

FIG. 2

VALVES FOR PRINT MATERIAL RESERVOIRS

Background

[0001] A printing device can deliver a print material to a print medium to form an image on the print medium. In some examples, a printing device can be an electrophotographic printing device that supplies a toner (which is a type of print material) to an electrostatic latent image formed on a photoconductor to form a visible toner image on the photoconductor. The electrophotographic printing device transfers the toner image to a print medium, and then fixes the transferred toner image to the print medium, to form an image on the print medium.

[0002] In other examples, other types of printing devices can employ other types of print materials. For example, a printing device can employ ink that is ejected onto a print medium to form an image on the print medium. In further examples, a printing device can be a three-dimensional (3D) printing device, also referred to as an additive manufacturing machine that builds 3D objects on a layer-by-layer basis. In processing each layer of build material used in forming a 3D object, the 3D printing device can supply a liquid print agent to the layer. The liquid print agent is a form of print material.

Brief Description of the Drawings

[0003] Some implementations of the present disclosure are described with respect to the following figures.

[0004] Fig. 1 is a block diagram of a printing device according to some examples.

[0005] Figs. 2, 3, 4A-4B, 5A-5B, and 6A-6B are schematic diagrams of arrangements that include print material reservoirs of printing devices and refill containers, according to some examples.

[0006] Fig. 7 is a block diagram of a printing device according to some examples.

[0007] Fig. 8 is a flow diagram of a process of a printing device, according to some examples.

[0008] Throughout the drawings, identical reference numbers designate similar, but not necessarily identical, elements. The figures are not necessarily to scale, and the size of some parts may be exaggerated to more clearly illustrate the example shown. Moreover, the drawings provide examples and/or implementations consistent with the description; however, the description is not limited to the examples and/or implementations provided in the drawings.

Detailed Description

[0009] In the present disclosure, use of the term "a," "an," or "the" is intended to include the plural forms as well, unless the context clearly indicates otherwise. Also, the term "includes," "including," "comprises," "comprising," "have," or "having" when used in this disclosure specifies the presence of the stated elements, but do not preclude the presence or addition of other elements.

[0010] A printing device can include a print material reservoir to hold a print material. The print material can be in the form of a powder or a liquid. The print material reservoir can be in the form of any type of space within the printing device in which a print material can be stored until the print material is delivered for use in a print operation. In some examples, the print material reservoir may be in the form of a cartridge that is attached inside the printing device. The cartridge may be fixedly or removably attached to the printing device. A "cartridge" can refer to any container for a print material. In some examples, cartridges can include tanks to hold print materials that are to be delivered to a fluid dispensing assembly, such as a toner developer unit or another type of fluid dispensing assembly. In further examples, print material reservoirs can be part of toner developer units or other types of fluid dispensing assemblies.

[0011] A print material reservoir of the printing device can be refilled with a print material when the supply of the print material in the print material reservoir is exhausted or falls below a threshold. In examples where the print material reservoir

is in the form of a removable cartridge, the ability to refill the cartridge with a print material multiple times can increase the useful life of the cartridge and reduce the cost associated with using the cartridge, since the cartridge that is capable of being refilled does not have to be discarded after just a single use. The refillable cartridge can be refilled multiple times before having to be replaced by removal from the printing device and replacement with a new cartridge.

[0012] A print material reservoir in the printing device can be refilled using a print material refill container. The refill container includes a housing and a chamber within the housing that contains the print material. The refill container can engage a refill interface of a printing device, at which point a user can actuate a refill actuator of the refill container, to deliver the print material in the refill container to the reservoir of the printing device.

[0013] In some cases, it may be desirable to control whether refilling of a print material reservoir in the printing device is allowed when a refill container is engaged with a refill interface of the printing device. For example, the reservoir may be full or partially filled, which may prevent the refill container from emptying its content into the print material reservoir at the end of the print material refill operation. As a result, after performing the print material refill operation, some amount of print material may remain in the refill container, which may be wasted if the refill container is discarded.

[0014] In examples where a print material reservoir in the printing device is a print cartridge, the print cartridge may be reused a specified number of times (based on refilling the print cartridge after the print material in the print cartridge is depleted). After the specified number of times, the print cartridge is considered to be at end of life. Refilling a print cartridge at end of life should be avoided.

[0015] In further examples, a printing device can perform an authentication procedure to authenticate a refill container. During the authentication procedure, refill of a print material reservoir in the printing device using the refill container is to be blocked.

[0016] In some cases, electromechanical locks can be used to prevent refill containers from refilling printing device reservoirs with print materials. However, electromechanical locks add to the complexity of printing devices and can increase costs.

[0017] In accordance with some implementations of the present disclosure, a mechanically actuated valve is used to control whether or not a print material of a refill container is permitted to enter a print material reservoir (e.g., a print cartridge) of a printing device. The print material reservoir of the printing device includes a stirrer that when operated stirs a print material contained in the print material reservoir. The stirrer is actuated by a drive assembly of the printing device. The valve is actuated based on operation of the stirrer, which simplifies the control mechanism for the valve.

[0018] Fig. 1 is a block diagram of a printing device 100 according to some examples, which includes a print material reservoir 102. The print material reservoir 102 can be fixedly or removably mounted in the printing device 100.

[0019] The print material reservoir 102 includes an inlet 104 to receive a print material from a refill container 106 when the refill container 106 is engaged with a refill interface 108 of the printing device 100. In some examples, the refill container 106 is releasably attached to the refill interface 108. For example, the user can engage the refill container 106 with the refill interface 108 for the purpose of refilling the print material reservoir 102 with a print material. When the refill operation is completed, the refill container 106 can be disengaged from the refill interface 108.

[0020] In examples according to Fig. 1, the refill container 106 is external of the printing device 100. In other examples, the refill container 106 may be inserted into the printing device 100.

[0021] The refill interface 108 can include mechanical engagement members that can releasably engage with the refill container 106. The refill interface 108 can also

include fluidic engagement members to fluidically engage with the refill container 106 to receive a flow of the print material from the refill container 106.

[0022] The print material reservoir 102 includes a stirrer 110, which is used to stir the print material 112 contained in the print material reservoir 102. For example, the stirrer 110 can include a rotatable shaft 114 and a stirring blade 116 (or multiple stirring blades). The rotatable shaft 114 is driven by a drive assembly 118 that is external of the print material reservoir 102. The drive assembly 118 can include a motor and a gear assembly and/or a clutch, as examples. When energized, the motor of the drive assembly 118 can rotate the rotatable shaft 114 through the gear assembly and/or clutch, for example.

[0023] In other examples, the stirrer 110 can have a different arrangement. For example, the stirring of the print material 112 contained in the print material reservoir 102 can be accomplished by some type of an oscillating motion or other motion of a member of the stirrer 110. More generally, a "stirrer" can refer to any mechanical structure that can produce a motion to create agitation of a print material contained in the print material reservoir 102.

[0024] In accordance with some implementations of the present disclosure, a valve 120 is provided to control a flow of a print material from the refill container 106 when engaged with the refill interface 108 through the inlet 104 to an inner chamber 103 of the print material reservoir 102. The print material in the inner chamber 103 is identified as 112 in Fig. 1.

[0025] The valve 120 can be located inside the inner chamber 103 of the print material reservoir 102. Alternatively, the valve 120 can be positioned outside of the inner chamber 103 of the print material reservoir 102. The valve 120 is operatively coupled to the inlet 104 of the print material reservoir 102. The valve 120 has an open position and a closed position. In the open position, the valve 120 allows print material from the refill container 106 to flow through the inlet 104 into the inner chamber 103 of the print material reservoir 102. When in the closed position, the

valve 120 blocks the ingress of print material from the refill container 106 into the inner chamber 103 of the print material reservoir 102.

[0026] Although reference is made to the valve 120 as having an open position and a closed position, it is noted that in some examples, the valve 120 can further have an intermediate position (or multiple intermediate positions) between a fully open position and a closed position. An intermediate position corresponds to a partially open position of the valve 120 in which the print material can flow at a slower rate into the inner chamber 103 of the print material reservoir 102 from the refill container 106, as compared to a flow rate when the valve 120 is in the fully open position.

[0027] In the ensuing discussion, an "open position" of the valve 120 can refer to a fully open position or an intermediate position.

[0028] The actuation mechanism for operating the valve 120 between different positions can include the stirrer 110. For example, the valve 120 can be attached to the stirring blade 116 and/or to the rotatable shaft 114 of the stirrer 110. Thus, the actuation of the valve 120 between different positions can be based on operation of the stirrer 110. For example, movement of the stirrer 110 (e.g., movement of the rotatable shaft 114 and/or the stirring blade 116) can actuate the valve 120 between different positions.

[0029] By using the stirrer 110 to operate the valve 120, a separate actuation mechanism does not have to be provided. A separate actuation mechanism for the valve 120 may add to the complexity and cost of the printing device 100 and/or the print material reservoir 102.

[0030] The printing device 100 further includes a controller 122 that controls a printing operation and/or other operations of the printing device 100. As used here a "controller" can refer to a hardware processing circuit, which can include any or some combination of a microprocessor, a core of a multi-core microprocessor, a microcontroller, a programmable integrated circuit, a programmable gate array, or

another hardware processing circuit. Alternatively, a "controller" can refer to a combination of a hardware processing circuit and machine-readable instructions (software and/or firmware) executable on the hardware processing circuit.

[0031] The controller 122 can control the operation of the drive assembly 118. For example, the controller 122 can cause the drive assembly 118 to rotate the rotatable shaft 114 such that the stirrer 110 can stir the print material 112 in the inner chamber 103 of the print material reservoir 102.

[0032] Also, a valve control engine 123 of the controller 122 can operate the drive assembly 118 to actuate the stirrer 110 for the purpose of actuating the valve 120 between different positions, e.g., transitioning the valve 120 from a closed position to an open position, or vice versa. The valve control engine 123 can be implemented using a portion of the hardware processing circuit, or can be implemented using machine-readable instructions executable by the controller 122.

[0033] In some examples, the valve control engine 123 can operate the stirrer 110 for the purpose of controlling the valve 120 based on information of the print material reservoir 102. For example, the print material reservoir 102 can include a sensor 124 that detects a fill level of the print material 112 in the inner chamber 103 of the print material reservoir 102. The sensor 124 provides measurement information 125 to the controller 122 over a communication path (e.g., an electrically conductive link or a wireless link), where the measurement information indicates a fill level of the print material 112 in the inner chamber 103. The valve control engine 123 can maintain the valve 120 in the closed position if the fill level of the print material 112, as indicated by the measurement information from the sensor 124, has not fallen below a specified threshold. This is to prevent a partial use of the print material in the refill container 106, in which some amount of fill material remains in the refill container 106.

[0034] In other examples, the refill container 106 can include a memory 128, which can be implemented using a non-volatile memory device (or multiple non-volatile memory devices), for example. The memory 128 can store information, such

as a credential or other information, that can be used by the controller 122 to authenticate the refill container 106. The information in the memory 128 can be provided through an electrical connection of the refill interface 108 as information 129 to the controller 122.

[0035] Prior to the controller 122 authenticating the refill container 106, the valve control engine 123 can maintain the valve 120 in the closed position. Once the valve control engine 123 has successfully authenticated the refill container 106, such as based on the information stored in the memory 128, the valve control engine 123 can operate the drive assembly 118 to actuate the stirrer 110 to open the valve 120 to the open position. If the controller 122 is unable to authenticate the refill container 106, then the valve control engine 123 can maintain the valve 120 in the closed position to prevent the print material in the refill container 106 from entering the print material reservoir 102.

[0036] As another example, the controller 122 can keep track of the quantity of refill operations that have been performed with respect to the print material reservoir 102. The controller 122 can store an indicator (e.g., a counter) that indicates a quantity of times that the valve 120 has been opened to allow a refill operation to occur. If the quantity of refill operations for the print material reservoir 102 exceeds a specified quantity, then the valve control engine 123 can prevent any opening of the valve 120 so that any further refill operation of the print material reservoir 102 is blocked.

[0037] Fig. 2 shows an example in which the valve 120 includes a plate 202 (more generally referred to as a shutter) attached to a first end portion 204 of the stirring blade 116. The plate 202 can be formed using a metal or non-metal. The plate 202 can be integrally attached to the stirring blade 116, or alternatively, the plate 202 can be separate from but attached to the stirring blade 116.

[0038] A second end portion 206 of the stirring blade 116 is attached to the rotatable shaft 114. Rotation of the rotatable shaft 114 (by the drive assembly 118 based on control of the controller 122) causes a corresponding rotation of the stirring

blade 116 to stir the print material 112 in the inner chamber 103 of the print material reservoir 102.

[0039] The movement of the stirring blade 116 also causes a rotational movement of the plate 202. In the position shown in Fig. 2, the plate 202 blocks an inlet channel 208 of the inlet 104. This prevents the print material in the refill container 106 from entering the inner chamber 103 of the print material reservoir 102 through the inlet 104.

[0040] When the rotatable shaft 114 is rotated, the movement of the stirring blade 116 causes a corresponding movement (e.g., clockwise or counterclockwise rotation) of the plate 202 from the closed position shown in Fig. 2 to an open position where the plate 202 no longer blocks a mouth 210 the inlet channel 208 of the inlet 104. When the plate 202 has moved to its open position, the print material from the refill container 106 can enter the inner chamber 103 of the print material reservoir 102 through the inlet 104.

[0041] Fig. 3 shows another example of the valve 120, which includes a flapper 302 (more generally referred to as a shutter). The flapper 302 can be formed of a metal or a non-metal. The flapper 302 has a first end portion 310 that is pivotally attached, at a hinge 308 to the housing of the print material reservoir 102. When the stirring blade 116 is positioned as shown in Fig. 3, an end 306 of the stirring blade 116 engages a second end portion 312 of the flapper 302, to maintain the flapper 302 in the closed position that blocks the inlet channel 208 of the inlet 104.

[0042] Rotation of the rotatable shaft 114 in the clockwise direction causes the end 306 of the stirring blade 116 to move away from the flapper 302, which allows the flapper 302 to pivot (at the hinge 308) away from the mouth 210 of the inlet channel 208, so that the print material flow can occur from the refill container 106 through the inlet 104 and into the inner chamber 103 of the print material reservoir 102.

[0043] In some examples, when the stirring blade 116 is disengaged from the flapper 302, the weight of the flapper 302 causes the flapper 302 to move away from the mouth 210 of the inlet channel 208. However, continued motion of the rotatable shaft 114 in the clockwise direction causes the stirring blade 116 to rotate until the stirring blade 116 re-engages with the flapper 302 and causes the flapper 302 to move against the mouth 210 of the inlet channel 208, to again block print material flow through the inlet channel 208.

[0044] Figs. 4A and 4B show an arrangement including another example of the valve 120. In Figs. 4A and 4B, the valve 120 is in the form of a shutter 402 that is in the form of an arc-shaped plate. The shutter 402 can be formed of a metal or a non-metal. The shutter 402 includes an opening 404 that when aligned with the inlet channel of the inlet 104 corresponds to the open position of the valve 120 (as shown in Fig. 4B). When the opening 404 is not aligned with the inlet channel of the inlet 104, as shown in Fig. 4A, the shutter 402 blocks the mouth of the inlet 104, which corresponds to the closed position of the valve 120.

[0045] The shutter 402 can be attached by support members 406 to the rotatable shaft 114 of the stirrer 110. The stirring blade 116 is also attached to the rotatable shaft 114.

[0046] Note that rotation of the rotatable shaft 114 causes the stirring blade 116 to rotate, but the support members 406 of the shutter 402 are mounted to the rotatable shaft 114 in a way that allows the rotatable shaft 114 to rotate without moving the shutter 402. This can be accomplished, for example, by defining circular portions on the rotatable shaft 114 to attach ring-shaped connectors 408 to the ends of the support members 406. The ring-shaped connectors 408 each has a circular opening that is mounted on a respective circular portion of the rotatable shaft 114, such that the rotatable shaft 114 can freely rotate inside the circular opening of the ring-shaped connectors 408.

[0047] Movement of the shutter 402 can be caused by engagement of the stirring blade 116 with either an impact face 410 or an impact face 412 of the shutter 402.

For example, when the stirring blade 116 is rotated in the clockwise position, the stirring blade 116 will engage the impact face 410 of the shutter 402, which can allow the stirring blade 116 to push the shutter 402 in the clockwise direction. On the other hand, rotation of the stirring blade 116 in the counter-clockwise direction causes the stirring blade 116 to engage the impact face 412, which causes the shutter 402 to rotate in the counter-clockwise direction.

[0048] In this manner, the opening 404 of the shutter 402 can be moved between the closed position of the valve (as shown in Fig. 4A) and the open position (as shown in Fig. 4B). In the open position shown in Fig. 4B, the print material can flow through the inlet 104 and the opening 404 of the shutter 402 into the inner chamber 103 of the print material reservoir 102.

[0049] In some examples, a stop 414 (Fig. 4A) can be attached to the inner surface of the housing of the print material reservoir 102. The stop 414 can be a protrusion that rises radially inwardly into the inner chamber 103 of the print material reservoir 102. When the shutter 402 is rotated in the clockwise direction as shown in Fig. 4A, the shutter 402 can contact the stop 414 (e.g., as shown in Fig. 4A), which prevents further rotation of the shutter 402 (such as further rotation in the clockwise direction). The stop 414 can thus restrict the amount of motion of the shutter 402.

[0050] Similarly, another stop 415 can be attached to the inner surface of the housing of the print material reservoir 102, to prevent further rotation of the shutter 402 in the counterclockwise direction. In other examples, the stop 414 and/or the stop 415 can be omitted.

[0051] In further examples, a biasing mechanism (which can include a spring, for example) can be included to bias the shutter 402 to either the open position (Fig. 4A) or the closed position (Fig. 4B). The stirring blade 116 when engaged with the impact face 410 or 412 of the shutter 402 can move the shutter 402 against the force exerted by the biasing mechanism.

[0052] Figs. 5A and 5B shows another arrangement in which the valve 120 includes a lever 504 that can pivot between different positions that correspond to the open position and the closed position of the valve 120.

[0053] Figs. 5A and 5B further show a portion of the housing 500 of a printing device (e.g., 100 in Fig. 1). A refill interface 502 is mounted to the housing 500, and can receive the refill container 106.

[0054] The lever 504 is pivotably mounted on a support 506. A first end portion 508 of the lever 504 is engaged to a cover (not shown) that can be actuated between an open position (Fig. 5A) and a closed position (Fig. 5B). The cover is part of the valve 120. In the open position of Fig. 5A, the cover (or more generally a shutter) allows the print material to flow from the refill container 106 into the inner chamber 103 of the print material reservoir 102. In the closed position of Fig. 5B, the cover blocks the print material from flowing from the refill container 106 into the inner chamber 103 of the print material reservoir 102.

[0055] A second end portion 518 of the lever 504 is attached to a locking member 510. The locking member 510 engages a curved edge surface 512 of a cam 514. In some examples, the cam 514 is generally disk-shaped. Each of the cam 514, locking member 510, and lever 504 can be formed of a metal or non-metal.

[0056] The cam 514 is mounted on the rotatable shaft 114 of the stirrer 110 (Fig. 1). The cam 514 has a radius that varies along the curved edge surface 512. For example, a radius R1 between a center portion 516 of the cam 514 (the center portion 516 is attached to the rotatable shaft 114) and a first point 512-1 on the curved edge surface 512 is greater than a radius R2 between the center portion 516 and a second point 512-2 of the curved edge surface 512. Note that the radius of the cam 514 gradually increases from the point 512-2 on the curved edge surface 512 to the point 512-1.

[0057] When the locking member 510 is engaged to a wider part of the cam 514, such as to the first point 512-1 of the curved edge surface 512, the second end

portion 518 of the lever 504 is pushed upwardly by the locking member 510 such that the second end portion 518 of the lever 504 is at a raised position (Fig. 5A). In the position shown in Fig. 5A, a first end portion 508 of the lever 504 (which is at the opposite end of the lever 504 relative to the second end portion 518) is in a lowered position. In the position of Fig. 5A, the cover of the valve 120 is open.

[0058] From the position of the cam 514 shown in Fig. 5A, if the cam 514 is rotated in a counter-clockwise direction, then the bottom of the locking member 510 would ride along the edge surface 512 of the cam 514 and gradually drop downwardly due to the reduced radius of the cam 514. When the cam 514 has been rotated in the counter-clockwise direction to the position shown in Fig. 5B, the locking member 510 has dropped downwardly to its lowest position, to allow the second end portion 518 of the lever 504 to also drop downwardly, such that the second end portion 518 is at a lowered position. In the position shown in Fig. 5B, the lever 504 is pivoted downwardly with respect to the lever 504 shown in Fig. 5A.

[0059] When the lever 504 pivots such that its second end portion 518 drops downwardly, the first end portion 508 of the lever 504 pushes the cover of the valve 120 upwardly to the closed position.

[0060] Figs. 6A and 6B show a variant of the arrangement shown in Figs. 5A and 5B. In Figs. 6A and 6B, instead of using the cam 514 to control the position of the locking member 510 (and thus the lever 504), the locking member 510 is attached to a flapper 602 that is pivotably connected at a hinge 604 that is attached to a housing of the print material reservoir 102. When the stirring blade 116 is engaged to the flapper 602 as shown in Fig. 6A, the second end portion 518 of the lever 504 is in the raised position, such that the valve 120 is open.

[0061] Once the stirring blade 116 is rotated in the clockwise direction to the position shown in Fig. 6B, the stirring blade 116 disengages from the flapper 602, which allows the flapper 602 to pivot downwardly at the hinge 604. This causes the locking member 510 and the second end portion 518 of the lever 504 to drop downwardly, which in turn causes the first end portion 508 of the lever 504 to rise.

The rising of the first end portion 508 of the lever 504 causes the cover of the valve 120 to be closed.

[0062] Fig. 7 is a block diagram of a printing device 700 including a refill interface 702 to receive a print material refill container. The printing device 700 further includes a reservoir 704. The reservoir 704 has an inlet 706 to receive a print material from the print material refill container when the print material refill container is engaged with the refill interface 702. The reservoir 704 further includes a stirrer 708 to stir the print material in the reservoir 704, and a valve 710 actuatable between an open position and a closed position by movement of the stirrer 708. The valve 710 when in the closed position blocks entry of the print material from the print material refill container through the inlet 706, and the valve 710 when in the open position allows entry of the print material from the print material refill container through the inlet 706.

[0063] The printing device 700 further includes a drive assembly 712 to actuate the stirrer 708.

[0064] Fig. 8 is a flow diagram of a process 800 that can be performed by a printing device.

[0065] The process 800 includes receiving (at 802), at a refill interface of the printing device, a print material refill container that is releasably engageable with the refill interface.

[0066] The process 800 includes maintaining (at 804) closed a valve of a reservoir of the printing device, to block entry of a print material into the reservoir from the print material refill container.

[0067] The process 800 includes operating (at 806) a stirrer in the reservoir to stir a print material in the reservoir.

[0068] The process 800 includes opening (at 808) the valve in response to operating the stirrer.

[0069] The process 800 includes filling (at 810) the reservoir with the print material from the print material refill container when the valve is opened.

[0070] In some examples, the valve remains closed when the print material refill container is disengaged from the refill interface. For example, the controller 122 (Fig. 1) of the printing device 100 can detect that the print material refill container is not engaged to the refill interface, and can control the valve to remain closed.

[0071] In the foregoing description, numerous details are set forth to provide an understanding of the subject disclosed herein. However, implementations may be practiced without some of these details. Other implementations may include modifications and variations from the details discussed above. It is intended that the appended claims cover such modifications and variations.

What is claimed is:

1. A print material reservoir for a printing device, comprising:
a stirrer to stir a print material in the print material reservoir; and
an inlet to receive the print material from a refill container for a refill operation;
a valve actuatable between an open position and a closed position by
movement of the stirrer, the valve when in the closed position to block entry of the
print material from the refill container through the inlet, and the valve when in the
open position to allow entry of the print material from the refill container through the
inlet.
2. The print material reservoir of claim 1, wherein the valve comprises a shutter
attached to the stirrer, the shutter moveable between different positions with the
movement of the stirrer, wherein the different positions comprise a first position
corresponding to the open position of the valve, and a second position
corresponding to the closed position of the valve.
3. The print material reservoir of claim 2, wherein the stirrer comprises a
rotatable shaft and a stirring blade attached to the rotatable shaft.
4. The print material reservoir of claim 3, wherein the shutter is to rotate with the
stirring blade upon rotation of the rotatable shaft.
5. The print material reservoir of claim 3, wherein the shutter is attached to the
stirring blade or to the rotatable shaft.
6. The print material reservoir of claim 2, wherein the shutter comprises a port
aligned with the inlet when the shutter is at the first position.

7. The print material reservoir of claim 1, further comprising a cam actuatable by the movement of the stirrer, the cam when in a first position allows the valve to actuate to the open position, and the cam when in a second position to maintain the valve at the closed position.
8. The print material reservoir of claim 7, wherein the cam is disk-shaped and has a radius that varies along a curved edge surface of the cam.
9. The print material reservoir of claim 8, further comprising a locking member that rides along the curved edge surface as the cam rotates to actuate the valve between the open position and the closed position.
10. The print material reservoir of claim 1, further comprising a lever actuatable by the movement of the stirrer, the lever when in a first position allows the valve to actuate to the open position, and the lever when in a second position to maintain the valve at the closed position.
11. The print material reservoir of claim 1, wherein the valve comprises a flapper having a blocking position to block the inlet, and an unblocking position to unblock the inlet, and wherein the stirrer when moved to a first position engages the flapper to the blocking position, and when moved to a second position allows the flapper to actuate to the unblocking position.

12. A printing device comprising:
a refill interface to receive a print material refill container;
a reservoir comprising:
an inlet to receive a print material from the print material refill container when the print material refill container is engaged with the refill interface,
a stirrer to stir the print material in the reservoir, and
a valve actuatable between an open position and a closed position by movement of the stirrer, the valve when in the closed position to block entry of the print material from the print material refill container through the inlet, and the valve when in the open position to allow entry of the print material from the print material refill container through the inlet; and
a drive assembly to actuate the stirrer.
13. The printing device of claim 12, wherein the stirrer comprises a rotatable shaft to rotate when stirring the print material in the reservoir, and the valve is actuatable between the open position and the closed position based on a rotation of the rotatable shaft.
14. A method for use with a printing device, comprising:
receiving, at a refill interface of the printing device, a print material refill container that is releasably engageable with the refill interface;
maintaining closed a valve of a reservoir of the printing device, to block entry of a print material into the reservoir from the print material refill container;
operating a stirrer in the reservoir to stir a print material in the reservoir;
opening the valve in response to operating the stirrer; and
filling the reservoir with the print material from the print material refill container when the valve is opened.
15. The method of claim 14, wherein the valve remains closed when the print material refill container is disengaged from the refill interface.

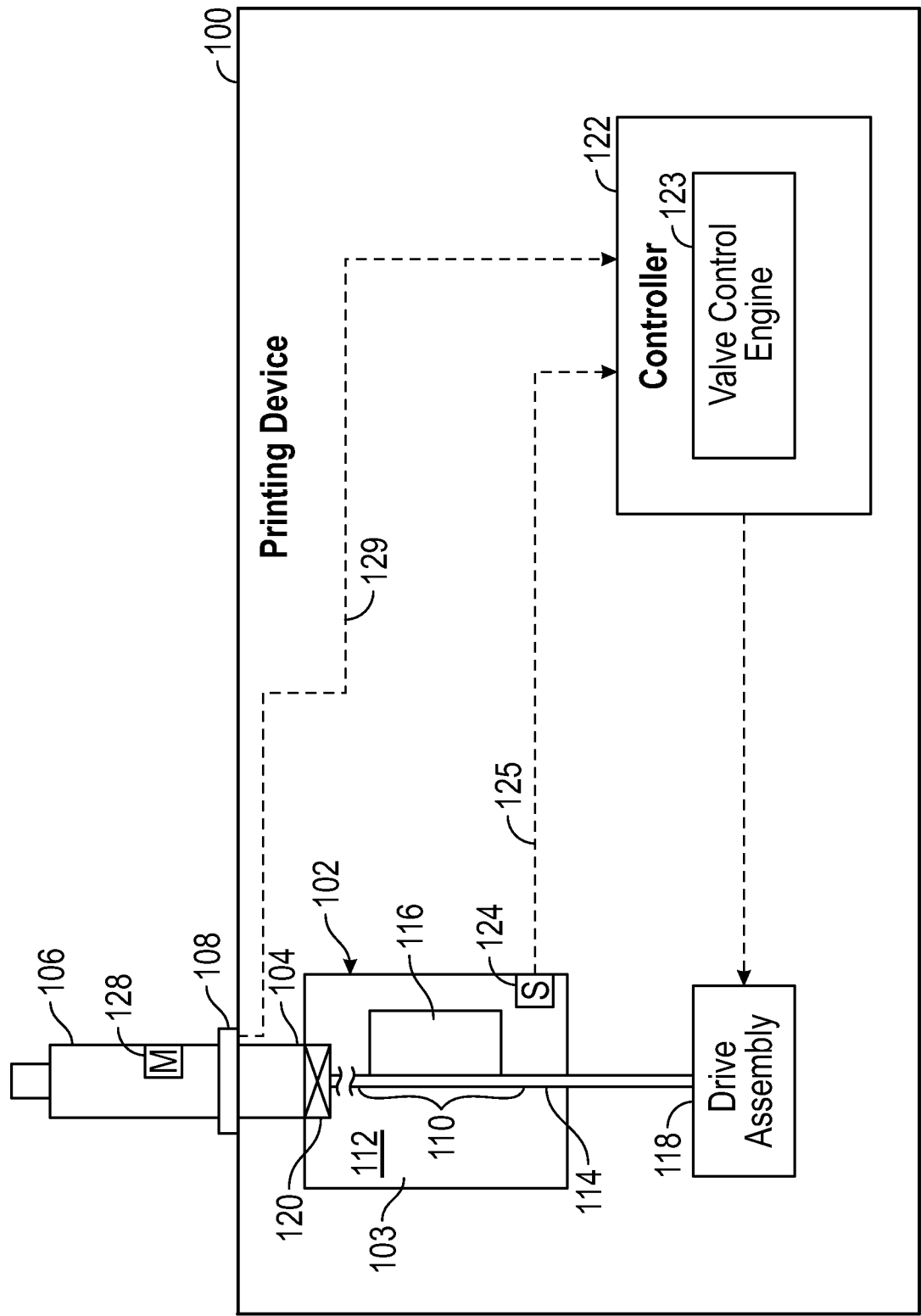


FIG. 1

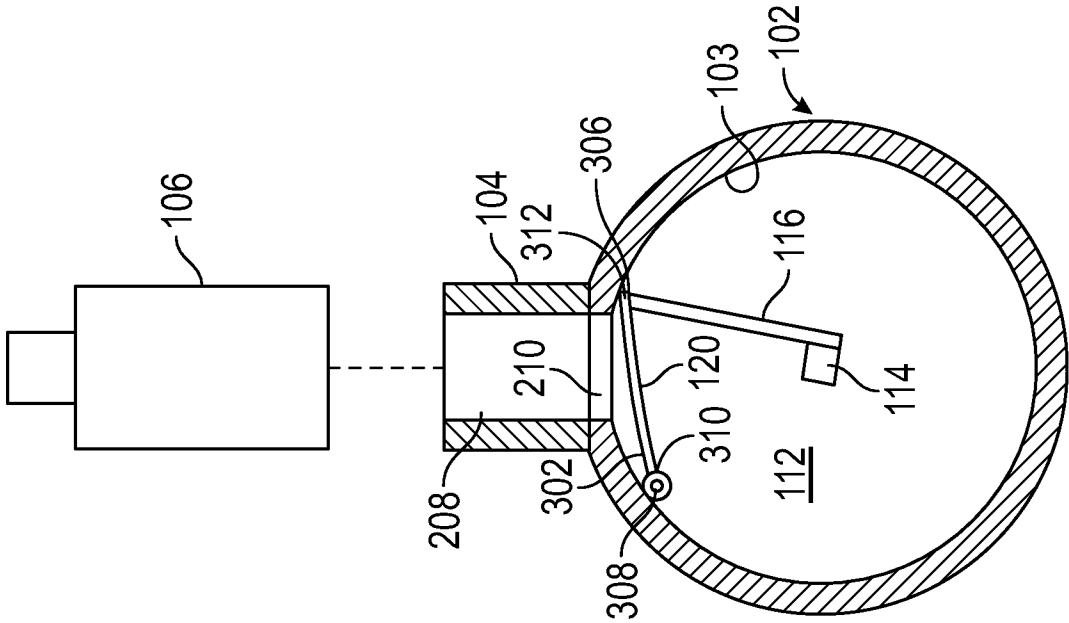


FIG. 3

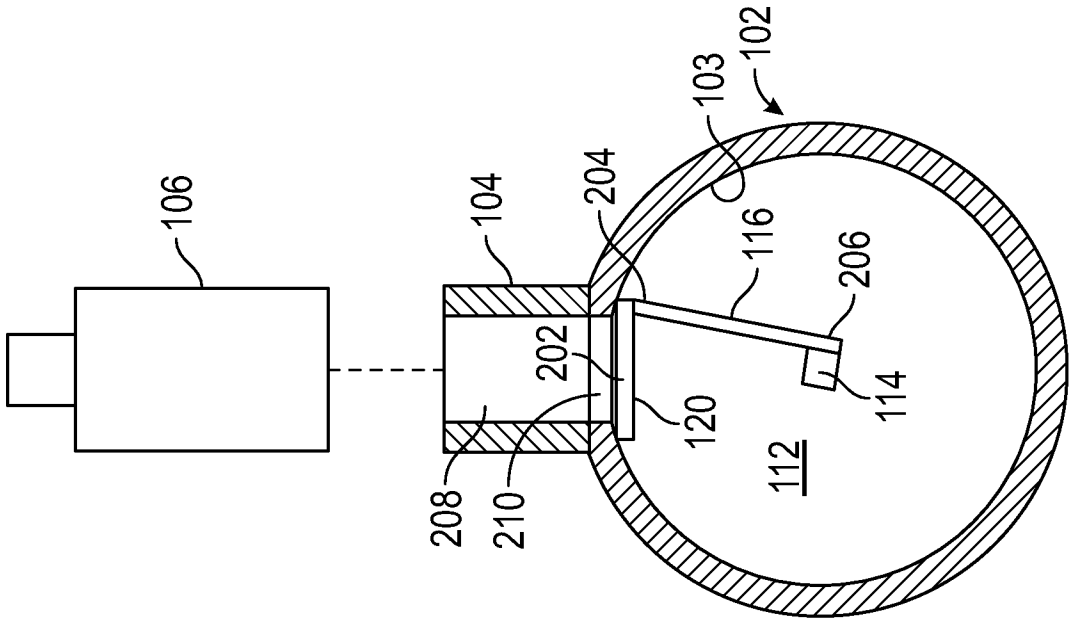


FIG. 2

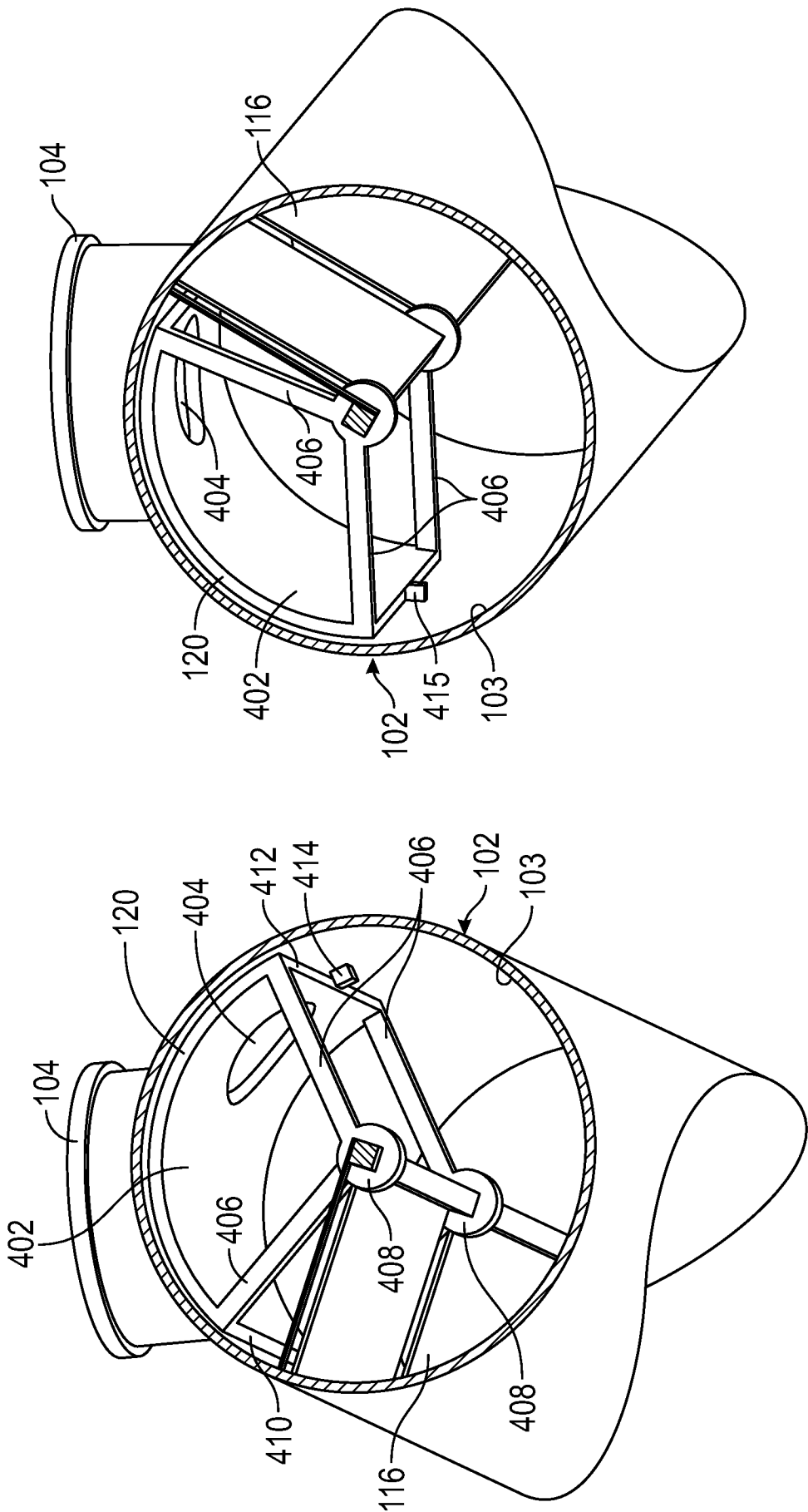
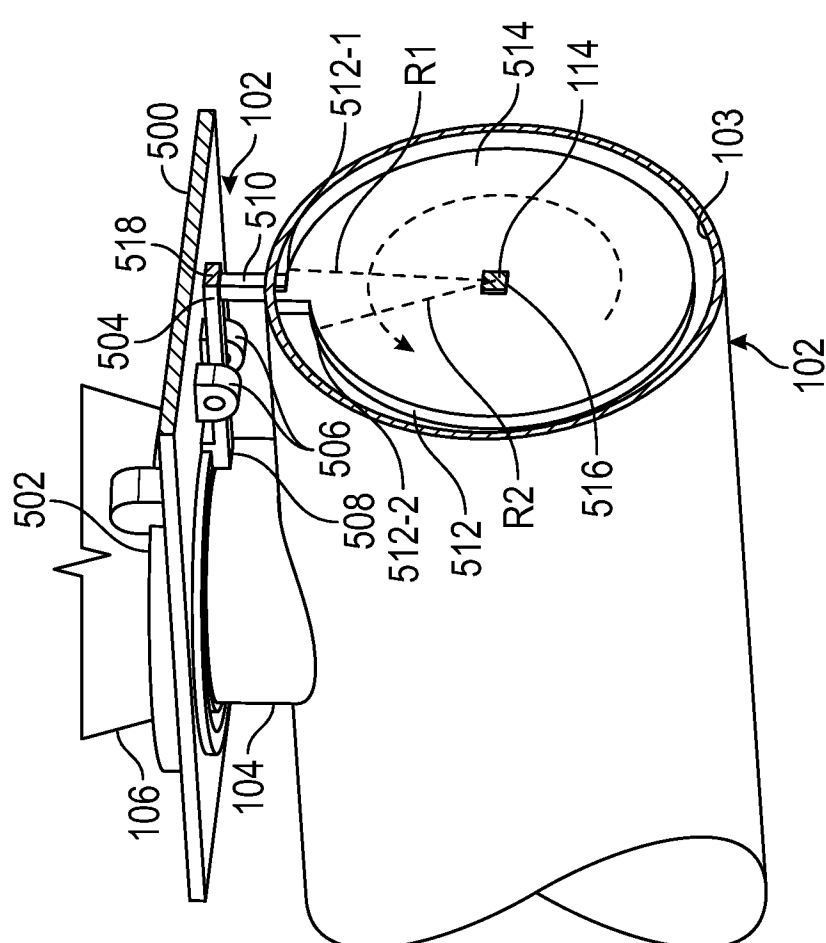
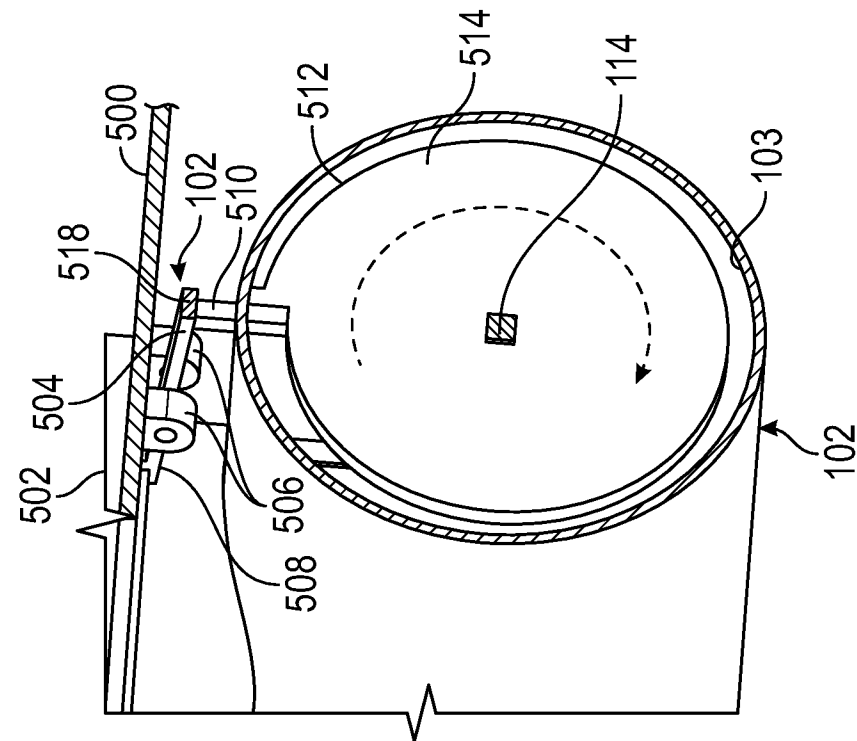


FIG. 4B

FIG. 4A



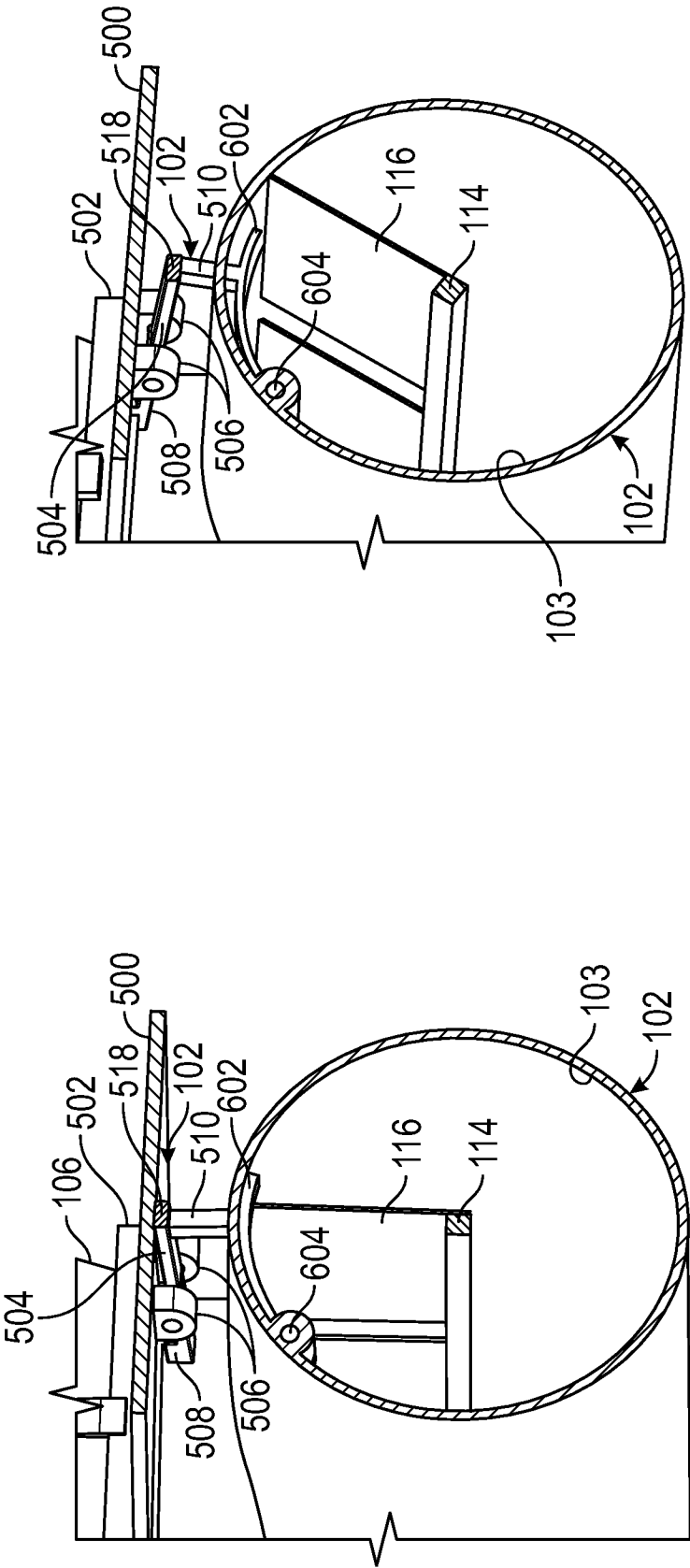


FIG. 6B

FIG. 6A

6/6

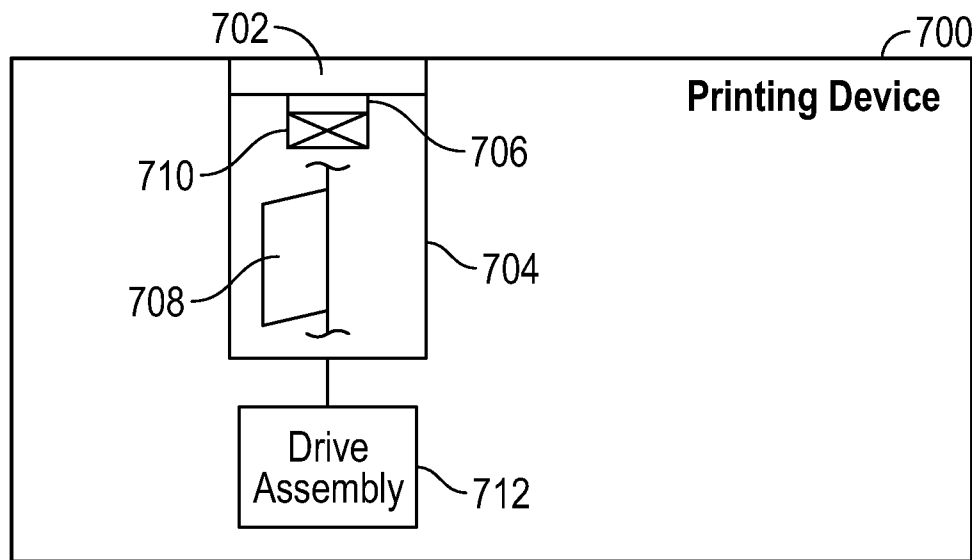


FIG. 7

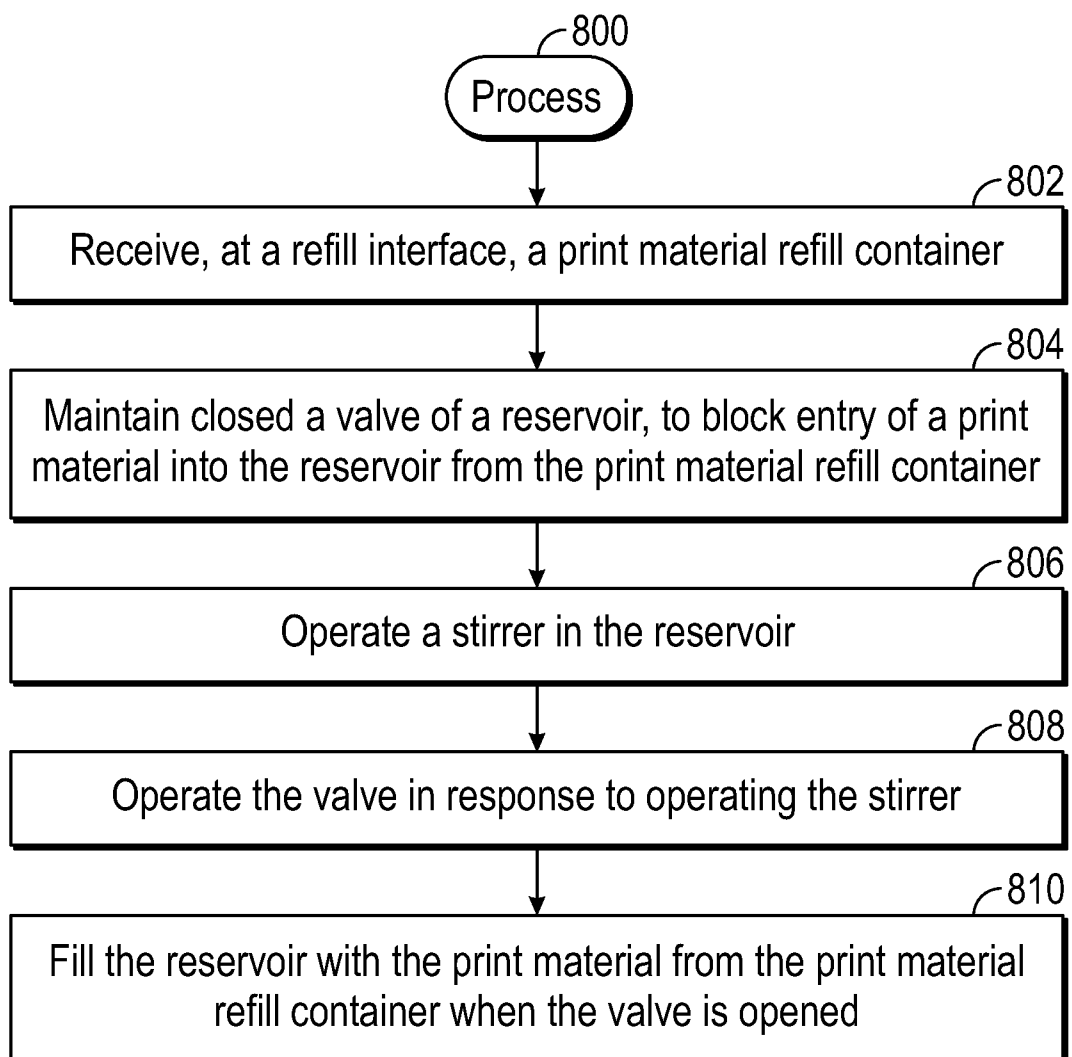


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2021/026175

A. CLASSIFICATION OF SUBJECT MATTER		<i>B41J 2/175 (2006.01)</i> <i>B41F 31/02 (2006.01)</i> <i>B41F 31/03 (2006.01)</i> <i>B41L 27/04 (2006.01)</i> <i>G03G 15/08 (2006.01)</i> <i>G03G 15/10 (2006.01)</i>	
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 2/00-2/175, 31/02, 31/03, B41L 27/04, G03G 15/08, 15/10			
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched			
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)			
PatSearch (RUPTO Internal), USPTO, PAJ, Espacenet, Information Retrieval System of FIPS			
C. DOCUMENTS CONSIDERED TO BE RELEVANT			
Category*	Citation of document, with indication, where appropriate, of the relevant passages		Relevant to claim No.
X	US 2012/0200645 A1 (SEIKO EPSON CORPORATION) 09.08.2012, abstract, paragraphs [0043]-[0045], [0047]-[0051], [0053], [0054], [0057], [0059]-[0060], [0066], figures 1-5		1-6, 12-15
A			7-11
A	US 9156272 B2 (BROTHER KOGYO KABUSHIKI KAISHA) 13.10.2015		1-15
A	US 7677690 B2 (FUJIFILM CORPORATION) 16.03.2010		1-15
A	WO 2008/035725 A1 (RICOH COMPANY, LTD et al.) 27.03.2008		1-15
A	RU 2406613 C1 (CANON KABUSHIKI KAISHA) 20.12.2010		1-15
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.			
* Special categories of cited documents:	"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 to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
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"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			
Date of the actual completion of the international search		Date of mailing of the international search report	
06 December 2021 (06.12.2021)		16 December 2021 (16.12.2021)	
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer T. Maev Telephone No. 8(495)531-65-15	