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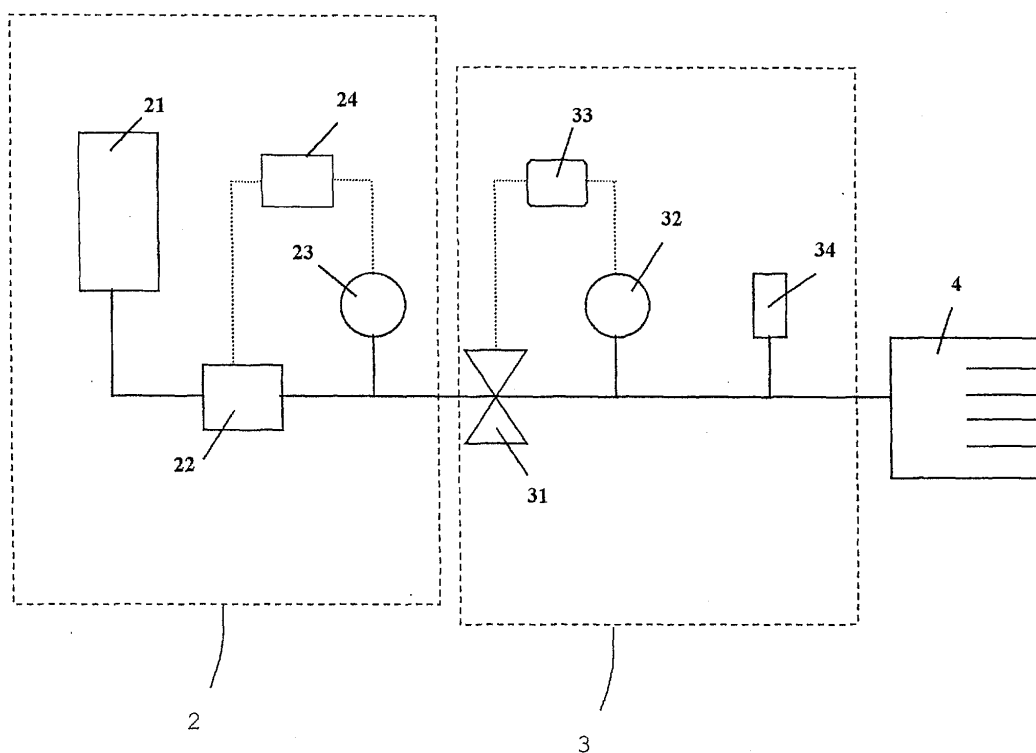
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(54) **System for supplying a printing apparatus**

(57) A system for supplying a printing apparatus comprising a primary hydraulic circuit (2) that allows ink to flow from a supply reservoir (21) with a substantially constant pressure and a secondary hydraulic circuit (3),

positioned between said primary circuit and a printhead (4). The secondary circuit comprises a regulation electrovalve (31), a second pressure sensor (32), an electronic regulation circuit (33) and a hydraulic pumping device (34).

Fig. 1



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Description

[0001] The present invention refers to a system for supplying a printing apparatus, for example used in packaging lines.

[0002] Printheads used for printing on packages, both of the piezoelectric type and of the thermal type, when they emit a jet of ink from their outlet nozzles, create a depression inside ink ducts connected to such nozzles. Such a depression allows an amount of ink to be sucked up, for example from a reservoir, corresponding to the amount of ink emitted by the printing nozzles.

[0003] To maintain this depression, passive devices have been developed, based upon simple differences in level, in which the supply reservoir must be placed at a fixed distance from the printhead and below it, for example by a height of 1 to 3 cm.

[0004] There are other devices provided with diaphragms under tension, capable of recreating the required depression, also allowing the positioning of the supply reservoir even above the printhead. Another possibility is that of placing the entire supply reservoir in depression, so as to be able to detach itself from the position and geometry of the supply source.

[0005] A drawback of these types of system is that it does not allow the position of the head to be varied with respect to the reservoir itself.

[0006] Currently, the increase in printing resolution and in areas to be printed (various square metres per hour) has brought a reduction in the size of the printing nozzles of printheads, which require lesser depressions for the correct operation of the heads.

[0007] A drawback is that these systems, combined with printheads having small nozzles, do not operate correctly since sometimes small air bubbles can be created inside the printing nozzles which result in printing with missing parts or poor print quality. Moreover, the substantial vastness of area to be printed forces the use of large ink reservoirs, to avoid having to frequently replace small reservoirs, which would involve frequent expensive idle times.

[0008] Another drawback of these systems is that air can remain at the outlets of the printing nozzles that prevents the ink from coming out from them due to the surface tensions that are present, and thus giving incomplete printing and the need for an intervention to restore the optimal printing conditions.

[0009] Yet another drawback is that these systems have low sensitivity and are unable to precisely adjust the pressure, and consequently they are not able to stably maintain a constant low depression at the printing nozzles.

[0010] Moreover, such systems have an operating transitory period when the unit is switched on before the suitable depression can be created for the correct operation of the printhead.

[0011] The purpose of the present invention is that of realising a system for supplying a printing apparatus, for

example used in packaging lines, which is reliable and also able to be integrated into already existing supply systems, to solve the problems stated previously.

[0012] Another purpose is that of realising a supply system that does not determine air bubbles inside the printing nozzles and that prevents the possibility of having an amount of air at the their outlet such as to compromise the printing and to require an intervention to restore correct operation.

[0013] The object of the present invention is a system for supplying a printing apparatus comprising a primary hydraulic circuit that allows the ink to flow from a supply reservoir with a substantially constant pressure and a secondary hydraulic circuit, positioned between said primary circuit and a printhead, comprising a regulation electrovalve, a second pressure sensor, an electronic regulation circuit and a hydraulic pumping device suitable for maintaining a predetermined depression in a supply duct of said printhead.

[0014] Further characteristics of the invention are highlighted in the subsequent claims.

[0015] The characteristics and advantages of the supply system according to the present invention shall become clearer from the following description, given as an example and not limiting purposes, referring to the attached schematic drawings, in which:

figure 1 is a schematic diagram illustrating an embodiment of a system for supplying a printing apparatus, for example used in packaging lines.

[0016] With reference to figure 1, a system for supplying a printing apparatus according to the present invention is shown, comprising a primary hydraulic circuit 2 and a secondary hydraulic circuit 3 arranged substantially in series with each other suitable for supplying a printhead.

[0017] The primary hydraulic circuit 2 comprises a supply reservoir 21 of the ink for such a printing apparatus, a supply pump 22, a first pressure sensor 23 and a first electronic control circuit 24 of such a pump 22.

[0018] Such a primary circuit is suitable for picking up ink from the reservoir and generating a substantially constant pressure of between 0.2 and 0.4 bar going out from the pump 22 entering into such a secondary circuit. The first control circuit 24 and the pressure sensor 23 are suitable for controlling the operation of the pump 22, so that such a pressure is substantially constant.

[0019] The system for supplying a printing apparatus according to the present invention foresees that between said primary circuit and the printing apparatus, for example printheads 4, the secondary circuit is inserted suitable for transforming the pressure going out from the primary circuit (around 0.2 bar) into a predetermined depression, for example between -1 millibar and -3 millibar, so as to be able to correctly supply the printheads 4 described above, which work in depression.

[0020] In particular, the secondary circuit is suitable

for maintaining such a predetermined depression, in a supply duct of said printhead.

[0021] The secondary circuit 3, so as to be able to finely adjust the pressure of the printing ink, comprises a regulation electrovalve 31, a second pressure sensor 32, an electronic regulation circuit 33 and a hydraulic pumping device 34. 5

[0022] The device 34 can, for example, be realised through a small hydraulic capacity consisting of two simple, suitably shaped, opposite drums placed between the second pressure sensor and the printhead 4. 10

[0023] Through the pumping device 34 and the regulation electrovalve 31 it is possible to adjust the pressure in the ink supply ducts of the printing nozzles.

[0024] The regulation circuit 33 determines the opening and closing of the regulation electrovalve, according to the pressure detected by the second pressure sensor, which has high sensitivity and is capable of detecting depressions in the order of 0.1 mbar. 15

[0025] Following the dripping of drops of ink from the printing nozzles, a depression is created that pulls the ink back inside the printhead and through the suitable opening of the electrovalve the depression is maintained close to the optimal value (for example between -1 millibar and -3 millibar). 20

[0026] The regulation circuit 33 can comprise a microprocessor and a memory in which a regulation programme is stored. 25

[0027] Moreover, the regulation circuit of the secondary hydraulic circuit and the electronic control circuit of the primary hydraulic circuit can be integrated in a single control and regulation device comprising a microprocessor. 30

[0028] This regulation system can easily be integrated into already existing systems or else advantageously integrated into the same printhead 4. 35

[0029] Moreover, the regulation system can thus comprise the printhead 4 and also the ink reservoir 21 that advantageously can contain a sensor, to detect whether the reservoir is empty, through a signal used by the control and regulation device. 40

[0030] The regulation circuit can be interfaced with the electrical signals that command the printhead, to obtain real time control of the successful printing, through an instant comparison between amount of ink required and the amount of ink delivered. 45

[0031] The supply system of the present invention thus conceived is susceptible to numerous modifications and variants, all of which are covered by the same inventive concept. 50

Claims

1. System for supplying a printing apparatus comprising a primary hydraulic circuit (2) that allows ink to flow from a supply reservoir (21) with a substantially constant pressure, 55

characterised in that it comprises a secondary hydraulic circuit (3), positioned between said primary circuit and a printhead (4), comprising a regulation electrovalve (31), a second pressure sensor (32), an electronic regulation circuit (33) and a hydraulic pumping device (34) suitable for maintaining a predetermined depression in a supply duct of said printhead.

2. System according to claim 1, wherein said predetermined depression is between -1 millibar and -3 millibar.
3. System according to claim 1, wherein said pumping device comprises a hydraulic capacity including two suitably shaped opposite drums placed between the second pressure sensor and the printhead.
4. System according to claim 1, wherein said primary circuit comprises said ink supply reservoir (21), a supply pump (22), a first pressure sensor (23) and a first electronic control circuit (24) of such a pump and is suitable for maintaining a substantially constant predetermined pressure going into said secondary circuit.
5. System according to claim 4, wherein said predetermined pressure is between about 0.2 bar and 0.4 bar.

Fig. 1

