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(54) **AIR CIRCULATION SYSTEM FOR A CONTINUOUS INKJET PRINTER**

(57) The invention concerns a continuous inkjet (CIJ) printer, comprising:
- a cabinet (100),
- at least two heat generating components (10, 34, 42) located within said cabinet,
- an air circulation system to generate an air flow within the cabinet to evacuate heat from the heat generating components, said air circulation system comprising at least one air inlet (2) for introducing ambient air into the cabinet, an air outlet (20) for evacuating air outside of the cabinet, an air flow path extending between the air inlet and the air outlet and an air circulation device (12), characterized in that the flow path is separated in at least two distinct flow paths (3, 5), wherein at least a first air flow path (3) accommodates a first heat generating component (10) and a second air flow path (5) accommodates a second heat generating component (34).

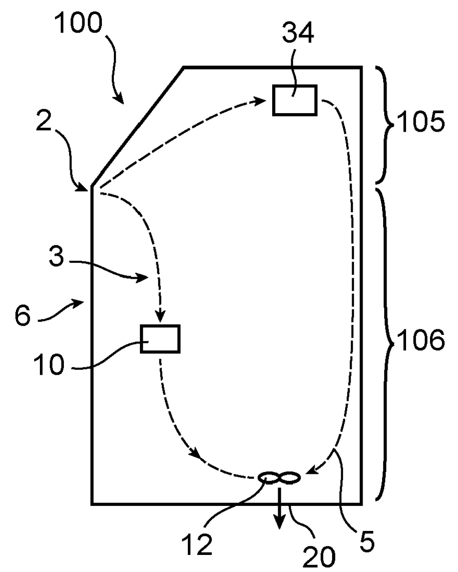

FIG. 1A

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Description

TECHNICAL FIELD AND PRIOR ART

[0001] The invention concerns the field of continuous inkjet printers (CIJ).

[0002] Continuous inkjet printers (CIJ) are known in the field of industrial coding and labelling of various products, for example to mark barcodes or expiry dates on food items or on packages for items directly on the production line and at fast production rate.

[0003] The ink circuit of a CIJ printers comprise many components, such as one or more ink pump(s) for pumping ink from a cartridge or from a reservoir and to send the ink to a print head. It can also comprise further components, for example one or more condenser and/or a Peltier module. These components, as well as others such as an electronic circuit and/or a power supply device, can also produce heat during the printing operations, so that their temperature is at least 5°C, sometimes at least 10°C, above the ambient temperature.

[0004] There is therefore a need for an air flow circulation circuit in order to evacuate heat from parts of the printer, for example at least part of an ink circuit, such as a pump, and/or at least part of an electronic circuit and/or of a voltage supply system and/or one or more other components which produce heat when the printer is operated.

[0005] CIJ printers can have to operate in an environment where the temperature can reach 40°C or more, even 45°C or 50°C.

[0006] At such temperatures, it is even more important to efficiently evacuate the heat generated by the above mentioned components of the printer, in particular in view of the ink and the solvent: the properties and the quality of these fluids is degraded by the high temperatures, resulting in a printing of poor quality.

[0007] More generally, the ink is directly heated by the hot components (the ink pump for example) through which the ink flows; but the hot components, even those through which no ink flows, also heat the air surrounding them, which then transfers heat to the ducts or the other components (the valves for example) through which the ink flows. The ink can therefore be heated, both directly and indirectly.

[0008] In order to solve these problems, it is known to circulate an air flow through the printer. But this air flow successively passes through or over several hot components of the printer before being evacuated outside of the printer.

[0009] For example, in a known solution, air first flows through an electronic compartment, then through an ink circuit compartment, where it flows over a pressure pump and possibly above one or more component(s), and is then finally evacuated out of the printer. This means that the air is first heated in the electronic compartment before flowing over the ink circuit. The situation is even worse for the components downstream of the ink pump. The capacity of the air to evacuate the heat out of the printer is thus limited.

[0010] There is therefore a need for a new air circulation system of a CIJ printer.

[0011] In particular there is a need for an air circulation system capable of efficiently evacuating heat from different hot points or components of a printer, even in environments (the air surrounding the printer or its cabinet) at temperatures as high as 45°C or 50 °C.

[0012] There is also a need for a CIJ printer, having an extended working range of temperatures, up to 45°C or 50 °C.

[0013] There is also a need for a CIJ printer, in which the temperature of the heat generating components is not higher than 5°C above the ambient air (the air surrounding the printer or its cabinet).

[0014] In addition, or alternatively, there is a need for a CIJ printer, in which the ink used for printing is maintained at a temperature which is not higher than 5°C above the ambient air.

SUMMARY OF THE INVENTION

[0015] The invention first concerns a continuous inkjet (CIJ) printer, comprising:

- a cabinet,
- at least two heat generating components located within said cabinet,
- an air circulation system to generate an air flow within the cabinet to evacuate heat, from the heat generating components, and possibly cool at least one of said components, said air circulation system comprising at least one air inlet for introducing ambient air into the cabinet, an air outlet for evacuating air outside of the cabinet, an air flow path extending between the air inlet and the air outlet and an air circulation device, characterized in that the flow path is separated in at least two distinct flow paths, wherein at least a first air flow path accommodates a first heat generating component and a second air flow path accommodates a second heat generating component.

[0016] Thus, different air flow paths are used to circulate air along different components which generate heat when the printer is operated. The air of the first, resp. second, air flow path has not circulated along another heat generating component, before circulating along said first, resp. second, heat generating component. Each air flow can therefore efficiently evacuate heat generated by at least one component. The quality of the ink and of the solvent used for printing is thereby greatly improved.

[0017] In a particular embodiment, the air flow path is separated in three distinct air flow paths, wherein the first air flow path accommodates the first heat generating component, for example an ink pump, the second air flow path accommodates the second heat generating component, for example a power supply and the third air flow path accommodates a third heat generating component, for example a condenser.

[0018] Thus, a printer according to the invention can comprise at least two, or even three, air flow paths, for at least two, or three, different heat generating components of the printer, thereby improving the evacuation of heat from the printer or the cabinet to the outside of the printer or the cabinet.

[0019] In a CIJ printer according to the invention, each air flow path can comprise at least an inlet, a heat generating component, air circulation device and an outlet.

[0020] At least one inlet of the third air flow path can be connected to the first air flow path and/or the second flow path upstream respectively of the first heat generating component and of the second heat generating component.

[0021] In each air flow path of a printer according to the invention, the air circulation device is preferably located downstream of the heat generating component of said flow path. This contributes to an efficient evacuation of heat out of the printer or its cabinet but does not affect the air circulation inside said printer or cabinet.

[0022] In a particular embodiment, the cabinet can be split in three compartments, each accommodating one of the heat generating components and being separated from each of the other two compartments by a wall comprising an opening.

[0023] For example the cabinet has an upper compartment and a lower compartment, which is itself divided in a front and a back compartment and:

- the upper compartment has an opening in a wall in common with the front compartment where the first heat generating component is located;
- the upper compartment has an opening in its wall in common with the back compartment where the third heat generating component is located;
- the front compartment has an opening in its wall in common with the back comportment where the third heat generating component is located.

[0024] The air circulation system of a CIJ printer according to the invention can have at least one filter receiving portion to receive at least one filter between the air inlet and an inlet of at least the first and/or second flow paths, and/or at least one filter between the air circulation device and the air outlet.

[0025] In a continuous inkjet (CIJ) printer according to the invention, the air inlet can be formed by a non-sealed space between a door and at least one wall of the cabinet. Thus ambient air can be introduced from outside of the cabinet, for example via a filter and into a compartment where one or more heat generating component(s), for example one or more electrical heat generating device(s), is located.

[0026] The door, when open, gives for example access to at least part of the ink circuit, for example the solvent and ink cartridges receiving portions, and possibly one or more components such as one or more filter(s).

[0027] In a preferred embodiment, air can enter the cabinet through a non-sealed space comprising a slot located at a horizontal bottom of said door; preferably this non-sealed space is the one having the largest cross section for incoming air.

[0028] In a continuous inkjet (CIJ) printer according to the invention, said first, said second and possibly said third flow path can comprise at least one of:

- an exhaust chamber to guide air between said air circulation device and said air outlet;
- one or more duct(s) or pipe(s) to guide heated air from an area downstream of at least one of said first and second and possibly said third heat generating component, to said air circulation device; thus heated air can be evacuated before circulating along, and possibly heating, other components and/or ducts and before heating ink in any other part of the ink circuit;
- a chamber to collect air from said first air flow path, said second air flow path and possibly said third air flow path, upstream from said air circulation device.

[0029] The invention also concerns a method for circulating air in a continuous inkjet (CIJ) printer, said printer comprising a cabinet and at least a first heat generating component and a second heat generating component located within said cabinet, said method comprising:

- introducing air into the cabinet, generating an air flow within the cabinet, thereby evacuating heat from the heat generating components, and possibly cooling at least one of said components, and evacuating said air flow outside of the cabinet, characterized in that the air flow is separated in at least two distinct air flows, wherein at least a first air flow circulates along said first heat generating component and a second air flow circulates along said second heat generating component.

[0030] In a particular embodiment of a method according to the invention, the air flow can be separated in three distinct air flows, wherein the first air flow accommodates said first heat generating component, for example an ink pump, the second air flow path accommodates said second heat generating component, for example a power supply, and the third air flow path accommodates a third heat generating component, for example a condenser.

[0031] The third air flow can be fed by air from said first air flow, upstream from the first heat generating component and/or from said second air flow, upstream from the second heat generating component.

[0032] In a method according to the invention, air can be introduced into the cabinet through a non-sealed space between a door and at least one wall of the cabinet. Thus ambient air is introduced from outside of the cabinet, for example via a filter, into the cabinet, for example into a compartment where one or more heat generating component(s), for example one or more electrical heat generating device(s), is located.

[0033] In a device or a method according to the invention:

- the air circulation device comprises for example a fan or a pump; it is preferably common to said first, second and possibly said third air flow paths;
- and/or each of said heat generating components is for example one of : (i) an ink pump, (ii) a power supply unit or (iii) a condenser; in a particular embodiment, the first heat generating component comprises at least an ink pump, the second heat generating component comprises at least a power supply device, and the third heat generating component can comprise at least a condenser;
- and/or each of said first flow path, said second flow path and possibly said third flow path further can comprise an outlet and/or an outlet filter, located downstream of said air circulation device, said outlet and/or outlet filter being possibly common to said first flow path, said second flow path and possibly to said third flow path.

[0034] In a device or a method according to the invention, a heat generating component is a component which generates heat when the printer is in operation; in particular, a CIJ printer comprises at least an ink pump to pump ink from an ink reservoir and/or from an ink cartridge and to send it to a print head: said pump generates heat when it is in operation. A CIJ printer can also comprise at least a power supply device, which also generates heat during operation. Other possible components of a CIJ printer according to the invention, for example a condenser (to condense solvent vapours inside the printer or its cabinet) or a Peltier module (also to condense solvent) also generate heat during operation and can be located in an air flow path as described on this application.

[0035] An embodiment of a method according to the invention can comprise at least one of the following steps:

- evacuating air from the cabinet through at least one exhaust chamber or box, for example comprising at least one wall, guiding air between said air circulation device and an air outlet;
- guiding heated air through one or more duct(s) or pipe(s) from an area downstream of at least one of said 1st and 2nd and possibly said third heat generating component, to the air circulation device; thus heated is evacuated before circulating along, and possibly heating, other components and/or ducts and before heating ink in any other part of the ink circuit; preferably, such a duct or pipe which evacuates air from an upper part of the printer has an inlet located as close as possible to an upper wall of the printer cabinet, so that the hottest air of the cabinet is evacuated;
- air from said first, second, and possibly third air flow paths is collected in a chamber upstream from said air circulation device before being evacuated; this improves the air evacuation out of the printer cabinet.

BRIEF DESCRIPTION OF THE FIGURES

[0036]

- Figures 1A-1C illustrates different embodiments of a printer cabinet according to the invention;
- Figure 2 illustrates a printer cabinet according to an embodiment of the invention, which can comprise 3 heat generating components;
- Figures 3A and 3B are different views of the front side of a printer cabinet according to an embodiment of the invention, having its front door open(figure 3A) and closed (figure 3B);
- Figure 3C is a front view of a printer cabinet according to an embodiment of the invention, showing the air flows into and inside the cabinet;
- Figure 4 is a view of an air inlet into 2 air flow paths of a printer cabinet according to the invention;
- Figure 5 is a view of an embodiment of an air exhaust of a printer cabinet according to the invention;
- Figure 6 is a view of a printer to which the invention can be applied;
- Figures 7A and 7B show a front view and a rear view of a cabinet of an ink-jet printer, comprising several modules.

DETAILED DESCRIPTION OF EMBODIMENTS

[0037] An internal structure of a printer cabinet 100 (also called, here and in the rest of this description, console or printer body) according to the invention is illustrated on figure 1A.

[0038] It comprises at least a first heat generating component 10, for example an ink pump, and at least a second heat generating component 34, different from the first one (it is for example a power supply), both components being located within the cabinet.

[0039] The first heat generating component 10 can be located in a lower part 104 of the cabinet, which can comprise an ink circuit making it possible, on the one hand, to supply ink to a print head (not illustrated on this figure) at a stable pressure and of a suitable quality and, on the other hand, to take charge of ink of jets not used for printing and being pumped from the print head and returned to the ink circuit; a front door 6 can allow access to the ink circuit of the lower part 104 of the cabinet;

[0040] The second heat generating component 34 can be located in an upper part 105, which can also comprise a controller of the printer, capable of managing the sequencing of actions and carrying out treatments enabling the activation of the different functions of the ink circuit and the print head.

[0041] An air circulation system generates an air flow within the cabinet to cool the heat generating components.

[0042] The air enters the cabinet through an air inlet 2 and is evacuated outside of the cabinet through an outlet 20. It circulates through said cabinet under the action of an air circulation device 12.

[0043] The air flow path thus created is separated in at least two distinct flow paths:

- at least a first air flow path 3, which accommodates said first heat generating component 10;
- and a second air flow path 5, which accommodates said second heat generating component 34.

[0044] Other internal structures of a printer cabinet 100', 100" according to the invention are illustrated on figures 1B and 1C; they have the same features as explained above in connection with figure 1A, with the following differences:

- on figure 1B, the second heat generating component 34 is located in the lower part of the cabinet, it is for example a condenser which condenses solvent from air;
- on figure 1C, the first and the second heat generating components are those of figure 1A; in addition, there is a third heat generating component 42, for example a condenser which condenses solvent from air, which can be located in the lower part of the cabinet.

[0045] On figures 1B and 1C an air circulation system generates two or three air flows within the cabinet to cool the heat generating components, the air entering the cabinet through an air inlet 2, and two or three air flows circulating through said cabinet under the action of an air circulation device 12 and being evacuated outside of the cabinet through outlet 20.

[0046] The air flow path thus created is separated in at two (figure 1B) or three (figure 1C) distinct flow paths:

- a first air flow path 3, which accommodates said first heat generating component 10;
- a second air flow path 5, which accommodates said second heat generating component 34;
- possibly a third air flow path 7 (figure 1C), which accommodates said third heat generating component 42; both first and third air flow paths 3, 7 can be separated by an internal wall 30; in a variant (not illustrated) of this embodiment, the printer has no third heat generating component 42, but the third air flow path is used to evacuate hot air from inside said back zone or area of the cabinet.

[0047] The respective positions of the components 10, 34 and 42 of figures 1A-1C are examples, these components can be distributed differently in the cabinet but a separate air flow is associated with each of them.

[0048] In the different embodiments, the air circulation device 12 comprises for example a fan or an air pump.

[0049] A first detailed example of a printer cabinet 100 (also called console or printer body) according to the invention is illustrated on figure 2. It has the general internal structure of figure 1C and comprises:

- a lower part 104, as explained above, which comprises an ink circuit, including the first heat generating device 10, here an ink pump;
- an upper part 105, as explained above, comprising a controller 33 and the second heat generating device 34, namely a power supply device,. An interface 106 gives the operator the means of implementing the printer and of being informed of its operation. As explained below, said upper part can also comprise a filter(s) receiving portion or compartment 41.

[0050] In other words, the cabinet of this example and of a printer according to the invention can comprise 2 sub-assemblies: in the upper part, the electronics, electrical supply and operator interface, and possibly one or more air filter(s), and in the lower part an ink circuit to supply the ink under pressure to the head and to recover ink not used by the head.

[0051] In this example, the cabinet comprises one or more air inlet(s) 2, 4 (other air inlets can be seen on figures 3B and 3C) so that air from the air surrounding the cabinet or from the environment of the printer can be introduced into the cabinet and then be circulated inside the cabinet through at least 2 different air flow paths to evacuate heat from at least the ink pump 10, , and the power supply 34 , and possibly cool one or more of said heat generating components.

[0052] The first air flow path 3 can comprise air flow inlet 8, at least said ink pump 10, the air circulation device 12, and outlet orifice 20. The air is circulated under the action of said air circulation device 12, through the air flow inlet 8, then over said ink pump 10 and is evacuated out of the cabinet through said outlet orifice 20. Said first flow path is for example at least partly delimited by the closed front door 6 and by at least one inner wall 30 of the printer cabinet, which can be substantially parallel to said closed front door 6 and separates a front compartment from a back compartment. Laterally it is limited by the lateral sides 13, 17 of the cabinet or by lateral sides of a frame 50 which hosts the ink circuit (see figure 3C). The air in said first air flow path is guided by said wall 30, said front door 6 and said lateral sides and flows over the body of the ink pump 10. The air circulation device 12 is located downstream from the pump 10 and preferably close to the outlet 20.

[0053] The second air flow path 5 comprises an air flow inlet 9, the power supply 34 of the printer, said air circulating device 12 and said outlet orifice 20. The air is circulated under the action of said device 12 through the air flow inlet 9, then over said power supply 34 and is evacuated out of the cabinet through said outlet orifice

20. Said second flow path is for example delimited by the upper sides 21, 15 of the cabinet, by at least one inner wall 32, which can be substantially perpendicular to the front side and which can separate said upper part (or compartment) from said lower part (or compartment) of the cabinet, and by the upper portions of the back side 11 and of the lateral vertical sides 13, 17. The air in said second air flow path is guided by said sides or walls and flows over the power supply 34. The air circulation device 12 is located downstream from said power supply 34 and preferably close to the outlet 20. Preferably said second air flow path comprises also comprises one or more electronic circuit(s), for example a circuit of the controller 33, over or along which the air also flows. Air can be evacuated from said upper compartment through one or more duct(s) or pipe(s) 36 connecting an area close to the power supply 34 to an area close to the air circulation device 12. Preferably, an inlet 36i of at least one of said duct(s) or pipe(s) is located close to the upper wall 21 of the cabinet, so that it is able to evacuate the hottest air from said upper part 105. For example, it is located less than 10 cm or less than 5 cm from said upper wall 21; this applies regardless of the position of the power supply 34 in the upper part 105: in another embodiment (not illustrated), the power supply is located on the wall 32 but the inlet 36i remains preferably close to the upper wall 21 in order to evacuate the hottest air from this upper compartment.

[0054] The example of figure 2 comprises a third flow path 7 which is formed for example by air flowing from the first and/or the second flow path. For example, different zones or compartments inside the cabinet, for example a front zone or compartment (which comprises cartridge receiving portions and can host cartridges (a cartridge 7c is visible on figure 2) and possibly one or more filter(s) and/or an ink recovery module) and a back zone or compartment (which can host for example a main reservoir, and possibly some ducts and solenoid valves), can be delimited by said internal wall(s) 30, 32 which are fixed to one or more lateral wall(s) or side(s) 11, 13, 17, of the cabinet. Air can flow through said wall(s) for example through one or more opening(s) or hole(s) or slot(s) 30a, 32a and/or along the lines where said internal wall(s) 30, 32 join said lateral wall(s) or side(s) 11, 13, 17. Such an air flow can be sufficient to evacuate some heat from at least one further, or third, heat generating component 42, for example a condenser which condenses solvent from air. Said third air flow path thus comprises said third component 42 and said air circulation device 12. The air flows into said third air flow path from said first and/or second air flow paths, then over the third component 42, which is located upstream from the air circulation device 12, and then through said outlet 20. More precisely, air can be evacuated from said component 42 through one or more ducts 37; in a particular embodiment, the printer has no third heat generating component 42, but the third air flow path is used to evacuate hot air from inside said back zone or area of the cabinet.

[0055] Figure 3A shows the cabinet 100 of figures 1A-1C or 2 with its front door 6 open.

[0056] A seal 61 is applied against the inner wall of said door for sealing the inner atmosphere of the front part of the ink circuit of the printer: when the door is closed, the seal applies against the frame 50 of an inner casing containing said front part of the ink circuit so that air cannot penetrate through the door directly into said ink circuit. The inner lateral areas or the inner space between the door seal and the fixed lateral sides of the cabinet are not sealed and air can flow through these lateral areas or this space and the seal when the door is closed (as illustrated by the arrows 2, 4, 62, 64 on figures 3B and 3C). This air, combined with the action of the air circulating device(s) 12, forms an air flow through the cabinet and can be separated into two or more air flow paths as explained above.

[0057] Alternatively, the seal is on the frame 50 and cooperates with the closed door in the same way as explained above.

[0058] When the door is closed and under the action of the air circulating device(s) 12, air flows 2, 4, 62, 64 can flow through the slits 2_1 (figure 3B), 4_1 (figure 2), 62_1 (figure 3B) between the door and the 4 sides of the cabinet (a 4th slit for the air flow 64 on the lateral side of the cabinet opposed to lateral side 13 is not visible on figure 3B) and then along the seal 61 (figure 3C) towards the filter(s) 40. Downstream from the filter outlet the filtered air separates into two flows, one circulating in the upper part 105 of the cabinet, without circulating in the lower part, the other one in the lower part 104.

[0059] Bottom slit 4 is preferably the one offering the largest section for the air flow and is located horizontally so that water flows used to clean the front side of the cabinet cannot penetrate into the cabinet.

[0060] The lower air flow 4 which enters the cabinet along the lower side of the door can be guided by one or more front foot/feet 43 of the cabinet, so that the hot air flowing out of the cabinet through the air outlet(s) 20 cannot mix with the air in front of the cabinet and flows towards the back side as illustrated on figure 1 by the double arrows between the lower floor 19 of the cabinet and the ground floor 57.

[0061] Figures 3C and 4 show how air filtered by the filter(s) 40 can be separated into two flows. The filtered air exits the filter(s) and flows into the upper part of the cabinet though an inlet 9, a grid in the illustrated example. Under the action of the air circulation device 12, part of the air (which has not yet extracted heat from the components located in said upper part) flows towards the air inlet 8 (which can be an opening in a wall between the upper compartment and the front compartment) of the first flow path, into the front compartment (where the ink pump 10 is located); the rest of the filtered air flows in the upper part 105, along the voltage supply 34 and possibly along one or more electronic component(s) or part(s) forming for example the controller 33. Alternatively, the cabinet can include means, for example one or more walls 81 (figure 3C), for separating the air in said first flow path and said second air flow path. Alternatively, the inlet of the first air flow is made by a duct inlet which is located against the outlet side of the filter 40.

[0062] The air filter(s) 40 can be located behind a front wall 60 which extends above the closed door 6 (see figure 3B). When the door is open (figure 3A), a slit 63 gives access to a filter compartment 41 (see figure 3C), where the filter(s) 40 can be fixed (for example it can be clamped) and from where it can be removed. The wall 60 protects the filter(s) from water jets which can be used to wash the front door.

[0063] The at least one air circulation device(s) 12 is preferably located close to the outlet(s) 20 from the cabinet. As illustrated on figures 1A-1C and 2, all air flows can converge on the device 12 so that a unique outlet flow flows through the outlet 20, thereby evacuating part of the heat generated by the different heat generating devices of the cabinet. The different air flows can be combined in an exhaust chamber or box 46 which guides the air from the air circulation device towards the filter 44 or the air outlet 20. A variant of the exhaust system is illustrated on figure 5, the exhaust chamber 46 being downstream from a chamber (having for example the shape of an inlet channel) 47 in which the different evacuated air streams are collected though connections 461, 462. The air is then evacuated from said chamber 47 through the air circulation device 12 and possibly the exhaust chamber 46.

[0064] As explained above, in order to avoid the evacuated hot air being reintroduced into the cabinet through the lower portion of the door, the lower air flow 4 which enters the cabinet can be guided by one or more front foot/feet 43, so that the hot air flowing out of the cabinet from the air outlet(s) 20 cannot penetrate again into the air circulation system. A vertical part 43a (see figure 2) of the foot/feet prevents the air coming from under the cabinet, and in particular the air flowing out of the cabinet through the hole(s) 20, to be recirculated into the air circulation system.

[0065] The cabinet 100 of a CIJ printer according to the invention is illustrated on figure 6 in combination with a print head 101 and a flexible umbilical cord 103 containing the hydraulic and electrical connections required for operation of the head, giving it a flexibility which facilitates inclusion of the head on a production line. Reference 105 is a printing support on which a message is printed.

[0066] In an embodiment, a gantry, not represented, makes it possible to install the print head facing a printing support 105, which moves along a direction. This direction is perpendicular for example to an axis of alignment of the nozzles of the print head or to an axis of deviation of the drops. The support moves along direction X. The position of the support with respect to the print head can be detected by a detector.

[0067] Such a printer can be integrated into a packaging machine.

[0068] Figures 7A and 7B show other aspects of cabinet 100 of a printer to which the invention can be applied.

[0069] As can be seen on figure 7A, the lower part of the cabinet can comprise an ink cartridge receiving portion 82a and a solvent cartridge receiving portion 84a (on figure 6A, both cartridges are unplugged); it also comprises at least part of the ink circuit, including for example a pump module 110 (containing pump 10 already mentioned above), and possibly a filter module 130 and/or a recovery module 150 which recovers ink not used for printing from the print head. References 112c and 114c are means of fluidic connections, to which cartridges are connected when they are inserted into the cartridge receiving portions. A cartridge 7c is illustrated on figure 2.

[0070] The modules 110, 130, 150 are accessible from the front side of the printer, so that they can be easily disassembled from the circuit by an operator, independently of each other.

[0071] A rear view of the cabinet is illustrated on figure 7B, showing the main reservoir 80 and a portion of exhaust chamber 46.

[0072] The ducts, valves and the other pumps of the circuit are not shown on figures 7A-B, but are also included in the hydraulic circuit.

[0073] As shown on figure 6, the cabinet 100 is hydraulically and electrically connected to a print head 101 by an umbilical 103.

[0074] An example of a print circuit is for example disclosed in EP3098075.

[0075] Examples of results achieved by a printer comprising an air circulation system according to the invention, comprising a single fan 12 and 3 air flow paths:

1. Temperature differences between the ambient temperature and the ink circuit:

- for an ambient temperature (outside the cabinet) of 20°C: between 2°C and less than 4°C according to the fan 12 used;
- for an ambient temperature (outside the cabinet) of 50°C: between 2,5 °C and less than 3,5°C according to the fan 12 used;

2. Temperature differences between the ambient temperature and the ink:

- for an ambient temperature (outside the cabinet) of 20°C or of 50°C: between 1,5°C and less than 4°C according to the fan 12 used;

3. Temperature differences between the ambient temperature and the electronic compartment:

- for an ambient temperature (outside the cabinet) of 20°C: between 3°C and 4,7°C according to the fan 12 used;
- for an ambient temperature (outside the cabinet) of 50°C: between 3,5 °C and 5°C according to

the fan 12 used;

4. Temperature differences between the ambient temperature and the pump head:

- for an ambient temperature (outside the cabinet) of 20°C: between 0,7 °C and 2 °C according to the fan 12 used;
- for an ambient temperature (outside the cabinet) of 50°C: between 0,6 °C and 2°C according to the fan 12 used;

[0076] The temperature differences of a CIJ printer cabinet having an air circulation system according to the invention are therefore quite low.

[0077] Tests were made on a CIJ printer cabinet having a single air flow path. For ambient temperatures between 20.1 °C and 23.4 °C, the following temperatures were measured:

- ink pump : temperature between 32.4°C and 47 °C,
- electronic compartment : temperature between 32.2°C and 40.9 °C (higher part of the compartment) and between 28.5°C and 35.4 °C (lower part of the compartment) ,
- ink : temperature between 33.9°C and 38.4 °C.

[0078] The temperature differences are thus much higher for a CIJ printer cabinet having a single air flow path than for CIJ printer cabinet having an air circulation system according to the invention.

Claims

1. A continuous inkjet (CIJ) printer, comprising:

- a cabinet (100),
- at least two heat generating components (10, 34, 42) located within said cabinet,
- an air circulation system to generate an air flow within the cabinet to evacuate heat from the heat generating components , said air circulation system comprising at least one air inlet (2, 4, 62, 64) for introducing ambient air into the cabinet, an air outlet (20) for evacuating air outside of the cabinet, an air flow path extending between the air inlet and the air outlet and an air circulation device (12), **characterized in that** the flow path is separated in at least two distinct flow paths (3, 5, 7), wherein at least a first air flow path (3) accommodates a first heat generating component (10) and a second air flow path (5) accommodates a second heat generating component (34, 42).

2. A continuous inkjet (CIJ) printer according to claim 1, wherein each of said heat generating components is one of: (i) an ink pump, (ii) a power supply unit or (iii) a condenser.

3. A continuous inkjet (CIJ) printer according any of the claims 1 or 2, wherein the air flow path is separated in three distinct air flow paths (3, 5, 7), wherein the first air flow path (3) accommodates an ink pump (10), the second air flow path (5) accommodates a power supply (34) and the third air flow path accommodates a condenser (42).

4. A continuous inkjet (CIJ) printer according to claim 3, wherein at least one inlet (30a, 32a) of the third air flow path is connected to the first air flow path (3) and/or the second flow path (5) upstream respectively of the ink pump (10) and of the power supply (34).

5. A continuous inkjet (CIJ) printer according to claim 3 or 4, wherein the cabinet is split in three compartments, each accommodating one of the heat generating components and being separated from each of the other two compartments by a wall comprising an opening (8, 30a, 332a).

6. A continuous inkjet (CIJ) printer according to any of the claim 1-5, wherein the air circulation system further comprises at least one filter receiving portion (63) to receive at least one filter (40), between the air inlet (2, 4, 62, 64) and an inlet (8, 9) of at least the first and/or second flow paths, and/or at least one filter (44) between the air circulation device (12) and the air outlet (20).

7. A continuous inkjet (CIJ) printer according to any of the claim 1-6, wherein the air inlet is formed by a non-sealed space between a door (6) and at least one wall of the cabinet.

8. A continuous inkjet (CIJ) printer according to claim 7, wherein said air inlet is for introducing ambient air from outside of the cabinet via a filter (40) into a compartment where one or more heat generating component(s), for example one or more electrical heat generating device(s), is located.

9. A continuous inkjet (CIJ) printer according to any of claims 1 to 8, said first, said second and possibly said third flow path further comprising at least one of:

- an exhaust chamber (46) to guide air between said air circulation device (12) and said air outlet (20);
- one or more duct(s) or pipe(s) (36, 37) to guide heated air from an area downstream of at least one of said 1st and 2nd and possibly said third heat generating component, to said air circulation device (12).

10. A continuous inkjet (CIJ) printer according to any of claims 1 to 9, further comprising a chamber (48) to collect air from said first air flow path, said second air flow path and possibly said third air flow path, upstream from said air circulation device (12).

11. A method for circulating air in a continuous inkjet (CIJ) printer, said printer comprising a cabinet (100) and at least a first heat generating component (10) and a second heat generating component (34) located within said cabinet, said method comprising:

- introducing air into the cabinet, generating an air flow within the cabinet to evacuate heat from the heat generating components, and evacuating said air flow outside of the cabinet, **characterized in that** the air flow is separated in at least two distinct air flows (3, 5, 7), wherein at least a first air flow (3) circulates along said first heat generating component (10) and a second air flow (5) circulates along said second heat generating component (34, 42).

12. A method according to claim 11, wherein the air flow is separated in three distinct air flows (3, 5, 7), wherein the first air flow (3) accommodates an ink pump (10), the second air flow path (5) accommodates a power supply (34) and the third air flow path accommodates a condenser (42).

13. A method according to claim 12, wherein the third air flow is fed by air from said first air flow (3), upstream from the ink pump (10) and/or from said second air flow (5), upstream from the power supply (34).

14. A method according to any of the claim 11 to 13, wherein air is introduced into the cabinet through a non-sealed space between a door (6) and at least one wall of the cabinet.

15. A method according to claim 14, ambient air from outside of the cabinet being introduced via a filter (40) into a compartment where one or more heat generating component(s), for example one or more electrical heat generating device(s), is located.

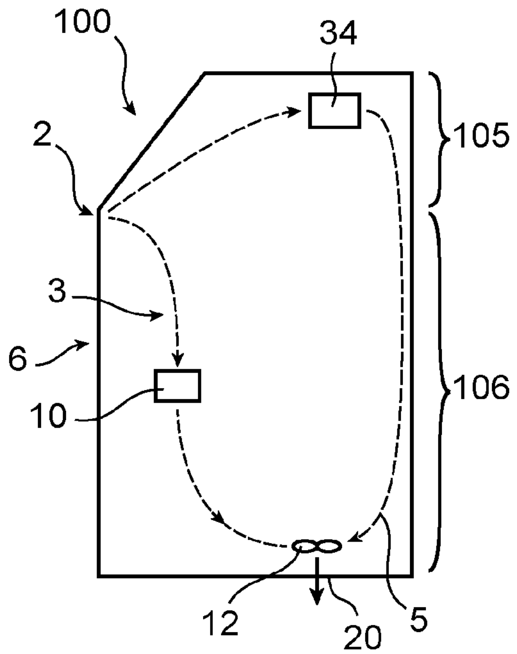


FIG. 1A

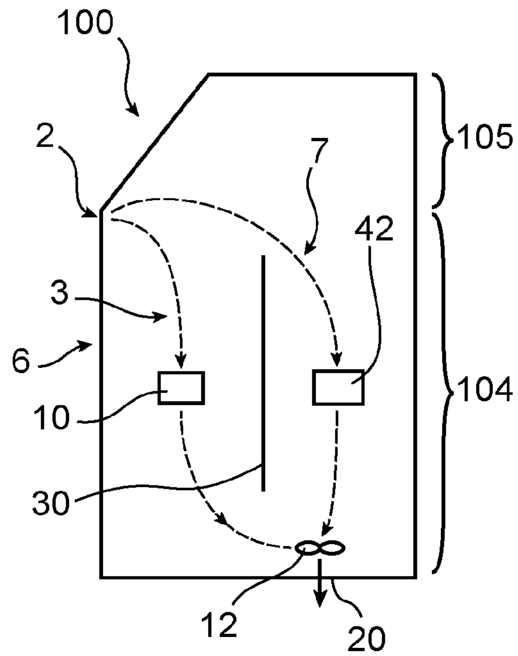


FIG. 1B

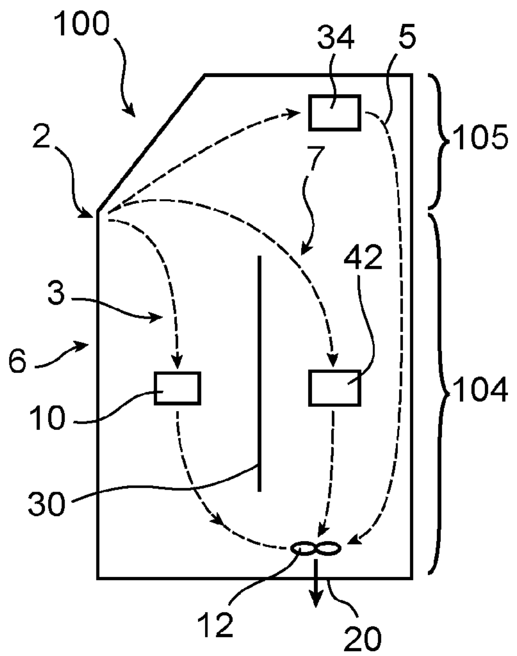
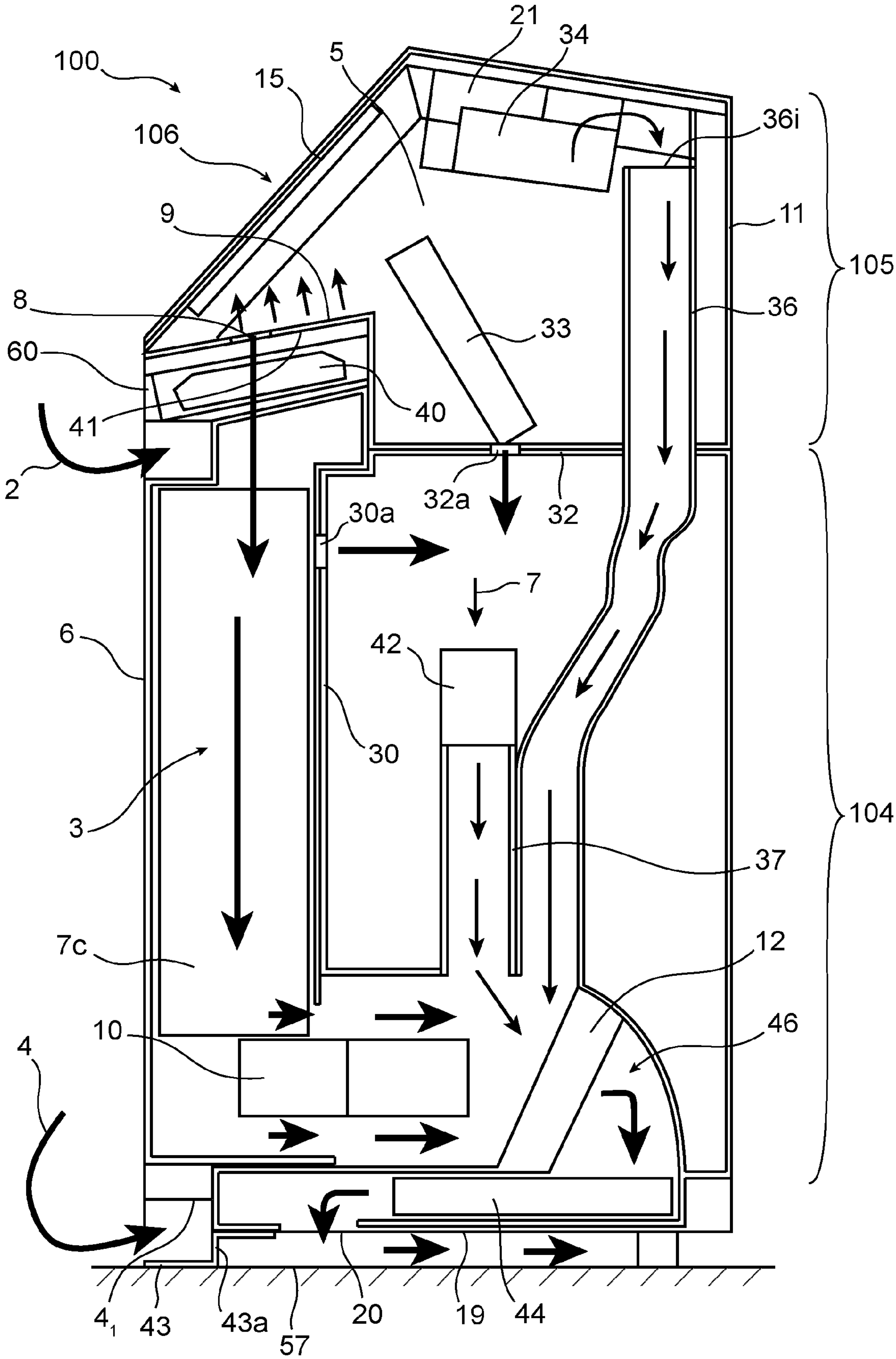


FIG. 1C


100
106
15
5
21
34
36i
9
8
60
41
40
33
11
105
36
2
32a
32
30a
7
6
42
30
3
37
104
7c
12
10
46
4
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43
43a
57
20
19
44

FIG. 2

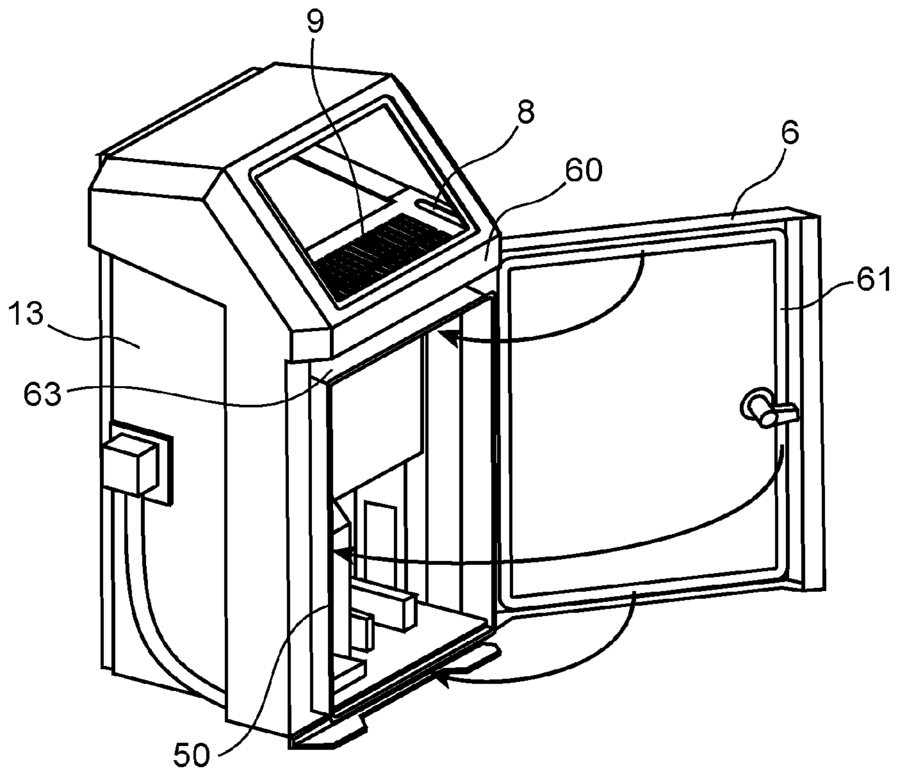

FIG. 3A

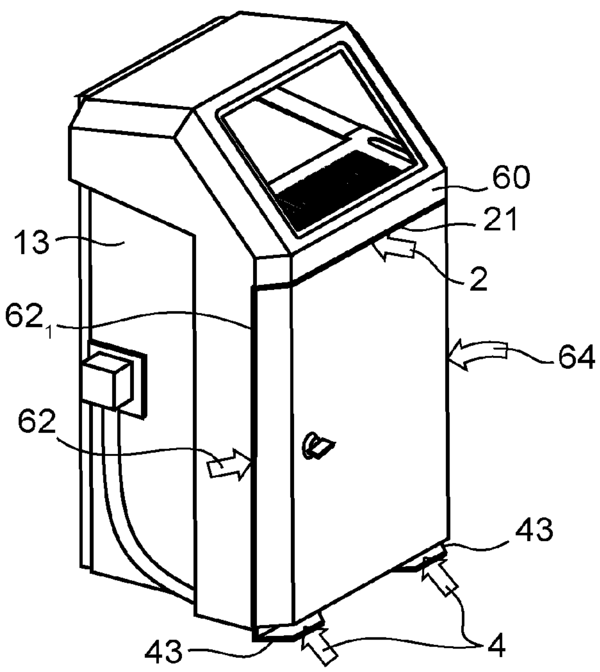

FIG. 3B

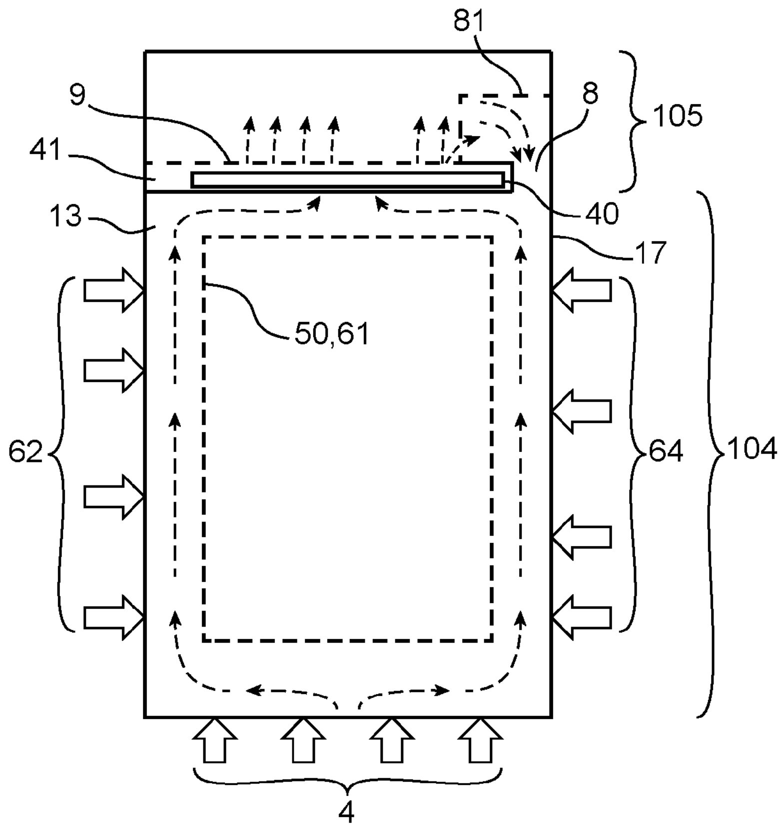

FIG. 3C

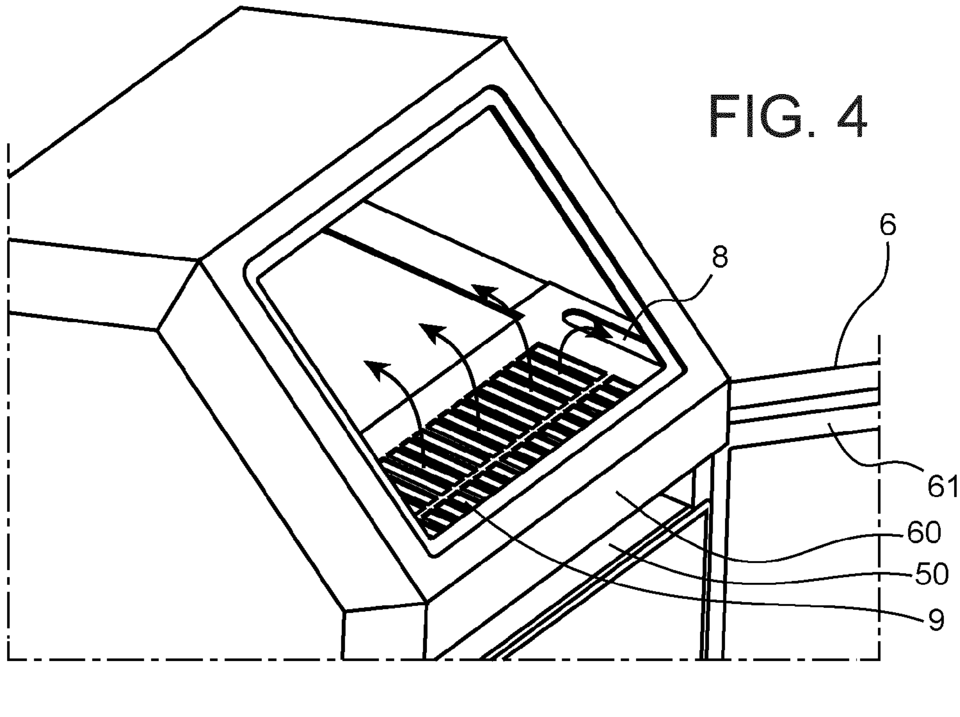

FIG. 4

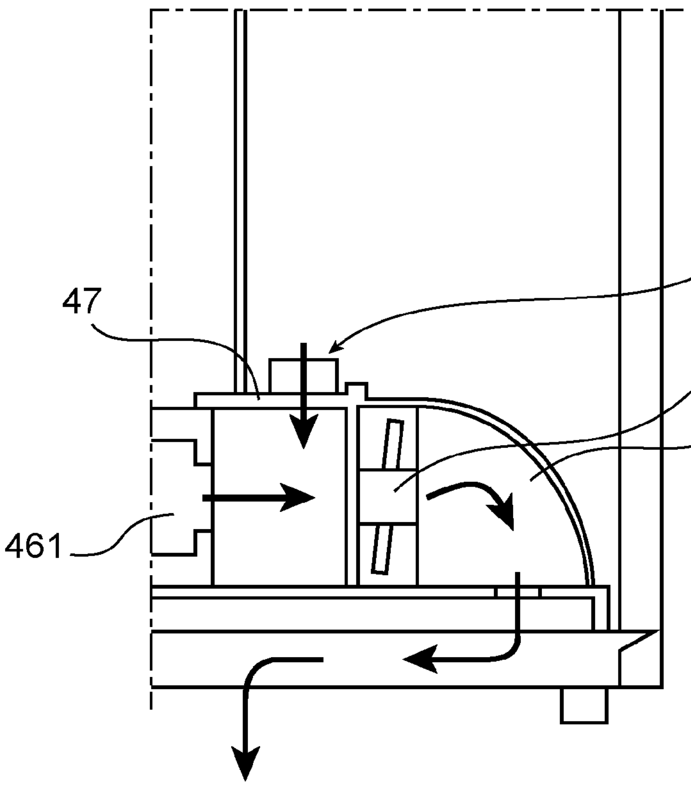

FIG. 5

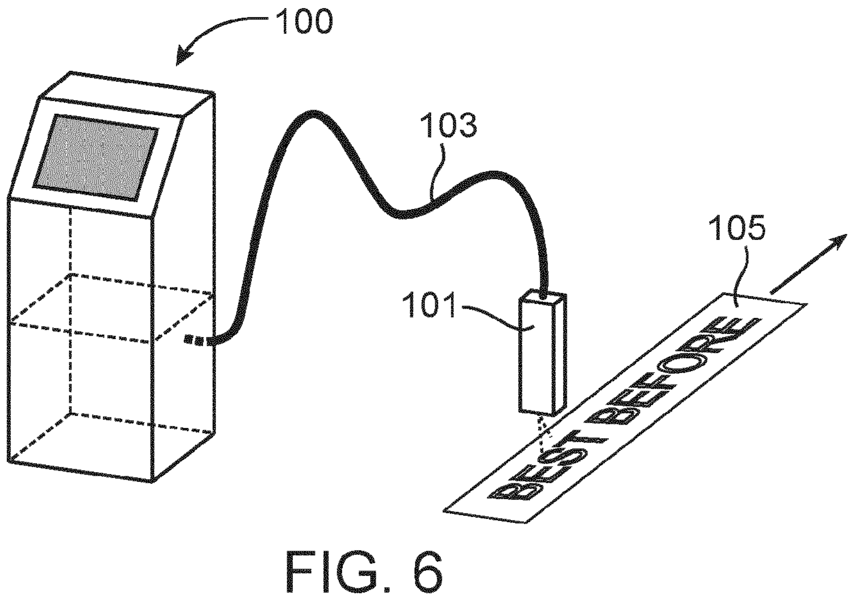

FIG. 6

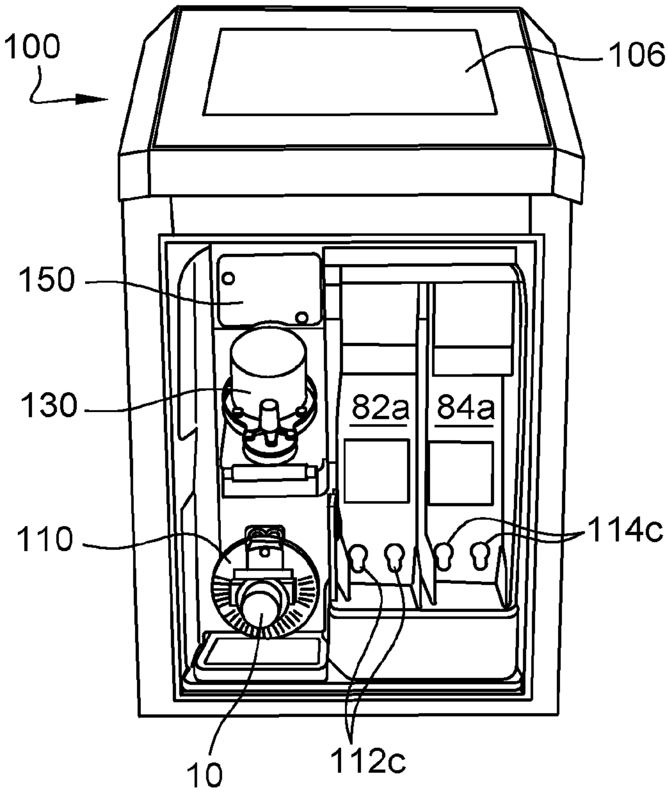

FIG.7A

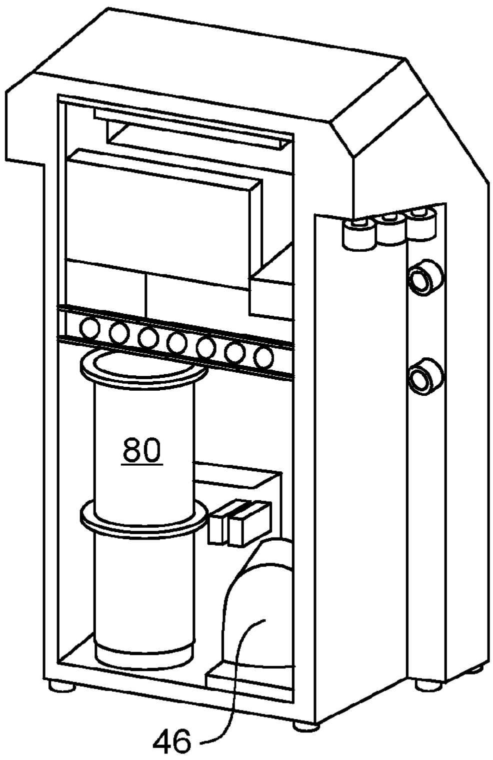

FIG.7B

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EUROPEAN SEARCH REPORT

Application Number
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1

Place of search	Date of completion of the search	Examiner
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