

(19)



(11)

EP 2 834 073 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

21.10.2015 Bulletin 2015/43

(51) Int Cl.:

B41J 2/18 ^(2006.01)

B41J 2/175 ^(2006.01)

(86) International application number:

PCT/IB2013/051559

(21) Application number: **13720035.8**

(22) Date of filing: **27.02.2013**

(87) International publication number:

WO 2013/150396 (10.10.2013 Gazette 2013/41)

(54) SUPPLY SYSTEM FOR INKJET PRINTERS

VERSORGUNGSSYSTEM FÜR TINTENSTRAHLDRUCKER

SYSTÈME D'ALIMENTATION POUR IMPRIMANTES À JET D'ENCRE

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

• **LICOPODIO, Fabio**

I-41126 Modena (IT)

• **CASARINI, Paolo**

I-41125 Modena (IT)

(30) Priority: **05.04.2012 IT MO20120093**

(43) Date of publication of application:

11.02.2015 Bulletin 2015/07

(74) Representative: **Casadei, Giovanni**

Bugnion S.p.A.

Via Vellani Marchi, 20

41124 Modena (IT)

(73) Proprietor: **System S.p.A.**

41042 Fiorano Modenese (MO) (IT)

(56) References cited:

EP-A1- 0 277 453

EP-A2- 2 082 883

GB-A- 2 447 919

US-A- 4 555 709

US-A1- 2010 214 334

US-A1- 2010 283 808

US-A1- 2011 242 156

(72) Inventors:

• **STEFANI, Franco**

I-41049 Sassuolo (Modena) (IT)

EP 2 834 073 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The subject matter of the present invention is a supply system for a printer that uses a jet of ink, commonly known as an inkjet printer. Specifically, but not exclusively, the supply system finds application in supplying inkjet printers that use inks with high solids content, the solids essentially being constituted by pigments reduced to fine particles.

[0002] The nature of such inks, constituted by suspensions of solids finely divided in a liquid, is the root of the main problem that the present invention intends to solve. The problem consists of the possibility of sedimentation of the solid parts that naturally tend to separate from the liquid in which they are suspended. This phenomenon has two main negative effects: it alters the physical-chemical properties of the suspension, thus influencing the quality of the inkjet printing and it can cause clogging of the print head nozzles.

[0003] The document US 2010/0039460 illustrates an example of the prior art concerning an ink supply system for an inkjet printer. The system comprises printing units, each one of which being made up of several print heads individually provided with one or more nozzles. Each print head is of the so-called recirculating type and supplied by its own channel from an ink reservoir. By means of another channel, the same print head is connected to a collection reservoir in which the excess ink is collected.

[0004] Other examples of prior art ink supply system are disclosed in US 2010/0283808 and US 2011/0242156.

[0005] Therefore, the principal aim of the present invention is to provide an adequate solution to the problem consisting of possible sedimentation, thereby overcoming the negative consequences described above.

[0006] An additional aim of the invention is to provide a simple means of control of the working conditions of the print heads that ensures a high level of constancy of operation.

[0007] An additional aim of the invention is that of rendering the operation of the (single) heads independent of the recirculation system so as to maximize the performance of both.

[0008] An advantage of the invention lies in the fact that it allows for a rapid stabilizing of the pressures throughout the circuit supplying the heads whenever, owing to the inevitable variations caused by corresponding variations in the flows required by some of the same heads, pressure imbalances occur, negatively affecting the regular operation of the printer. Another advantage can definitely be found in the fact that the supply system permits regular operation even in the event of a temporary shutdown of some parts of the system, such as the pumps that produce circulation of the ink for example.

[0009] Further characteristics and advantages of the present invention will become more apparent from the detailed description herein below of several embodiments of the invention, which are illustrated by way of

non-limiting example in the attached figures, wherein:

- Figure 1 is a diagram of a supply system according to the invention, in which the print heads 1, which, as a set, make up a printing unit 2, are only roughly indicated;
- Figure 2 shows a portion of the diagram appearing in Figure 1, and concerns a second embodiment;
- Figure 3 shows part of the diagram appearing in Figure 1 and concerns an additional embodiment illustrated to an extent limited to a circuit for the reversal of circulation in the heads 1;
- Figure 4 is a schematic perspective view of a supply system according to the invention applied to the in-line decoration of ceramic tiles 10.

[0010] With reference to the above-mentioned figures, "1" indicates a single print head, which is provided with a plurality of nozzles 11, which are assigned the function of producing, on command, the release of tiny droplets of ink. In this case, the print head 1 is an ink recirculation print head of the type in which in other words the ink flows continuously "in front of" the nozzles 11 of the print head and ink ejection is carried out, upon specific command, by the preselected nozzle independently of the others.

[0011] The print head 1 is part of a printing unit 2 that proves to be made up of one or more print heads 1 with ink recirculation and that forms a "bar of colour" or a printing unit 2 of an extension suited to the size to be printed. The print heads that make up the "bar of colour" or printing unit 2 work with the same ink, that is, with the same colour.

[0012] The print heads 1 forming the said "bar of colour" are supplied by an ink supply system, which comprises: a line for supply-distribution of the ink, indicated in its entirety by the number 3, and a line for recirculation 4 of the ink.

[0013] In particular, the supply-distribution line 3 originates from a reservoir 5, has a plurality of short connecting branches 30 for supplying the print heads 1 and empties into the same reservoir 5.

[0014] The line for recirculation 4 of the ink is made up of a plurality of short channels 40 originating from the print heads 1 - in the case represented, a short channel 40 originates from each print head - and converging into a collection manifold 41, which empties into the reservoir 5.

[0015] The ink supply-distribution line 3 comprises a distribution tube 31, from which the short connecting branches 30 directly branch off for the supply of the print heads 1 in a number at least equal to the number of print heads 1 to be supplied.

[0016] At least the distribution tube 31 is shaped and proportioned so as to reduce to a minimum head loss of the liquid circulating therein.

[0017] This means for example that the distribution tube 31 has a larger diameter than that of the tubing making up the remaining part of the entire supply-distribution line 3. The distribution tube 31 empties directly into the

reservoir 5.

[0018] There is provided a first means suitable for producing the circulation of the ink in the supply-distribution line 3.

[0019] This first means serves the function of producing the circulation of the ink in the supply-distribution line 3 and comprises a circulation pump 32 located upstream of the distribution tube 31.

[0020] Also upstream of the distribution tube 31, and downstream of the circulation pump 32, there is provided an equipment, indicated in its entirety by the number 33, containing a filtering device and a device for deaeration of the ink.

[0021] The supply-distribution line 3 is subject to a set of control means, the function of which is that of controlling the pressure in the said supply-distribution line and particularly in the distribution tube 31.

[0022] These means comprise a first pressure sensor 34 suitable for measuring the pressure existing in the distribution tube 31 of the supply-distribution line 3, for comparing said pressure value with a preset pressure value and, based on the difference found, for commanding the activation of an apparatus 50 suitable for maintaining the pressure inside the reservoir 5 in keeping with the said preset value.

[0023] The apparatus 50 keeps the reservoir 5 under vacuum conditions, creating therein the said preset vacuum value, which is determined and regulated to enable the proper timed operation of the print head nozzles, thus realizing the ejection of ink only on command and in the amount foreseen, without the occurrence of conditions giving rise to the possibility for example of undesired spontaneous ejection.

[0024] The ink level pre-established for proper functioning of the printing unit is automatically maintained in the reservoir 5 by means of a simple device that comprises an ink level sensor 51, which automatically activates a refiller pump 52. The latter provides for replenishment of the liquid until the pre-established level is reached.

[0025] The ink recirculation line 4 is made up of a plurality of short channels 40 originating from the print heads 1 and converging into a collection manifold 41, which empties by converging into the reservoir 5.

[0026] A second means suitable for producing the circulation of the ink in the collection manifold 41 comprises a suction-pumping device, which is preferably constituted by a pump 43 that is commanded to suction the ink from the collection manifold 41 and re-introduce it into the reservoir 5.

[0027] As an alternative, instead of the pump 43, there may be provided an apparatus made up of a reservoir, in which a pre-established vacuum degree is maintained through a vacuum pump or a Venturi for the purpose of generating suction and thus the circulation of the ink in the recirculation line 4.

[0028] A specific control means is provided for controlling the pressure in the recirculation line 4 and particularly

in the collection manifold 41, thus controlling the system in this manner.

[0029] In particular, a pressure sensor 42 is provided for measuring the pressure existing in the recirculation line 4, for comparing of said pressure value with a preset pressure value and, based on the difference found, for commanding the activation of a suction-pumping device consisting of a pump 43 suitable for maintaining the pressure in keeping with the said preset value.

[0030] In practice, the apparatus 50 controls the pressures inside the heads 1 by controlling the pressure in the reservoir 5.

[0031] For this purpose, as regards the realization, there may be provided a sort of safety circuit, which for example makes it possible to prevent undesired discharge of ink from the heads 1, when supply voltage to the electrical equipments for activation of the system is not present. The system may consist of a circuit comprising a valve 46, a Venturi tube 47 and a pressure gauge or pressure indicator 48. A compressed air circuit 49 passes through the pressure gauge 48, the valve 46 and the Venturi tube 47, thereby realizing in the Venturi tube a vacuum that is transmitted by means of a channel 55 to the reservoir 5.

[0032] The electrically commanded valve 46 is of a type that is normally open when electrical voltage is present. Therefore, when it is energized, it closes, preventing the passage of air. The electrical command of the valve is directly connected to the voltage generator of the machine. In the event of an electrical power failure, the apparatus 50 stops working, the valve goes out of control, opening instantly and permitting the compressed air to reach the Venturi tube 47. The vacuum created by the Venturi tube 47 is transmitted to the reservoir 5 by means of the channel 55. The pressure gauge or pressure indicator 48 is regulated in such a manner as to have the necessary flow of air pass into the Venturi tube for the purpose of generating the proper vacuum level inside the reservoir 5, which makes it possible to maintain the ink in equilibrium inside the heads 1.

[0033] The special structure of the supply system that is the subject matter of the invention described creates an operating condition of the printing unit 2, which substantially renders the operation of the individual head 1 independent of that of the others making up the printing unit 2, thereby permitting a considerable reduction of the possibility of sedimentation of solid particles. This is afforded by the possibility of keeping considerable amounts of ink in constant movement, in a manner substantially independent of the absorption of the individual heads. In fact, the constant movement and the considerable flows counteract the risk of sedimentation very effectively. The flow of ink drawn by the individual heads is independent of the "external" flow that takes place in the distribution tube 31, which closes the supply-distribution line 3 in a loop on the reservoir 5.

[0034] The flow is drawn by the individual head 1 through the short connecting branches 30, thus being

fractionated in two parts: the first, which is ejected on command from the nozzles so as to realize the printing, or decoration in the case of ceramic tiles 10, the second, which is recirculated through the short channel 40 and directed into the collection manifold 41, which provides for channelling it into the-reservoir 5.

[0035] In the event of a temporary zeroing of the first fraction of the flow, internal recirculation of the second fraction of the flow takes place in any case, this latter fraction being recirculated in its entirety through the short channel 40.

[0036] The control system implemented as a whole by the described control means, which operates by monitoring the pressure in the distribution tube 31 and in the collection manifold 41, makes it possible to carry out the adjustments needed so as to maintain the operation of the system constantly aligned with the required parameters in the presence of variability of the situations involving the demand for ink on the part of the various print heads.

[0037] The flow rate of the ink realized by the system can be set as desired, and this is an advantage of the system. In particular, it can also be set at a value higher than the maximum supply value and simultaneously for all the heads 1 in the printing unit 2. This makes it possible to have ink flow into the heads, always under the best conditions, for example being highly deaerated by the system 33. In addition, the present solution also makes it possible to exclude the circulation pump 32 or the equipment 33 temporarily for short periods of time, without impairing the regular operation of the same heads.

[0038] The pump 43 is of a type capable of realizing, on command, reversal of the flow of the fluid pumped, for the purpose of carrying out internal recirculation in the heads 1 in a direction opposite the usual direction for carrying out internal cleaning.

[0039] The reversal of the flow is important for removing contaminating particles that may be present inside the individual head and that can obstruct the head, or also simply for washing out the heads.

[0040] The reversal of the flow is realized by means of the reversal of the motion of the pump 43 that draws the ink from the reservoir 5 and sends it to the heads. The stabilization inside the heads is realized by regulating the pressure in the reservoir 5. The external recirculation through the distribution tube 31 returns the ink to the reservoir 5.

[0041] In the event that electrical reversal cannot be realized, the same results of the reversal of flow can be achieved with an auxiliary circuit 14 such as the one shown in Figure 3.

[0042] This auxiliary circuit can be obtained by means of the insertion, on the collection manifold 41, of two three-way valves 14a and 14b, located, respectively, upstream and downstream of the pump 43 so that there is a direct connection of the downstream valve 14b with the reservoir 5.

[0043] There are also provided a direct connection of

the upstream valve 14a with the reservoir 5 by means of a first channel 14c, and a direct connection of the downstream valve 14b by means of a second channel 14d, to the collection manifold 41 in a point located upstream of the upstream valve 14a.

[0044] The reversal of the flow in the collection manifold 41 can thus be realized very simply, by activating the valves 14a and 14b so that the ink is collected from the reservoir 5 through the first channel 14c and pushed by the pump 43 so as to re-enter the collection manifold 41 through the second channel 14d.

[0045] Normal operation of the supply system is achieved by commanding the valves 14a and 14b so as to enable the passage of fluid solely along the collection manifold 41.

Claims

1. A supply system for an inkjet printer of a type comprising at least one printing unit proving to be made up of one or more print heads (1) with ink recirculation, each of which is equipped with one or more nozzles (11) for at least one colour, comprising: - a line for supply-distribution (3) of the ink and that originates from a reservoir (5), has a plurality of short connecting branches (30) for supplying the said print heads (1) and empties into the same reservoir (5); - a line for recirculation (4) of the ink and made up of a plurality of short channels (40) originating from the said print heads (1) and converging into a collection manifold (41), which empties into the said reservoir (5); there being provided a first means suitable for producing the circulation of the ink in the said supply-distribution line (3) and a second means suitable for producing the circulation of the ink in the said recirculation line (4) comprising the said collection manifold (41); there further being provided a control means suitable for controlling the pressure in a distribution tube (31) of said supply-distribution line (3), and a control means suitable for controlling the pressure and circulation in the said recirculation line (4); said ink supply-distribution line (3) comprises said distribution tube (31), wherefrom the said short connecting branches (30) directly branch off for the supply of the said print heads (1) in a number at least equal to the number of print heads (1) to be supplied; at least said distribution tube (31) being shaped and proportioned so as to reduce to a minimum head loss of the liquid circulating therein; wherein said distribution tube (31) empties directly in the said reservoir (5).
2. The supply system according to the preceding claim, **characterized in that** the said distribution tube (31) has a larger diameter than that of the remaining part of the tubing that makes up the said supply-distribution line (3).

3. The supply system according to one of the preceding claims, **characterized in that** the first means suitable for producing the circulation of the ink in the said supply-distribution line (3) comprises a circulation pump (32) located upstream of the said distribution tube (31). 5
4. The supply system according to one of the preceding claims, **characterized in that** upstream of the said distribution tube (3), it comprises an equipment (33) that contains a filtering device and a device for de-aeration of the ink. 10
5. The supply system according to one of the preceding claims, **characterized in that** the supply-distribution line (3) is enslaved to a set of control means, the function of which is that of controlling the pressure in the said supply-distribution line (3) and particularly in the distribution tube (31), said means comprising a first pressure sensor (34) suitable for measuring the pressure existing in the distribution tube (31) of the supply-distribution line (3), for comparing said pressure value with a preset pressure value and, based on the difference found, for commanding the activation of an apparatus (50) suitable for maintaining the pressure inside the reservoir (5) in keeping with the said preset value. 15 20 25
6. The supply system according to one of the preceding claims, **characterized in that** said second means suitable for producing the circulation of the ink in the collection manifold (41) comprises a suction-pumping device, which is commanded to suction the ink from the collection manifold (41) and re-introduce it into the reservoir. (5). 30 35
7. The supply system according to one the preceding claims, **characterized in that** in the said line for recirculation (4) of the ink and made up of a plurality of short channels (40) originating from the said print heads (1) and converging into a collection manifold (41), which empties into the said reservoir (1), the said control means suitable for controlling the pressure and circulation comprises a pressure sensor (42) suitable for measuring the pressure existing in the collection manifold (41) of the same recirculation line (4), for comparing said pressure value with a preset pressure value and, based on the difference found, for commanding the activation of the said suction-pumping device that is suitable for maintaining the pressure in keeping with the said preset value. 40 45 50
8. The supply system according to claim 7, **characterized in that** the said suction-pumping device is constituted by a pump (43) that is commanded to suction the ink from the said collection manifold (41) and to re-introduce it into the reservoir (5). 55
9. The supply system according to claim 6, **characterized in that** the said suction-pumping device comprises an apparatus made up of a reservoir, wherein a pre-established vacuum degree is maintained through a vacuum pump or a Venturi.
10. The supply system according to claim 8, **characterized in that** it comprises a safety circuit suitable for preventing undesired discharge of ink from the heads (1) when supply voltage to the electrical equipments for activation of the system is not present; said safety circuit comprising a valve (46), a Venturi tube (47) and a pressure gauge or pressure indicator (48); a compressed air circuit (49) passing through the pressure gauge (48), the valve (46) and the Venturi tube (47) so as to realize in the latter a vacuum that is transmitted by means of a channel (55) to the reservoir (5); the valve (46) being electrically commanded and of the type that is normally open when electrical voltage is present.
11. The supply system according to one of claims 9 or 10, **characterized in that** the pump (43) is of a type capable of realizing, on command, reversal of the flow of the pumped fluid for the purpose of carrying out internal recirculation in the heads (1) in a direction opposite the usual direction for carrying out internal cleaning.
12. The supply system according to one of claims 8 to 10, **characterized in that** it comprises an auxiliary circuit (14) suitable for realizing, on command, reversal of the flow of the fluid for the purpose of carrying out internal recirculation in the heads (1) in a direction opposite the usual direction for carrying out internal cleaning; said auxiliary circuit (14) comprising the insertion, on the collection manifold (41), of two three-way valves (14a) and (14b), located, respectively, upstream and downstream of the pump (43), a direct connection of the downstream valve (14b) with the reservoir 5, a direct connection of the same downstream valve 14b, by means of a second channel (14d), to the collection manifold (41) in a point upstream of the upstream valve (14a), a direct connection of the upstream valve (14a) with the reservoir 5.

Patentansprüche

1. Versorgungssystem für einen Tintenstrahldrucker eines Typs, umfassend mindestens eine Druckeinheit, bestehend aus einem oder mehreren Druckköpfen (1) mit Tintenumwälzung, von denen ein jeder mit einer oder mehreren Düsen (11) für mindestens eine Farbe ausgestattet ist, umfassend:- eine Leitung für die Versorgungsverteilung (3) der Tinte, die von einem Behälter (5) ausgeht, eine Vielzahl an

- kurzen Verbindungsabschnitten (30) zur Versorgung der Druckköpfe (1) aufweist und in denselben Behälter (5) entleert wird; eine Leitung für die Umwälzung (4) der Tinte, bestehend aus einer Vielzahl an kurzen Kanälen (40), ausgehend von den Druckköpfen (1) und zusammenlaufend in ein Sammelrohr (41), das in den Behälter (5) entleert wird; wobei erste Mittel bereitgestellt sind, die geeignet sind, um die Zirkulation der Tinte in der Versorgungsverteilungsleitung (3) zu erzeugen, und zweite Mittel, die geeignet sind, um die Zirkulation der Tinte in der Umwälzungsleitung (4) zu erzeugen, umfassend das Sammelrohr (41); wobei zudem Kontrollmittel bereitgestellt sind, um den Druck in einem Verteilerrohr (31) der Versorgungsverteilungsleitung (3) zu kontrollieren, und Kontrollmittel, die geeignet sind, um den Druck und die Zirkulation in der Umwälzungsleitung (4) zu kontrollieren; wobei die Tintenversorgungsverteilungsleitung (3) das Verteilerrohr (31) umfasst, von dem die kurzen Verbindungsabschnitte (30) direkt abzweigen, um die Druckköpfe (1) zu versorgen, und zwar in einer Zahl, die mindestens gleich der Zahl der zu versorgenden Druckköpfe (1) ist; wobei mindestens das Verteilerrohr (31) ausgebildet und proportioniert ist, um die Kopfverlustmenge der darin zirkulierenden Flüssigkeit auf ein Mindestmaß zu reduzieren, wobei das Verteilerrohr (31) direkt in den Behälter (5) entleert wird.
2. Versorgungssystem nach dem vorhergehenden Anspruch, **dadurch gekennzeichnet, dass** das Verteilerrohr (31) einen größeren Durchmesser aufweist als der restliche Teil der Rohrleitung, die die Versorgungsverteilungsleitung (3) ausmacht.
 3. Versorgungssystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die ersten Mittel, die geeignet sind, um die Zirkulation der Tinte in der Versorgungsverteilungsleitung (3) zu erzeugen, eine Zirkulationspumpe (32) umfassen, die vor dem Verteilerrohr (31) angeordnet ist.
 4. Versorgungssystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** es vor dem Verteilerrohr (3) eine Ausrüstung (33) umfasst, die eine Filtervorrichtung und eine Vorrichtung zur Entlüftung der Tinte enthält.
 5. Versorgungssystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Versorgungsverteilungsleitung (3) einer Reihe von Kontrollmitteln untersteht, deren Funktion es ist, den Druck in der Versorgungsverteilungsleitung (3) und insbesondere im Verteilerrohr (31) zu kontrollieren, wobei diese Mittel einen ersten Drucksensor (34) umfassen, der geeignet ist, um den im Verteilerrohr (31) der Versorgungsverteilungsleitung (3) bestehenden Druck zu messen, um diesen Druckwert mit einem vorgegebenen Druckwert zu vergleichen, und um basierend auf dem gemessenen Unterschied die Aktivierung eines Geräts (50) zu steuern, das geeignet ist, um den Druck im Behälter (5) beizubehalten und auf den vorgegebenen Wert abzustimmen.
 6. Versorgungssystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die zweiten Mittel, die geeignet sind, um die Zirkulation der Tinte im Sammelrohr (41) zu erzeugen, eine Saugpumpenvorrichtung umfassen, die gesteuert wird, um die Tinte aus dem Sammelrohr (41) abzusaugen und wieder in den Behälter (5) einzuleiten.
 7. Versorgungssystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Kontrollmittel, die für die Kontrolle von Druck und Zirkulation geeignet sind, in der Umwälzungsleitung (4) der Tinte, bestehend aus einer Vielzahl an kurzen Kanälen (40), ausgehend von den Druckköpfen (1) und zusammenlaufend in ein Verteilerrohr (4), das in den Behälter (1) entleert wird, einen Drucksensor (42) umfassen, der geeignet ist, um den im Verteilerrohr (41) der Umwälzungsleitung (4) bestehenden Druck zu messen, um diesen Druckwert mit einem vorgegebenen Druckwert zu vergleichen, und um basierend auf dem gemessenen Unterschied die Aktivierung der Saugpumpenvorrichtung zu steuern, die geeignet ist, um den Druck beizubehalten und auf den vorgegebenen Wert abzustimmen.
 8. Versorgungssystem nach Anspruch 7, **dadurch gekennzeichnet, dass** die Saugpumpenvorrichtung aus einer Pumpe (43) besteht, die gesteuert wird, um die Tinte aus dem Verteilerrohr (41) anzusaugen und wieder in den Behälter (5) einzuleiten.
 9. Versorgungssystem nach Anspruch 6, **dadurch gekennzeichnet, dass** die Saugpumpenvorrichtung ein Gerät umfasst, bestehend aus einem Behälter, in dem ein vorgegebener Vakuumgrad mittels einer Vakuumpumpe oder eines Venturi-Rohrs aufrecht erhalten wird.
 10. Versorgungssystem nach Anspruch 8, **dadurch gekennzeichnet, dass** es einen Sicherheitskreis umfasst, der geeignet ist, um das unerwünschte Entladen von Tinte aus den Köpfen (1) zu verhindern, wenn keine Versorgungsspannung an den elektrischen Ausrüstungen zur Aktivierung des Systems anliegt, wobei der Sicherheitskreis ein Ventil (46), ein Venturi-Rohr (47) und ein Manometer oder eine Druckanzeige (48) umfasst und eine Druckluftleitung (49) durch das Manometer (48), das Ventil (46) und das Venturi-Rohr (47) führt, sodass in Letzterem ein Vakuum erzeugt wird, das mittels eines Kanals (55)

an den Behälter (5) weitergeleitet wird, wobei das Ventil (46) elektrisch betätigt wird und es sich dabei um ein Ventil handelt, das bei anliegender elektrischer Spannung stromlos geöffnet ist.

11. Versorgungssystem nach einem der Ansprüche 9 oder 10, **dadurch gekennzeichnet, dass** die Pumpe (43) von einem Typ ist, der in der Lage ist, auf Befehl die Strömung der gepumpten Flüssigkeit umzukehren, um eine interne Umwälzung in den Köpfen (1) in eine Richtung durchzuführen, die der gewöhnlichen Richtung für die interne Reinigung entgegengesetzt ist.
12. Versorgungssystem nach einem der Ansprüche 8 bis 10, **dadurch gekennzeichnet, dass** es einen Hilfskreis (14) umfasst, der geeignet ist, auf Befehl die Flüssigkeitsströmung umzukehren, um eine interne Umwälzung in den Köpfen (1) in eine Richtung durchzuführen, die der gewöhnlichen Richtung für die interne Reinigung entgegengesetzt ist, wobei der Hilfskreis (14) das Einfügen von zwei Dreizeig-Ventilen (14a) und (14b) am Verteilerrohr (41) umfasst, die jeweils vor und nach der Pumpe (43) angeordnet sind, sowie eine direkte Verbindung des nachgeordneten Ventils (14b) mit dem Behälter (5), eine direkte Verbindung des nachgeordneten Ventils (14b) mittels eines zweiten Kanals (14d) mit dem Verteilerrohr (41) an einer Stelle vor dem vorgeordneten Ventil (14a), und eine direkte Verbindung des vorgeordneten Ventils (14a) mit dem Behälter (5).

Revendications

1. Système d'alimentation pour une imprimante à jet d'encre d'un type comprenant au moins une unité d'impression pouvant être composée d'une ou plusieurs têtes d'impression (1) à recirculation d'encre, chacune d'elles est équipée d'une ou plusieurs buses (11) pour au moins une couleur, comprenant : - une ligne pour l'alimentation-distribution (3) de l'encre et qui provient d'un réservoir (5) possède une pluralité de branches courtes de raccordement (30) servant à alimenter lesdites têtes d'impression (1) et débouche dans le même réservoir (5) ; - une ligne servant à la recirculation (4) de l'encre et composée d'une pluralité de conduits courts (40) provenant desdites têtes d'impression (1) et convergeant dans un manifold de collecte (41) qui débouche dans ledit réservoir (5) ; des premiers moyens étant aptes à produire la circulation de l'encre dans ladite ligne d'alimentation-distribution (3) et des seconds moyens aptes à produire la circulation de l'encre dans ladite ligne de recirculation (4), comprenant ledit manifold de collecte (41), étant prévus ; des moyens de contrôle aptes à contrôler la pression dans un tube de distribution (31) de ladite ligne d'alimentation-distribution (3) ainsi que des moyens de

contrôle aptes à contrôler la pression et la circulation dans ladite ligne de recirculation (4) étant aussi prévus ; ladite ligne d'alimentation-distribution (3) comprend ledit tube de distribution (31) duquel partent directement lesdites branches courtes de raccordement (30) servant à alimenter lesdites têtes d'impression (1) dans un nombre au moins équivalent au nombre de têtes d'impression (1) à alimenter ; ledit tube de distribution (31) ayant au moins une forme et des proportions lui permettant de réduire au minimum la perte de charge du liquide circulant en son sein, dans lequel ledit tube de distribution (31) débouche directement dans ledit réservoir (5).

2. Système d'alimentation selon la revendication précédente, **caractérisé en ce que** ledit tube de distribution (31) possède un diamètre supérieur à celui de la partie restante de la gaine constituant ladite ligne d'alimentation-distribution (3).
3. Système d'alimentation selon l'une des revendications précédentes, **caractérisé en ce que** les premiers moyens aptes à produire la circulation de l'encre dans ladite ligne d'alimentation-distribution (3) comprennent une pompe de circulation (32) située en amont dudit tube de distribution (31).
4. Système d'alimentation selon l'une des revendications précédentes, **caractérisé en ce que** en amont dudit tube de distribution (3), il comporte un équipement (33) contenant un dispositif de filtrage et un dispositif de désaération de l'encre.
5. Système d'alimentation selon l'une des revendications précédentes, **caractérisé en ce que** la ligne d'alimentation-distribution (3) est asservie à un ensemble de moyens de contrôle dont la fonction est de contrôler la pression dans ladite ligne d'alimentation-distribution (3), en particulier dans le tube de distribution (31), lesdits moyens comprenant un premier détecteur de pression (34), apte à mesurer la pression existante dans le tube de distribution (31) de la ligne d'alimentation-distribution (3), pour comparer ladite valeur de pression avec une valeur de pression prédéfinie et, sur la base de la différence trouvée, pour commander l'activation d'un appareil (50) apte à maintenir la pression à l'intérieur du réservoir (5) conforme à ladite valeur prédéfinie.
6. Système d'alimentation selon l'une des revendications précédentes, **caractérisé en ce que** lesdits seconds moyens aptes à produire la circulation de l'encre dans le manifold de collecte (41) comprennent un dispositif d'aspiration-pompage qui est commandé pour aspirer l'encre à partir du manifold de collecte (41) et pour la réintroduire dans le réservoir

- (5).
7. Système d'alimentation selon l'une des revendications précédentes, **caractérisé en ce que** dans ladite ligne servant à la recirculation (4) de l'encre et composée d'une pluralité de conduits courts (40) provenant desdites têtes d'impression (1) et convergeant dans un manifold de collecte (41) qui débouche dans ledit réservoir (1), lesdits moyens de contrôle aptes à contrôler la pression et la circulation comprennent un détecteur de pression (42) apte à mesurer la pression existante dans le manifold de collecte (41) de la même ligne de recirculation (4), pour comparer ladite valeur de pression avec une valeur de pression prédéfinie et, sur la base de la différence trouvée, pour commander l'activation dudit dispositif d'aspiration-pompage étant apte à maintenir la pression conforme à ladite valeur prédéfinie. 5 10 15 20
 8. Système d'alimentation selon la revendication 7, **caractérisé en ce que** ledit dispositif d'aspiration-pompage est constitué par une pompe (43) qui est commandée pour aspirer l'encre provenant dudit manifold de collecte (41) et pour la réintroduire dans le réservoir (5). 25
 9. Système d'alimentation selon la revendication 6, **caractérisé en ce que** ledit dispositif d'aspiration-pompage comprend un appareil constitué d'un réservoir, dans lequel un degré de vide préétabli est maintenu à travers une pompe à vide ou un Venturi. 30
 10. Système d'alimentation selon la revendication 8, **caractérisé en ce qu'il** comprend un circuit de sécurité apte à empêcher un écoulement intempestif d'encre des têtes (1) en l'absence d'une tension d'alimentation aux équipements électriques servant à l'activation du système ; ledit circuit de sécurité comprenant une vanne (46), un tube Venturi (47) et un manomètre ou indicateur de pression (48) ; un circuit d'air comprimé (49) passant à travers le manomètre (48), la vanne (46) et le tube Venturi (47) de manière à réaliser dans ce dernier un vide qui est transmis au réservoir (5) par le biais d'un conduit (55) ; la vanne (46) étant électriquement commandée et du type normalement ouvert en présence d'une tension électrique. 35 40 45
 11. Système d'alimentation selon l'une des revendications 9 ou 10, **caractérisé en ce que** la pompe (43) est d'un type en mesure de réaliser, sur commande, l'inversion du flux du fluide pompé dans le but d'effectuer une recirculation interne dans les têtes (1) dans une direction opposée à la direction habituelle pour effectuer un nettoyage interne. 50 55
 12. Système d'alimentation selon l'une des revendica-

tions de 8 à 10, **caractérisé en ce qu'il** comprend un circuit auxiliaire (14) apte à réaliser, sur commande, l'inversion du flux du fluide dans le but d'effectuer une recirculation interne dans les têtes (1) dans une direction opposée à la direction habituelle pour effectuer un nettoyage interne ; ledit circuit auxiliaire (14) comprenant l'insertion, sur le manifold de collecte (41), de deux vannes à trois voies (14a) et (14b), situées, respectivement, en amont et en aval de la pompe (43), un raccordement direct de la vanne en aval (14b) au réservoir (5), un raccordement direct de la même vanne en aval (14b) au manifold de collecte (41), par le biais d'un second conduit (14d), en un certain point situé en amont de la vanne en amont (14a), un raccordement direct de la vanne en amont (14a) au réservoir (5).

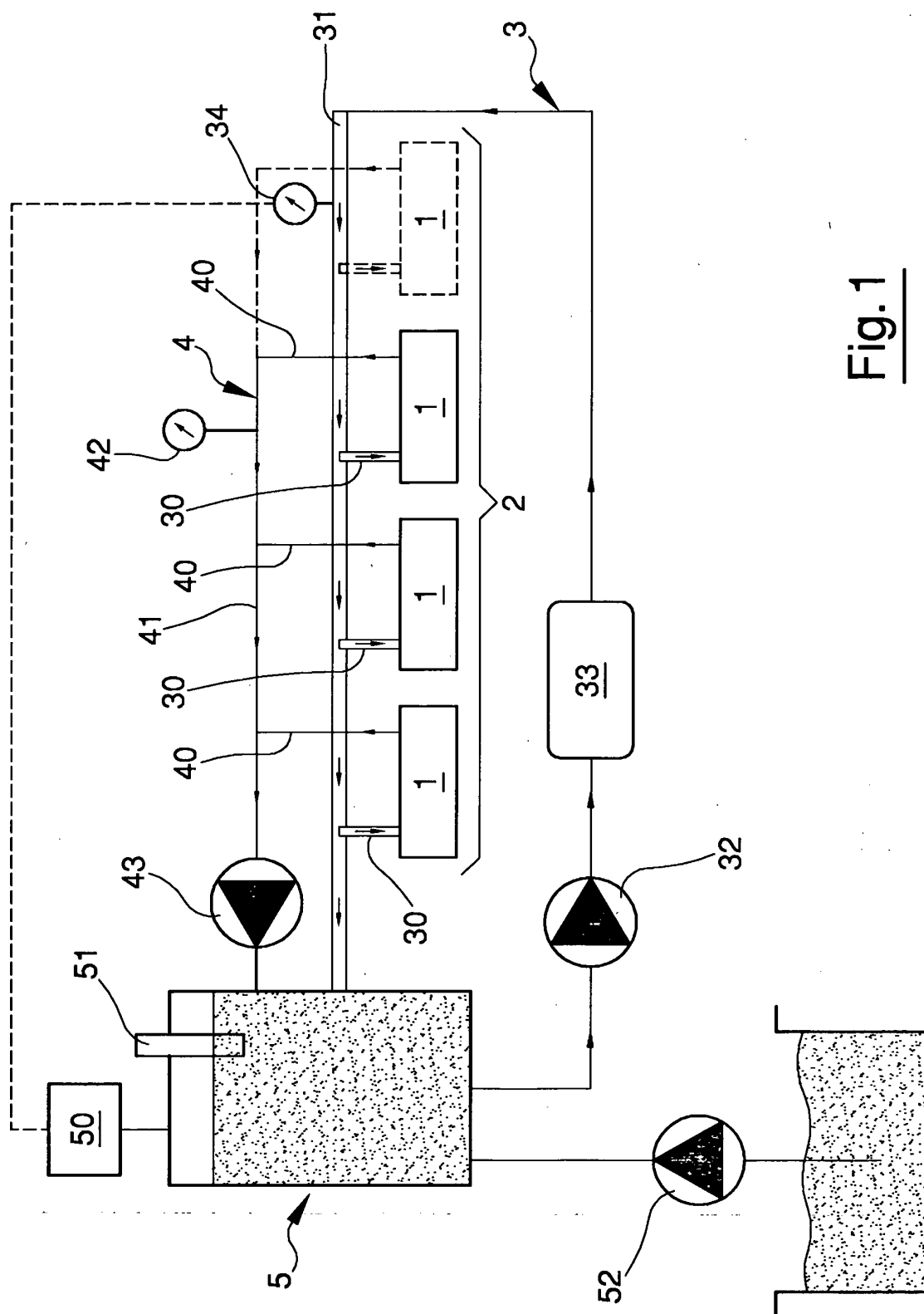


Fig. 1

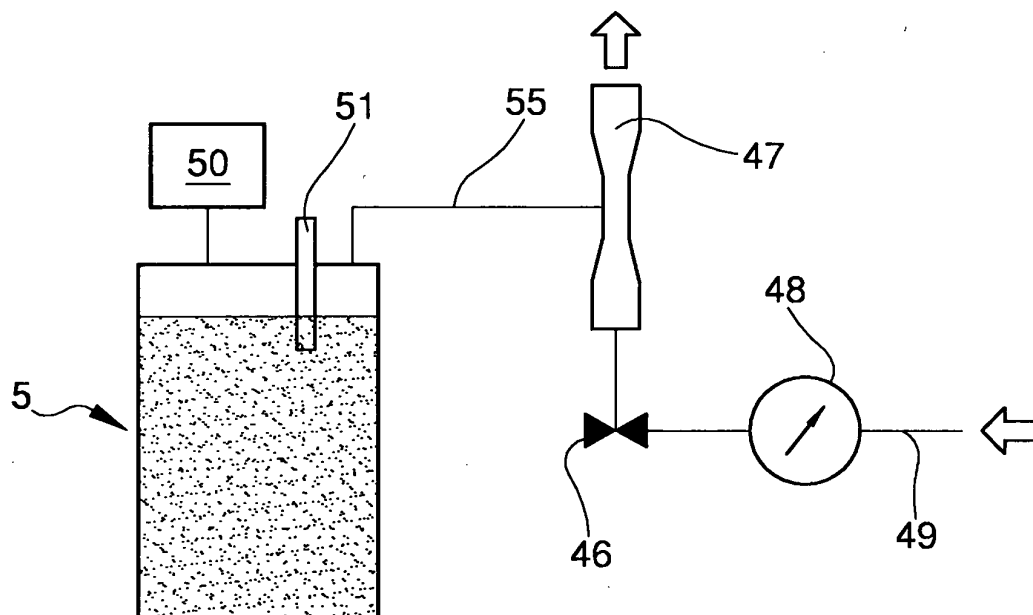


Fig. 2

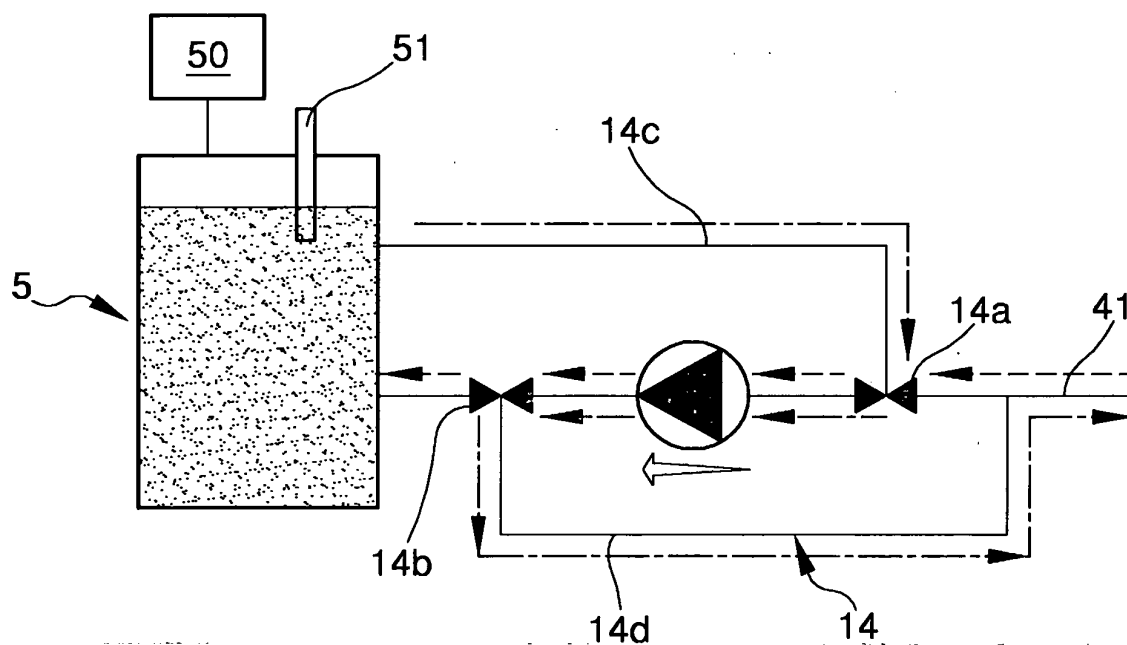


Fig. 3

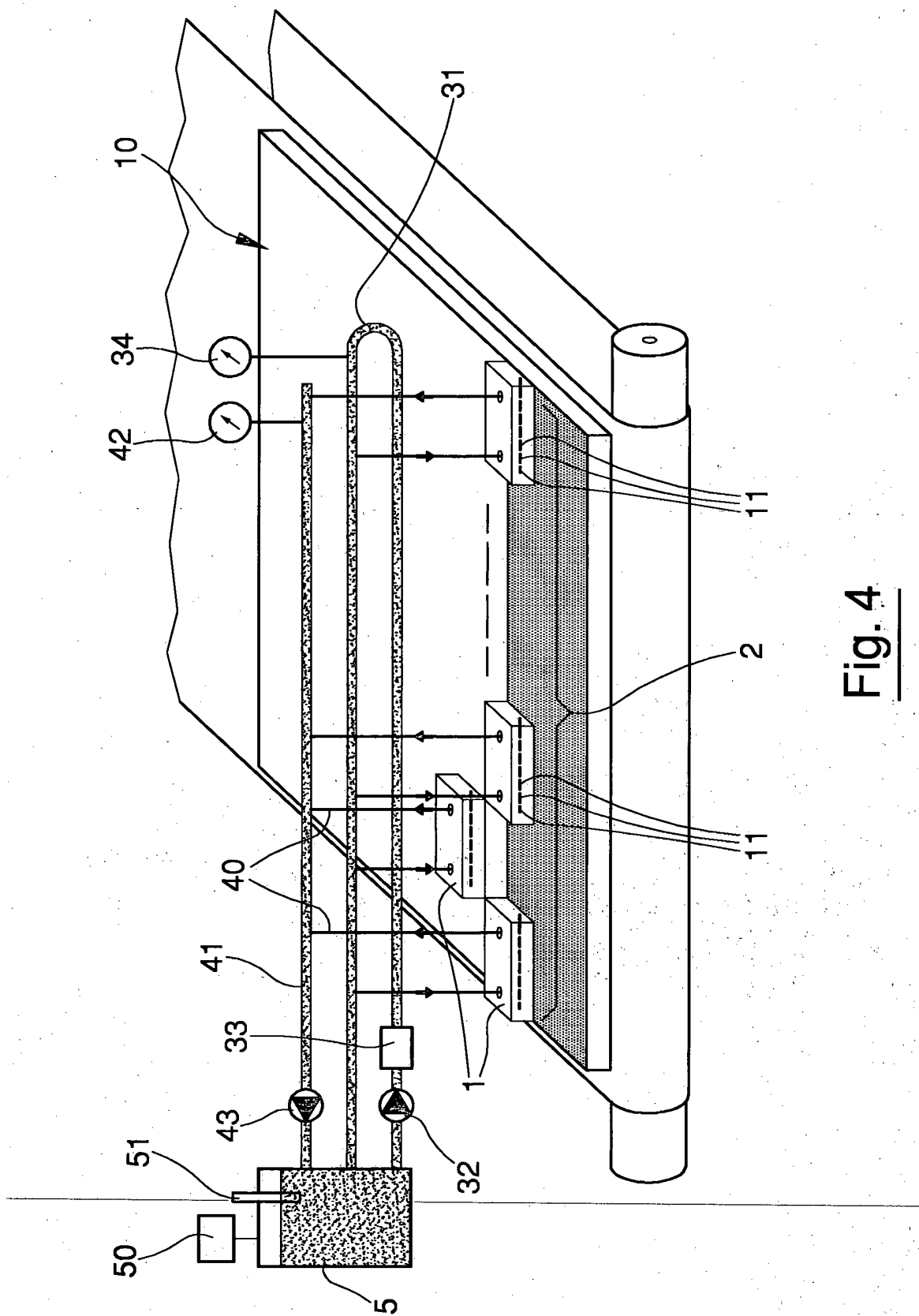


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20100039460 A [0003]
- US 20100283808 A [0004]
- US 20110242156 A [0004]