illustrated example, the control means 6 comprise a venturi tube 60, which is connected with the reservoir 3 via a conduit 61 which opens at the narrow section of the venturi tube 60. The venturi tube 60 is crossed by a continuous air flow, such as to obtain a pressure drop in the narrowed section, and thus to create a depression in the reservoir 3.

[0031] A known-type printing head 7 is inserted in the delivery line 4, which printing head 7 is positioned at a lower height than the reservoirs 2 and 3.

[0032] The printing head 7 schematically comprises an inlet 70, an outlet 71 and a plurality of small ink-dispensing nozzles 72, open to the atmosphere.

[0033] The inlet 70 is connected to the reservoir 2 via a first conduit 40, along which an ink filter 41 is inserted, while the outlet 71 is connected to the reservoir 3 via a second conduit 42 of the delivery line 4.

[0034] The return line 5 comprises a single conduit 50 in which a recycling pump 52 is inserted, which collects ink from an outlet mouth 35 of the reservoir 3 in order to push it towards an inlet mouth 25 of the reservoir 2. The inlet mouth 25 is located higher than the outlet mouth 35, such as to prevent backflow of the ink.

[0035] An ink filter 5 is also inserted in the line, which is interposed between the recycling pump 52 and the reservoir 2.

[0036] When the supply system 1 is active, the heaters 24 and 34 regulate the temperature of the ink contained in the respective reservoirs 2 and 3, such that the dynamic viscosity of the ink is preferably comprised between 12 and 60 centipoise (cP).

[0037] The breather mouth 20 of the reservoir 2 is open, such that the pressure internally of the reservoir 2 is always atmospheric, while the breather mouth 30 of the reservoir 3 is kept closed by the solenoid 31.

[0038] At the same time a continuous air flow is made to cross the venturi tube 60, such as to place the reservoir 3 in depression and thus consequently impose a predetermined pressure difference between the reservoir 3 and the reservoir 2.

[0039] When the printer is not required for printing, the pressure in the reservoir 3 is regulated to a minimum level, i.e. high depression, such that the pressure difference between the reservoirs 2 and 3 reaches a maximum value, able to overcome the overall impedance of the delivery line 4.

[0040] In this way, a continuous ink flow is set up in the delivery line 4, which ink flow, leaving the reservoir 2, first crosses the filter 41, then the printing head 7 without exiting the dispensing nozzles 72, and finally rises and returns internally of the reservoir 3.

[0041] On crossing the filter 41, the ink is rid of any particles of dirt and/or air bubbles which might have formed in the reservoir 2.

[0042] When the sensor 33 detects that the level L3 of the ink in the reservoir 3 has exceeded a predetermined threshold value, the recycling pump 52 enters into operation, such as to source ink from the reservoir 3, pass it through the filter 51 and newly pour it internally of the reservoir 2, completing the cycle.

[0043] On crossing the filter 51 the ink is purified of any particles of dirt and/or air bubbles which might have formed in the reservoir 3, or on passing through the recycling pump 52.

[0044] During the printing operations, the pressure in the reservoir 3 is increased, i.e. the depression is reduced, such that the pressure difference between the reservoirs 2 and 3 is brought to a minimum level, not sufficient to overcome the impedance of the delivery line 4.

[0045] In this way, the ink runs only along the first tract 40 of the delivery line 4, flowing from the reservoir 2 towards the printing head 7.

[0046] The ink passes through the filter 41, in which it is purified, and when it reaches the printing head 7 it exits

through the dispensing nozzles 72 which are at atmospheric pressure and is deposited on the surface to be printed.

[0047] When the sensor 23 detects that the level L2 of the ink in the reservoir 2 has fallen below a predetermined threshold level, the system supplies fresh ink from the tank to the reservoir 2, through the inlet conduit 22.

[0048] Finally, when the supply system 1 is deactivated, the solenoid 21 closes the breather mouth 20 of the reservoir 2, such that the ink remains confined inside the closed circuit and cannot exit the dispensing nozzles 72 of the printing head 7.

[0049] Obviously a technical expert in the sector might make numerous modifications of a technical-applicational nature to the above-described supply system, without its forsaking the ambit of the invention as claimed herein below.

Claims

1. An ink supply system for inkjet printers, comprising two storage reservoirs (2, 3) which are reciprocally connected by a delivery line (4), in which a printing head (7) provided with at least a dispensing nozzle (72) of the ink is inserted, and by a return line (5), in which a recycling pump (52) is inserted, **characterised in that** a first storage reservoir (2) is open to the atmosphere through a breather mouth (20) and a second reservoir (3) is associated to pressure control means (6) which internally maintain a pressure level which is lower than an atmospheric pressure.

2. The system of claim 1, **characterised in that** the first reservoir (2) and the second reservoir (3) are located at a same height.

3. The system of claim 1, **characterised in that** the pressure control means (6) comprise a venturi tube (60) which is in communication with the second reservoir (3) via a conduit (61) which opens at a narrowed section of the venturi tube (60).

4. The system of claim 1, **characterised in that** it comprises heating means (24, 34) for regulating the temperature of the ink in the first reservoir (2) and the second reservoir (3).

5. The system of claim 4, **characterised in that** the heating means (24, 34) comprise a single body (10) of a heat-conducting material, which single body (10) is located in contact with both reservoirs (2, 3) and which is crossed by at least an electrical resistance (12).

6. The system of claim 1, **characterised in that** it comprises a first filter (41) of the ink, which first filter (41) is inserted along the delivery line (4) between the first reservoir (2) and the printing head (7).

7. The system of claim 1, **characterised in that** it comprises a second filter (51) of the ink, which second filter (51) is inserted along the return line (5), between the recycling pump (52) and the first reservoir (2).

8. The system of claim 1, **characterised in that** the first reservoir (2) comprises an inlet conduit (22), via which the first reservoir (2) is connected to a tank of the ink.

9. The system of claim 1, **characterised in that** the first reservoir (2) and the second reservoir (3) are singly provided with a level sensor (23, 33).

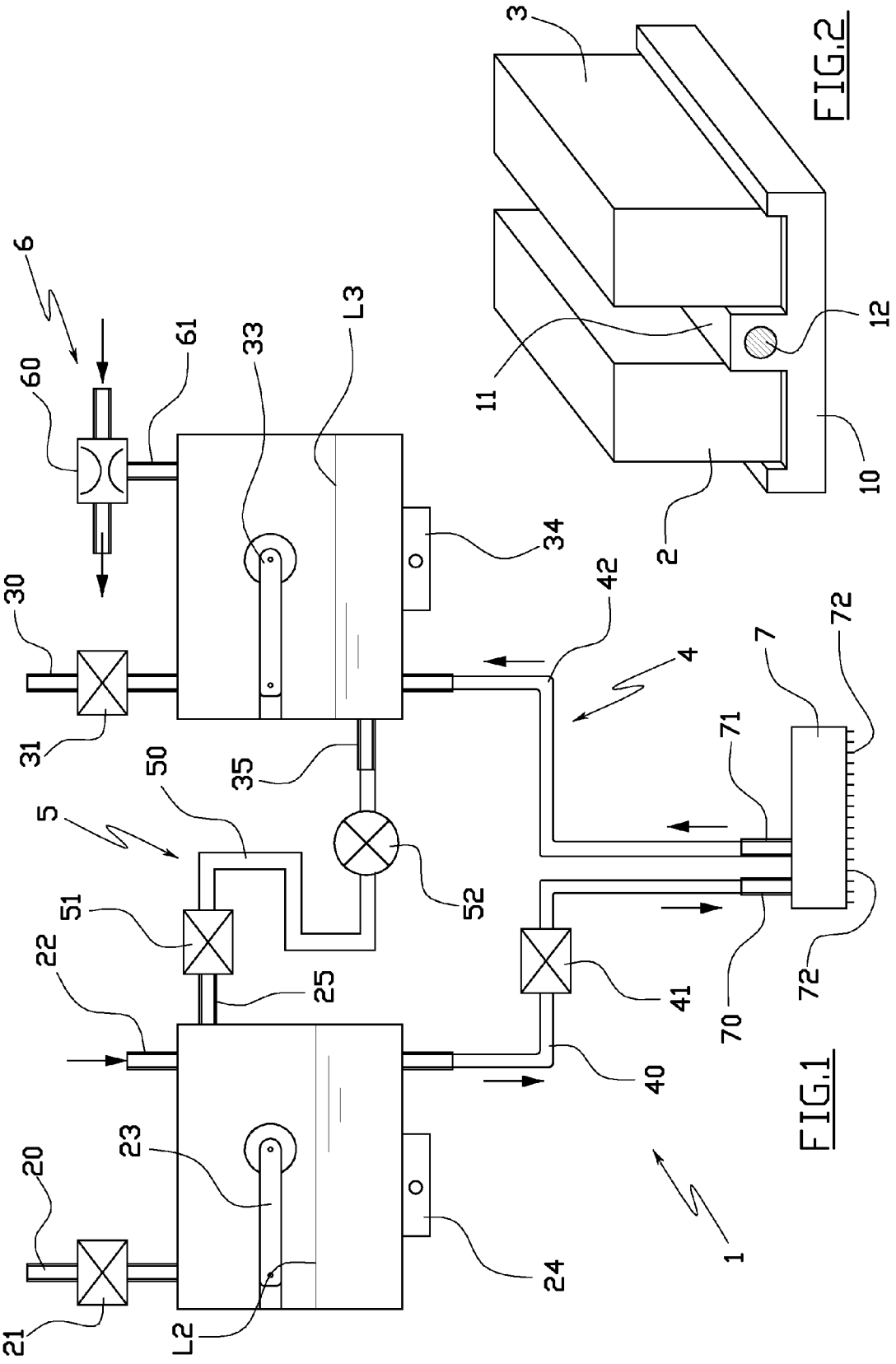
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FIG.1

FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 09 15 2388

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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