Abstract: An inking device for printing machines that comprises an inking body (2) which is designed to be arranged so as to face the lateral surface of an anilox roller (3) and forms an inking chamber (7) that is open toward the anilox roller (3) and has at least one inlet (8) for introducing the ink into the inking chamber (7) and at least one outlet (9) for the exit of the ink from the inking chamber (7). The particularity of the invention consists in the fact that it comprises control means (13) that are adapted to vary the passage opening (9a) of the or of each outlet (9) as a function of the pressure of the ink in the inking chamber (7).
INKING DEVICE FOR PRINTING MACHINES

The present invention relates to an inking device for printing machines.

As is known, printing machines and, in particular, flexographic printing machines have a plurality of color units, each one of which is provided with an inking device the function of which is to transfer the ink onto the lateral surface of an anilox roller, which is provided with a plurality of cells the function of which is to hold the ink on the anilox roller.

Each color unit is completed by a plate cylinder, which is arranged adjacent to the anilox roller and is designed to produce the print on the medium to be printed on.

Typically, the inking device comprises a doctor assembly, which is constituted by an inking body facing the lateral surface of the anilox roller.

Such inking body longitudinally forms an inking chamber, which in technical jargon is also called a doctor chamber.

In particular, the inking chamber is open in the direction of the anilox roller and is delimited, above and below, by a pair of doctor blades, which are mounted inclined, in mutually opposite directions, with respect to the lateral surface of the anilox roller on the inking body and which are designed to engage, with a sliding contact, the lateral surface of the anilox roller.

The inking process in each color unit occurs in the following manner.

The ink, by way of an adapted closed circuit, is transferred to the inking chamber, so that it can be transferred onto the anilox roller, filling the cells arranged on the lateral surface of the anilox roller.

The doctor blades ensure an optimal filling of the cells of the anilox roller, in that the "negative" blade, i.e. the one inclined in the direction opposite to the direction of rotation of the anilox roller, scrapes off the ink that did not enter the cells but instead remained on the lateral surface of the anilox roller, while the "positive" blade, i.e. the one inclined in the same
direction as the direction of rotation of the aniiox roller, ensures that the ink is kept inside the inking chamber.

The aniiox roller subsequently transfers the ink contained in its surface cells to the plate cylinder, which thus performs the printing on the medium.

In the flexographic inking process, an essential role is played by the pressure of contact between the doctor blades and the lateral surface of the aniiox roller.

In order to be able to ensure the correct pressure between the doctor blades and the aniiox roller, control of the system for moving and supporting the inking device is important.

However, the system for pumping the ink into the inking chamber can also influence the pressure of contact between the doctor blades and the aniiox roller.

Currently, a pneumatic double-membrane pump is commonly used to transfer the ink from its storage tank to the inking chamber, and a pneumatic double-membrane pump is used to pump the ink from the inking chamber in order to transfer it back to the storage tank.

A drawback of the known art consists in the fact that, under certain conditions, during the printing process, there can be an uneven wetting of the aniiox roller over its whole width, with consequent onset of visible print defects and losses of ink at the doctor blade intended to contain the ink in the inking chamber.

In fact, the use of pneumatic double-membrane pumps in place of electric pumps, as in the past, has, on the one hand, solved considerable problems, such as the problem of safety in explosive environments and the ability to use pumps to suck from the inking chamber, but on the other hand involves a pulsing flow of ink, which determines a cyclic variation of the pressure inside the inking chamber with consequent variation of the pressure between the doctor blades and the aniiox roller.
Furthermore, if the system for moving and supporting the inking device is not perfectly rigid, there will be a movement of the same during the cycle of variation of the pressure in the inking chamber, with a further variation of the pressure of contact between the doctor blades and the anilox roller.

The end effect of this pressure variation is an uneven and non-homogeneous filling of the cells of the anilox roller and, as a consequence, a non-optimal print result and possible losses of ink from the doctor chamber.

The aim of the present invention is to provide a solution to the drawbacks of the known art, by providing an inking device that is capable of maintaining the pressure of contact between the doctor blades and the anilox roller which is as constant as possible.

Within this aim, an object of the present invention is to prevent or, at least greatly limit, any variations of pressure inside the doctor chamber, even in the presence of strongly pulsing flows of ink.

Another object of the present invention is to provide an inking device that is capable of offering the highest guarantees of safety and reliability of use.

Another object of the present invention is to provide an inking device that is simple in terms of construction and low-cost.

This aim and these and other objects which will become more apparent hereinafter are all achieved by an inking device, according to the invention, as defined in claim 1.

Further characteristics and advantages of the invention will become more apparent from the description of some preferred, but not exclusive, embodiments thereof, illustrated by way of non-limiting example in the accompanying drawings wherein:

Figure 1 is a schematic side view of a color unit of a printing machine of the flexographic type;

Figure 2 is a perspective view of a first embodiment of the inking
device according to the invention;

Figure 3 is a detail of the embodiment in Figure 2;
Figure 4 is a front elevation view of the embodiment in Figure 2;
Figure 5 is a cross-section along the line V-V in Figure 4;
Figure 6 is a perspective view of a variation of embodiment of the inking device according to the invention;
Figure 7 is a detail of the variation of embodiment in Figure 6;
Figure 8 is a front elevation view of the variation of embodiment in Figure 6;
Figure 9 is a cross-section along the line IX-IX in Figure 8;
Figure 10 is a perspective view of a third embodiment of the inking device according to the invention;
Figure 11 is a detail of the third embodiment;
Figure 12 is a front elevation view of the third embodiment;
Figure 13 is a cross-section along the line XIII-XIII in Figure 12;
Figure 14 is a perspective view of another possible variation of embodiment of the inking device according to the invention;
Figure 15 is a detail of the variation of embodiment in Figure 14;
Figure 16 is a front elevation view of the variation of embodiment in Figure 14;
Figure 17 is a cross-section along the line XVII-XVII in Figure 14.

With reference to the figures, the inking device, according to the invention, generally indicated with the reference numeral 1, comprises an inking body 2 which is designed to be arranged so as to face the lateral surface of an anilox roller 3.

As can be seen in Figure 1, the anilox roller 3 is, in turn, adjacent, in a manner that is known per se, to a plate cylinder 4 which is designed to print the ink on a medium 5 which is driven by a drum 6.

The inking body 2 forms an inking chamber 7 that is open toward the
anilox roller 3 and is provided with at least one inlet 8, through which the ink is introduced into the inking chamber 7, and one or more outlets 9, through which the ink can exit from the inking chamber 7.

Conveniently, the inking chamber 7 has a longitudinal extension that is substantially parallel to the axis of the anilox roller 3.

Preferably, substantially at each one of the longitudinal ends of the inking chamber 7, there is at least one respective ink outlet 9, while the ink inlet 8 is arranged in an intermediate position along the longitudinal extension of the inking chamber 7.

The inlet 8 and the outlets 9 of the inking chamber 7 are connected to an ink supply circuit, not shown, which, as is normal in the known art, can be provided with at least one pulsatile-flow supply pump, such as, for example, a pneumatic double-membrane pump, which provides the circulation of the ink between the tank for storing the ink in the printing machine and the inking chamber 7.

As can be seen in the examples shown, each outlet 9 can be, conveniently, constituted by a discharge opening 10, which is formed through the inking body 2 and which communicates with a siphon-shaped discharge channel 11, which lies on the side of the inking body 2 opposite to the one directed toward the anilox roller 3 from which the ink is sucked.

As is normal, mounted on the inking body 2 are furthermore, in a way that is known per se, at least one pair of doctor blades 12a and 12b, which are arranged on mutually opposite sides with respect to the longitudinal extension of the inking chamber 7 and which are designed to engage by contact, with a longitudinal edge thereof, with the lateral surface of the anilox roller 3.

The particularity of the invention consists in the fact that means 13 are provided for controlling the outlets 9 of the inking chamber 7, which are adapted to vary, in at least one region, the passage opening 9a of the outlets 9 of the inking chamber 7 as a function of the pressure of the ink inside the
inking chamber itself.

In particular, such control means 13, in response to a possible variation of the inner pressure of the inking chamber 3 with respect to a reference value considered correct for a good level of print quality, are automatically able to vary, for example in shape and/or in size, the passage opening 9a of the outlets 9, consequently modifying their permeability, so as to maintain the pressure inside the chamber permanently at the aforementioned reference value.

In essence, thanks to the control means 13, if there is an overpressure of the ink inside the inking chamber 7, with respect to a reference value considered correct, for example owing to the pulsing flow of the ink into the inking chamber 7, an increase occurs in the size of the passage opening 9a of the outlets 9 which makes it possible to keep the pressure in the inking chamber 7 unchanged.

Similarly, in the event of a decrease of the pressure inside the inking chamber 7, which could occur between one pulsation and the next of the ink flow into the inking chamber 7, the aforementioned control means 13 will cause a reduction of the passage opening 9a of the outlets 9, with the consequence that the pressure inside the inking chamber 7 is maintained more or less unchanged.

By maintaining the pressure inside the inking chamber 7 practically constant, the inking device itself will be free from movements, so that the pressure of contact between the doctor blades 12a and 12b will remain, in turn, stable and, as a consequence, the inking will be optimal.

Going now into details, the control means 13 comprise, conveniently, at least one flow control element 14 which is arranged at the respective outlet 9 and can move, with respect to the inking body 2, between a position for opening the corresponding outlet 9 and a position for at least partially closing the corresponding outlet 9.

Advantageously, the movement of the flow control element 14
between the open position and the closed position of the corresponding outlet 9 can be controlled by elastic return means.

With reference to a first embodiment shown in Figures 2 to 5, the flow control element 14 can be constituted by a lamina 15, elastically flexible, which, at one of its ends, is fixed to the inking body 7 and which cantilevers toward the passage opening 9a of the respective outlet 9.

Conveniently, the lamina 15 can be made of plastic material, for example polyethylene, and is, advantageously, structured so as to almost perfectly cover the passage opening 9a of the corresponding outlet 9.

Again with reference to the embodiment in Figures 2 to 5, at each ink outlet 9, there can be a redirection wall, which is constituted, for example, by a latten 16. In particular, such a redirection wall extends substantially parallel to the longitudinal extension of the inking chamber 7 and its function is to force the ink that flows inside the inking chamber 7 to travel along the entire length of the inking chamber 7 before reaching the outlets 9, so as to ensure the complete filling of the cells of the anilox roller 3 even in its end regions, which, being near the outlets 15, could be more difficult to fill.

As can be seen in Figure 5, the lamina 15 is, conveniently, applied directly on the inking body 7 and held in place by the latten 16.

With this structure, when the pressure inside the inking chamber 7 increases with respect to a preset reference value considered correct for a good print result, for example owing to the pulsing of the ink supply pump, the lamina 15 bends, opening the passage openings 9a of the outlets 9 proportionally to the pressure of the ink inside the inking chamber 7, with the consequence that it brings about, almost instantly, a decrease in pressure inside the inking chamber 7.

Vice versa, in the event of a decrease of the pressure of the ink inside the inking chamber 7 with respect to the aforementioned reference value, the lamina 15 is brought to a position for closing the passage opening 9a of
the ink outlets 9, thus causing, almost instantly, a rise in pressure in the
inking chamber 7.

In this manner, it is possible to maintain the pressure inside the inking
chamber 7 practically constant.

Figures 6 to 9 show a possible variation of embodiment that proposes,
in essence, a solution similar to the one we have previously seen, with the
sole difference that the use of the latte 16 is omitted.

It should be noted, furthermore, that the lamina 15 can also be applied
in a position different from the one shown, as long as it is capable of
choking the passage opening 9a of the corresponding outlet 9.

According to a third possible embodiment, illustrated in Figures 10 to
13, the flow control element 14 can be constituted by a ball element 17,
which is arranged so as to at least partially intercept the respective outlet 9.

Such ball element 17 is elastically pressed, for example by way of a
return spring 18, toward a sealing edge 19 that is formed by the inking body
2, around the corresponding outlet 9.

Conveniently, as can be seen in particular in Figure 13, the ball
element 17 can be installed at the discharge opening 10 of the respective
outlet 9.

Also in this embodiment, a sudden increase in pressure causes the
almost instantaneous transition of the ball element 17 that provides the flow
control element 14 to a position for opening the corresponding outlet 9, with
consequent restoration of the pressure inside the inking chamber 7 to the
value essentially prior to the disturbance.

In contrast, a decrease in pressure will cause, under the effect of the
return spring 18, a movement of the ball element 17 toward the sealing edge
19, with consequent transition of the ball element 17 to an at least partially
closed position of the corresponding outlet 9 which again results in the
restoration of the pressure conditions in the inking chamber 7 prior to the
disturbance.
Similarly to what has been said previously for the previous solutions, the position in which the ball element 17 is installed in the corresponding outlet 9 is not important.

In fact, as can be seen in the embodiment shown in Figures 14 to 17, the ball element 17 can also be arranged along the siphon-shaped discharge channel 11 of the corresponding outlet 9.

In practice it has been found that the inking device according to the invention is capable of fully achieving the set aim in that it makes it possible to compensate for any variations of the pressure inside the inking chamber, consequently keeping the print quality constant.

All the characteristics of the invention, indicated above as advantageous, convenient or similar, may also be missing or be substituted by equivalent characteristics.

The individual characteristics set out with reference to general teachings or to specific embodiments may all be present in other embodiments or may substitute characteristics in such embodiments.

The invention, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

In practice the materials employed, provided they are compatible with the specific use, and the dimensions and shapes, may be any according to requirements.

Moreover, all the details may be substituted by other, technically equivalent elements.

The content of Italian patent application no. VR2012A000185, the priority of which is claimed in the present application, is incorporated as a reference.

Where the technical features mentioned in any claim are followed by reference numerals and/or signs, those reference numerals and/or signs have been included for the sole purpose of increasing the intelligibility of the
claims and accordingly, such reference numerals and/or signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference numerals and/or signs.
CLAIMS

1. An inking device for printing machines, comprising an inking body (2), which is designed to be arranged so as to face the lateral surface of an anilox roller (3) and forms an inking chamber (7) that is open toward said anilox roller (3) and has at least one inlet (8) for introducing the ink into said inking chamber (7) and at least one outlet (9) for the exit of the ink from said inking chamber (7), characterized in that it comprises control means (13) adapted to vary the passage opening (9a) of said at least one outlet (9) as a function of the pressure of the ink in said inking chamber (7).

2. The device according to claim 1, characterized in that said control means (13) comprise at least one flow control element (14), which is arranged at said at least one outlet (9) and can move with respect to said inking body (2) between a position for opening said at least one outlet (9) and a position for closing at least partially said at least one outlet (9).

3. The device according to one or more of the preceding claims, characterized in that said at least one flow control element (14) can move between said open position and said at least partially closed position of said at least one outlet (9) in contrast to, or by the action of, elastic return means.

4. The device according to one or more of the preceding claims, characterized in that said at least one outlet (9) comprises at least one discharge opening (10), which is formed through said inking body (2) and is connected to at least one respective siphon-shaped discharge channel (11) that lies on the side of said inking body (2) opposite to the one directed toward said anilox roller (3).

5. The device according to one or more of the preceding claims, characterized in that said inking chamber (7) has a longitudinal extension that is substantially parallel to the axis of said anilox roller (3), substantially at each one of the longitudinal ends of said inking chamber (7) at least one respective ink outlet (9) being provided, equipped with said control means (13), said at least one ink inlet (8) being arranged in an intermediate
position along the longitudinal extension of said inking chamber (7).

6. The device according to one or more of the preceding claims, characterized in that said at least one flow control element (14) comprises an elastically flexible lamina (15), which is fixed at one of its ends to said inking body (2) and cantilevers out toward the passage opening (9a) of the respective outlet (9).

7. The device according to one or more of the preceding claims, characterized in that it comprises, at each ink outlet (9), a redirection wall (16) that extends substantially parallel to the longitudinal extension of said inking chamber (7) so as to force the flow of ink to travel along the entire length of said inking chamber (7).

8. The device according to one or more of the preceding claims, characterized in that said at least one flow control element (14) comprises a ball element (17), which is arranged so as to at least partially intercept the respective ink outlet (9) and is pressed elastically toward a sealing edge (19) that is formed by the inking body (7) around the corresponding outlet (9).

9. The device according to one or more of the preceding claims, characterized in that said ball element (17) is arranged in the discharge opening (10) of the respective ink outlet (9).

10. The device according to one or more of the preceding claims, characterized in that said ball element (17) is arranged along the siphon-shaped discharge channel (11) of the corresponding outlet (9).

11. The device according to one or more of the preceding claims, characterized in that said inking body (2) supports, on mutually opposite sides with respect to the longitudinal extension of said inking chamber (7), at least two doctor blades (12a, 12b) which are designed to engage by contact the lateral surface of said anilox roller (3).
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

**INV.** B41F31/02

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

B41F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>the whole document</td>
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**abstract**

paragraphs [0003], [0007], [0014], [0017] - [0018], [0020] - [0021], [0029] - [0031], figures 2-3

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**Further documents are listed in the continuation of Box C.**

**See patent family annex.**

- **"A"** document defining the general state of the art which is not considered to be of particular relevance
- **"E"** earlier application or patent but published on or after the international filing date
- **"L"** document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- **"O"** document referring to an oral disclosure, use, exhibition or other means
- **"P"** document published prior to the international filing date but later than the priority date claimed
- **"T"** later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- **"X"** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- **"Y"** document of particular relevance; the claimed invention cannot be considered combined with one or more other such documents, such combination being obvious to a person skilled in the art
- **"Z"** document member of the same patent family

**Date of the actual completion of the international search**

3 December 2013

13/12/2013

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Bellofiore, Vincenzo
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