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BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

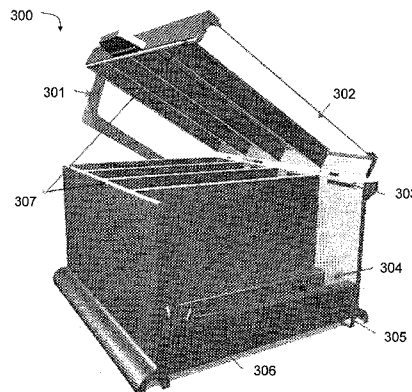
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(54) **Title:** DEVICE FOR REFILLING INK CARTRIDGE

Fig. 3



(57) **Abstract:** According to some embodiments of the invention, a multiple usage ink cartridge, integrated within a printer is provided herein. The multiple usage ink cartridge is comprised of the following elements: (i) multiple dispensing containers' cells, enabling controlled ink dispensing, wherein each dispensing container cell encapsulates sealed(isolated) space and includes a dissolving mechanism; (ii) a closure comprised of multiple covering elements, wherein each cover element is designed to fit a single container cell; and (iii) multiple disposable ink capsules having a solid initial state and encapsulated by skin cover that is sealing the ink capsule, wherein the ink capsule composition is characterized by dissolving into liquid state upon initiation of the dissolving mechanism, wherein upon inserting each ink capsule within each container cell and pressing the closure to enclose the containers the dissolving mechanism is activated, thereby initiating the dissolving process of the ink capsule into a liquid state.



DEVICE FOR REFILLING INK CARTRIDGE

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This application claims priority to US provisional patent application no. 61/814608 filed on April 22, 2013, which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates generally to methods and systems for an inkjet printer, which is using an ink cartridge, and more specifically to methods and apparatus of replaceable dissolving ink capsules based on a unique container for the inkjet printer.

BACKGROUND OF THE INVENTION

[0003] Printers known in the art use ink cartridges which are replaced once the ink is consumed. The ink cartridge may be refilled, however this option is not supported by manufactures of original ink cartridges. Replacement of the ink cartridge may be time consuming, inconvenient for a user and may cause electronic waste.

SUMMARY OF THE INVENTION

[0004] According to some embodiments of the invention, a multiple usage ink cartridge, integrated within a printer is provided herein. The multiple usage ink cartridge comprised of:

(i) multiple dispensing containers' cells, enabling controlled ink dispensing, wherein each dispensing container cell encapsulates sealed/isolated space and includes a dissolving mechanism; (ii) a closure comprised of multiple covering elements, wherein each cover element is designed to fit a single container cell; and (iii) multiple disposable ink capsules having a solid initial state and encapsulated by skin cover that is sealing the ink capsule, wherein the ink capsule composition is characterized by dissolving into liquid state upon initiation of the dissolving mechanism, wherein upon inserting each ink capsule within each container cell and pressing the closure to enclose the containers the dissolving mechanism is activated, thereby initiating the dissolving process of the ink capsule into a liquid state.

The present invention provides a multipurpose ink cartridge for a printer. The multipurpose ink cartridge comprising: multiple dispensing container cells each

configured for containing and dispensing of ink, wherein each dispensing container cell forms therein a sealable space and comprises a liquefying mechanism and a closure configured to cover all dispensing container cells.

According to some embodiments of the present invention each dispensing container cell is configured for liquefying a solidified composition of ink from an ink composition capsule placed therein by using said liquefying mechanism thereof.

According to some embodiments of the present invention the liquefying mechanism is configured to only activate upon closing of said closure.

According to some embodiments of the present invention the liquefying mechanism is a mechanical mechanism using sharp projection installed within the cartridge unit, which cut the skin layer of the ink capsule when the closing the cartridge.

According to some embodiments of the present invention the liquefying mechanism is electrical mechanism, including an ultrasonic transmitting unit which is associated with the cartridge, enabling to transmit ultrasonic signal toward the ink capsule for initiating the dissolving process of the of ink into liquid state.

According to some embodiments of the present invention the liquefying mechanism is heating element is associated with the cartridge, enabling to heat the ink capsule for initiating the dissolving process of the ink into liquid state.

According to some embodiments of the present invention the ink capsule encapsulated a PCB the ink capsules ,said PCB includes code for controlling the activation of the printer.

According to some embodiments of the present invention the PCB can't be removed from the ink capsule before dissolving into liquid.

According to some embodiments of the present invention the PCB code determines at least one of the following: limits for activating the printer in terms of remaining ink level, time period or number of prints, wherein once the limit is reached the printer can't be activated before a new PCB is released from a new ink capsule.

According to some embodiments of the present invention the PCB a inserted in a slot of the cartridge, wherein a PCB of a new capsule ink is pushing away the old PCB of the previous ink capsule .

The multipurpose usage ink cartridge wherein the cartridge unit has transparent upper lid, which enables to estimate the remaining ink in the container

cell, and to insert a new ink capsule.

The present invention provides a method for providing replacing ink within permanent cartridge unit which is integrated within a printer. The method comprising the steps of: providing multiple dispensing container cells each configured for containing and dispensing of ink, wherein each dispensing container cell forms therein a sealable space and comprises a liquefying mechanism and inserting each disposable ink capsule into one dispensing container cell within the permanent cartridge unit, dispensing container cell enabling controlled ink dispensing, wherein each container cell forms therein a sealable space and comprises a liquefying mechanism.

According to some embodiments of the present invention upon inserting each ink capsule within each container cell, activating the liquefying mechanism, thereby initiating the dissolving process of the ink capsule into liquid state.

According to some embodiments of the present invention the method further comprising the step of closing a closure of the permanent cartridge unit, said closure configured to cover all dispensing container cells and activating the liquefying mechanism;

According to some embodiments of the present invention the activation of the liquefying mechanism is initiated by the user.

The present invention a printer for a multipurpose ink cartridge. The printer comprising: an ink cartridge comprising multiple dispensing container cells each configured for containing and dispensing of ink, wherein each dispensing container cell forms therein a sealable space, multipurpose ink cartridge, a liquefying mechanism and a closure; and a control chip for controlling the cartridge unit movement along rails situated along the bottom of the printer.

According to some embodiments of the present invention dispensing container cell is configured for liquefying a solidified composition of ink from an ink composition capsule placed therein by using said liquefying mechanism thereof

According to some embodiments of the present invention the liquefying mechanism is a mechanical mechanism using sharp projection installed within

the cartridge unit, which cut the skin layer of the ink capsule when the closing the cartridge.

According to some embodiments of the present invention the liquefying mechanism is electrical mechanism positioned within the printer, including an ultrasonic transmitting unit which is associated with the cartridge, enabling to transmit ultrasonic signal toward the ink capsule for initiating the dissolving process of the of ink into liquid state.

According to some embodiments of the present invention the liquefying mechanism is heating element is associated with the cartridge positioned within the printer, enabling to heat the ink capsule for initiating the dissolving process of the ink into liquid state..

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The invention will now be described in connection with certain preferred embodiments with reference to the following illustrative figures so that it may be more fully understood.

[0006] With specific reference now to the figures in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice.

In the drawings:

Fig. 1 is a simplified pictorial illustration showing an internal view of a printer and a cartridge unit, according to some embodiments of the present invention;

Fig. 2 is a simplified pictorial illustration showing the cartridge unit separated from the printer according to some embodiments of the present invention;

Fig. 3 is a simplified pictorial illustration showing an internal view of the

cartridge unit, according to some embodiments of the present invention;

Figures 4A-4D are simplified pictorial schemes of the cartridge unit, according to some embodiments of the present invention: **Fig. 4A** shows a side view of the cartridge unit; **Fig. 4B** shows another side view of the cartridge unit; **Fig. 4C** shows a top inner view of the cartridge unit; **Fig. 4D** shows an inner view of a cell of the cartridge unit;

Fig. 5 is a simplified pictorial illustration showing an internal view of the cartridge unit and the control chip, according to some embodiments of the present invention;

Fig. 6 is a simplified pictorial illustration showing a top view of the cartridge unit and the ink capsules, according to some embodiments of the present invention; and

Fig. 7 is a simplified pictorial illustration showing a front view of ink capsules and the printing chip, according to some embodiments of the present invention.

Fig. 8 is a simplified pictorial illustration showing an internal view of the cartridge unit and ultrasonic unit, according to some embodiments of the present invention.

Fig. 9 is a simplified pictorial illustration showing an internal view of the cartridge unit and heating unit, according to some embodiments of the present invention.

Fig. 10 is a simplified pictorial illustration showing an internal view of the cartridge unit with a heating element, according to some embodiments of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0007] In the detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that these are specific embodiments and that the present invention may be practiced also in different ways that embody the characterizing

features of the invention as described and claimed herein.

[0008] The present invention, in some embodiments thereof, provides a unique ink cartridge for printers and a unique technique for economical printing, using this permanent single use cartridge unit that is installed in a printer optionally as an integral part thereof. The permanent single use cartridge unit is refillable with unique ink capsules, each capsule having an ink material kept sealed and in an initial solid state, which dissolves into liquid under certain conditions or through a certain chemical or electrical processes. Therefore, the cartridge is configured such that only when the capsule is inserted into the cartridge unit it liquefies (also referred to herein as "dissolves") into a disposable liquid ink. The initiation of the liquefied state can be achieved in different techniques using a dissolving mechanism based on the configuration of the cartridge.

[0009] One technique suggested and exemplified by the present invention is a mechanical dissolving mechanism using sharp projection installed within the cartridge unit. The sharp projection cut the skin layer of the unique ink capsule when closing the cartridge.

[0010] According to some embodiments of the present invention, an electrical dissolving mechanism is implemented using an ultrasonic transmitting unit which is associated with the cartridge unit, enabling to transmit an ultrasonic signal toward the ink capsule for initiating the liquefying process of the of ink.

[0011] According to some embodiments of the present invention, a heating element is associated with the cartridge unit, enabling to heat the ink capsule for initiating the dissolving process of the ink into a liquid state.

[0012] Reference is now made to **Fig. 1**, which is a simplified pictorial illustration showing an internal view of a printer **100** with a cartridge unit **102** and cover **101**, according to some embodiments of the invention.

[0013] Reference is now made to **Fig. 2** which is a simplified pictorial illustration of a printer **200**, and the cartridge unit **202** of the present invention, which comprises four container dispensing cells **203**. Each cell **203** can be filled with a different ink capsule of a different color, such as: Cyan, Magenta, Yellow and Black. The cartridge unit **202** can slide along rails **506** (as seen in **Fig. 5**) using sliding elements **204**, which are installed at the bottom part of the printer.

[0014] Reference is now made to **Fig. 3**, which is a simplified pictorial illustration showing an internal view of a cartridge unit **300** which includes: a closure arm **301** for supporting the cover at an opened position, sealing ribbons **307** for preventing ink from drying, transparent windows **302** enabling to view the liquid level therethrough, a slot **303** for placing the Printed Circuit Board (PCB) **703** (as shown in **Figure 7**), an ink nozzle **304** for spraying the ink, located at the lower part of the cartridge unit **300** slightly above the bottom thereof, a container **305**, which is used to collect ink overloads, and a sharp projection **306** at the bottom of each container cell for cutting the skin of the ink capsules **701** (as shown in **figure 7**).

[0015] Once the skin which wraps the ink capsules **701** (as shown in **figure 7**) is cut, the capsule composition therein starts dissolving, in reaction to the exposure of the capsule composition to air. Within the ink capsule a PCB (Printed Circuit Board) is encapsulated, which includes a code for controlling the activation of the printer. The PCB cannot be removed from the ink capsule before the composition thereof liquefies. The PCB code determines limits for activating the printer in terms of remaining ink level, time period, number of prints etc. Once the limit is reached the printer cannot be activated before a new PCB is released from a new ink capsule. The PCB therefore may include one or more sensors for sensing the remaining volume or weight of the ink in the cartridge cell.

[0016] Reference is now made to **Figures 4A-4D** which are simplified pictorial schemes **400** of the cartridge unit **202** (as shown in **Fig. 2**) in a closed position. **Fig. 4A** is a front view of the cartridge unit with a closure **401**.

[0017] **Fig. 4B** is a side view of the cartridge unit with a supporting arm **403** and the sliding element **404**. **Fig. 4C** is a top view of the cartridge unit with a lid cover **407**. **Fig. 4D** is a side view of the cartridge unit with the cover lid **405** and the container **406**.

[0018] Reference is now made to **Fig. 5**, which is a simplified pictorial illustration showing the internal view **500** of the cartridge unit **202** (as shown in **Fig. 2**) and the control chip **503**, which is used for controlling the cartridge unit **202** (as shown in **Fig. 2**) movement along the rails **506**.

[0019] Reference is now made to **Fig. 6**, which is a simplified pictorial illustration showing a top view **600** of the cartridge unit **202** (as shown in **Figure 2**) and the ink

capsules **601**, located in the containers cells. The cartridge unit **202** (as shown in Figure 2) which is designed for permanent use is covered by top lid **602** which seals the ink capsules **601**.

[0020] Reference is now made to **Fig. 7**, which is a simplified pictorial illustration showing a side view **700** of ink capsules **701** and its PCB **703a** inserted in the slot **704** pushing away the old PCB **703b** of the previous ink capsule. The cartridge unit **202** (as shown in Figure 2) has a transparent upper lid **702**, which enables to estimate the remaining ink in the container cell, and to insert a new ink capsule.

[0021] Fig. 8 is a simplified pictorial illustration showing an internal view of the cartridge unit and ultrasonic unit, according to some embodiments of the present invention. According this embodiment is provided an ultrasonic unit **810** for implementing the liquefying mechanism. The ultrasonic unit is controlled electronically to be activated when the closure is pressed down or manually upon user selection and the when cartridge unit is positioned near by the ultrasonic unit. When activated the ultrasonic unit transmits ultrasonic signal toward the ink capsule for initiating the liquefying process of the of ink.

[0022] Fig. 9 is a simplified pictorial illustration showing an internal view of the cartridge unit and heating unit, according to some embodiments of the present invention. According this embodiment is provided an ultrasonic unit **910**, positioned within the printer for implementing the liquefying mechanism. The heating unit **910**, positioned inside the printer, is controlled electronically to be activated when the closure is pressed down or manually upon user selection and the cartridge unit is positioned near by the heating unit. Upon activation of the heating unit, heat is generated in proximity to ink capsule for initiating the dissolving liquefying process of the ink.

[0023] Fig. 10 is a simplified pictorial illustration showing an internal view of the cartridge unit with a heating element, according to some embodiments of the present invention. According this embodiment is provided a heating unit **910**, positioned within the cartridge for implementing the liquefying mechanism. The heating unit **1000**, is controlled electronically to be activated when the closure is pressed down or manually upon user selection. Upon activation of the heating unit, heat is generated in proximity to ink capsule for initiating the liquefying process of the ink.

[0024] The references cited herein teach many principles that are applicable to the present invention. Therefore the full contents of these publications are incorporated by reference herein where appropriate for teachings of additional or alternative details, features and/or technical background.

[0025] It should be understood that the invention is not limited in its application to the details set forth in the description contained herein or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Those skilled in the art will readily appreciate that various modifications and changes can be applied to the embodiments of the invention as hereinbefore described without departing from its scope, defined in and by the appended claims

CLAIMS:

1. A multipurpose ink cartridge for a printer, said multipurpose ink cartridge comprising:
 - multiple dispensing container cells each configured for containing and dispensing of ink, wherein each dispensing container cell forms therein a sealable space and comprises a liquefying mechanism; and
 - a closure configured to cover all dispensing container cells,
wherein each said dispensing container cell is configured for liquefying a solidified composition of ink from an ink composition capsule placed therein by using said liquefying mechanism thereof.
2. The multipurpose ink cartridge of claim 1 wherein said liquefying mechanism is configured to only activate upon closing of said closure.
3. The multipurpose ink cartridge of claim 1 wherein the liquefying mechanism is a mechanical mechanism using sharp projection installed within the cartridge unit, which cut the skin layer of the ink capsule when the closing the cartridge.
4. The multipurpose ink cartridge of claim 1 wherein the liquefying mechanism is electrical mechanism, including an ultrasonic transmitting unit which is associated with the cartridge, enabling to transmit ultrasonic signal toward the ink capsule for initiating the dissolving process of the of ink into liquid state.
5. The multipurpose ink cartridge of claim 1 wherein the liquefying mechanism is heating element is associated with the cartridge, enabling to heat the ink capsule for initiating the dissolving process of the ink into liquid state.
6. The multipurpose ink cartridge of claim 1 wherein the ink capsule encapsulated a PCB the ink capsules ,said PCB includes code for controlling the activation of the printer.
7. The multipurpose usage ink cartridge of claim 6 wherein PCB can't be removed from the ink capsule before dissolving into liquid.
8. The multipurpose ink cartridge of claim 7, wherein the PCB code determines at least one of the following: limits for activating the printer in terms of remaining ink level, time period or number of prints, wherein once the limit is

reached the printer can't be activated before a new PCB is released from a new ink capsule.

9. The multipurpose ink cartridge of claim 6 wherein the PCB is inserted in a slot of the cartridge, wherein a PCB of a new capsule ink is pushing away the old PCB of the previous ink capsule.
10. The multipurpose usage ink cartridge wherein the cartridge unit has transparent upper lid, which enables to estimate the remaining ink in the container cell, and to insert a new ink capsule.
11. A method for providing replacing ink within permanent cartridge unit which is integrated within a printer, said method comprising the steps of:
 - providing multiple dispensing container cells each configured for containing and dispensing of ink, wherein each dispensing container cell forms therein a sealable space and comprises a liquefying mechanism;
 - inserting each disposable ink capsule into one dispensing container cell within the permanent cartridge unit, dispensing container cell enabling controlled ink dispensing, wherein each container cell forms therein a sealable space and comprises a liquefying mechanism;wherein upon inserting each ink capsule within each container cell, activating the liquefying mechanism, thereby initiating the dissolving process of the ink capsule into liquid state.
12. The method of claim 11 further comprising the step of closing a closure of the permanent cartridge unit, said closure configured to cover all dispensing container cells and activating the liquefying mechanism;
13. The method of claim 11 wherein the activation of the liquefying mechanism is initiated by the user.
14. A printer for a multipurpose ink cartridge, said printer comprising:
 - an ink cartridge comprising multiple dispensing container cells each configured for containing and dispensing of ink, wherein each dispensing container cell forms therein a sealable space, multipurpose ink cartridge
 - a liquefying mechanism and a closure; and
 - a control chip for controlling the cartridge unit movement along rails situated along the bottom of the printer;

wherein each said dispensing container cell is configured for liquefying a solidified composition of ink from an ink composition capsule placed therein by using said liquefying mechanism thereof

15. The printer of claim 14 wherein the liquefying mechanism is a mechanical mechanism using sharp projection installed within the cartridge unit, which cut the skin layer of the ink capsule when the closing the cartridge.
16. The printer of claim 14 wherein the liquefying mechanism is electrical mechanism positioned within the printer, including an ultrasonic transmitting unit which is associated with the cartridge, enabling to transmit ultrasonic signal toward the ink capsule for initiating the dissolving process of the of ink into liquid state.
17. The printer of claim 14 wherein the liquefying mechanism is heating element is associated with the cartridge positioned within the printer, enabling to heat the ink capsule for initiating the dissolving process of the ink into liquid state..

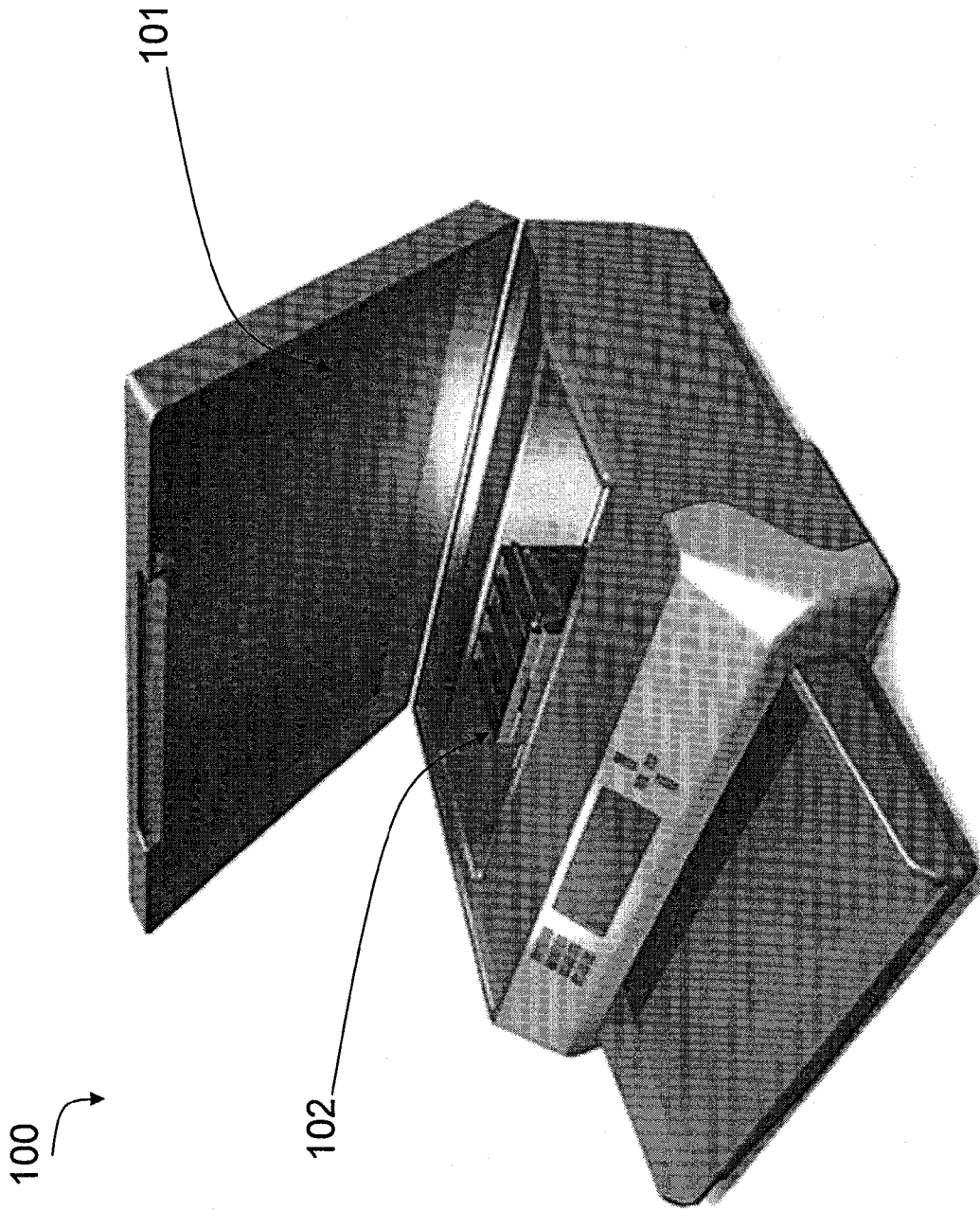
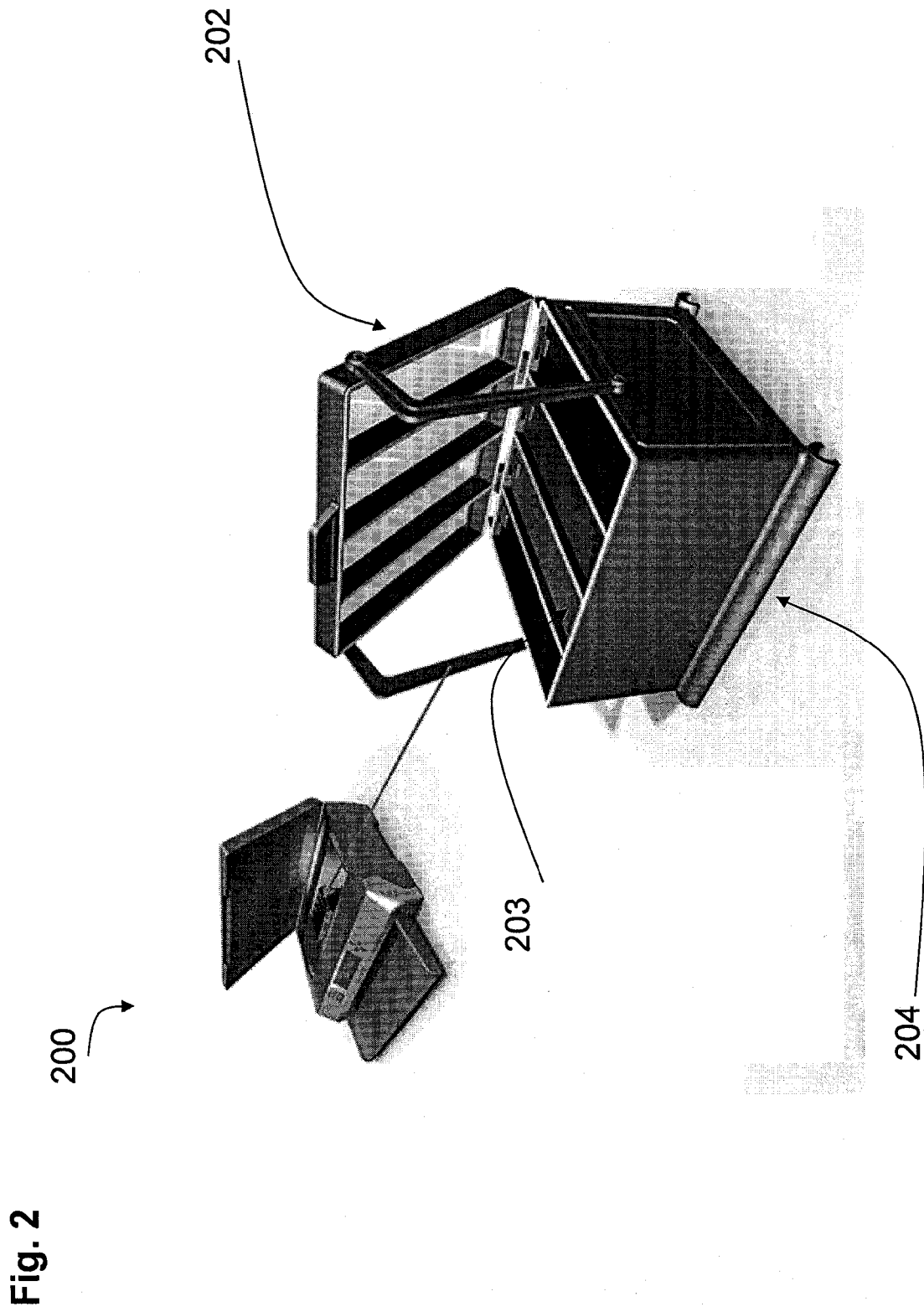


Fig. 1



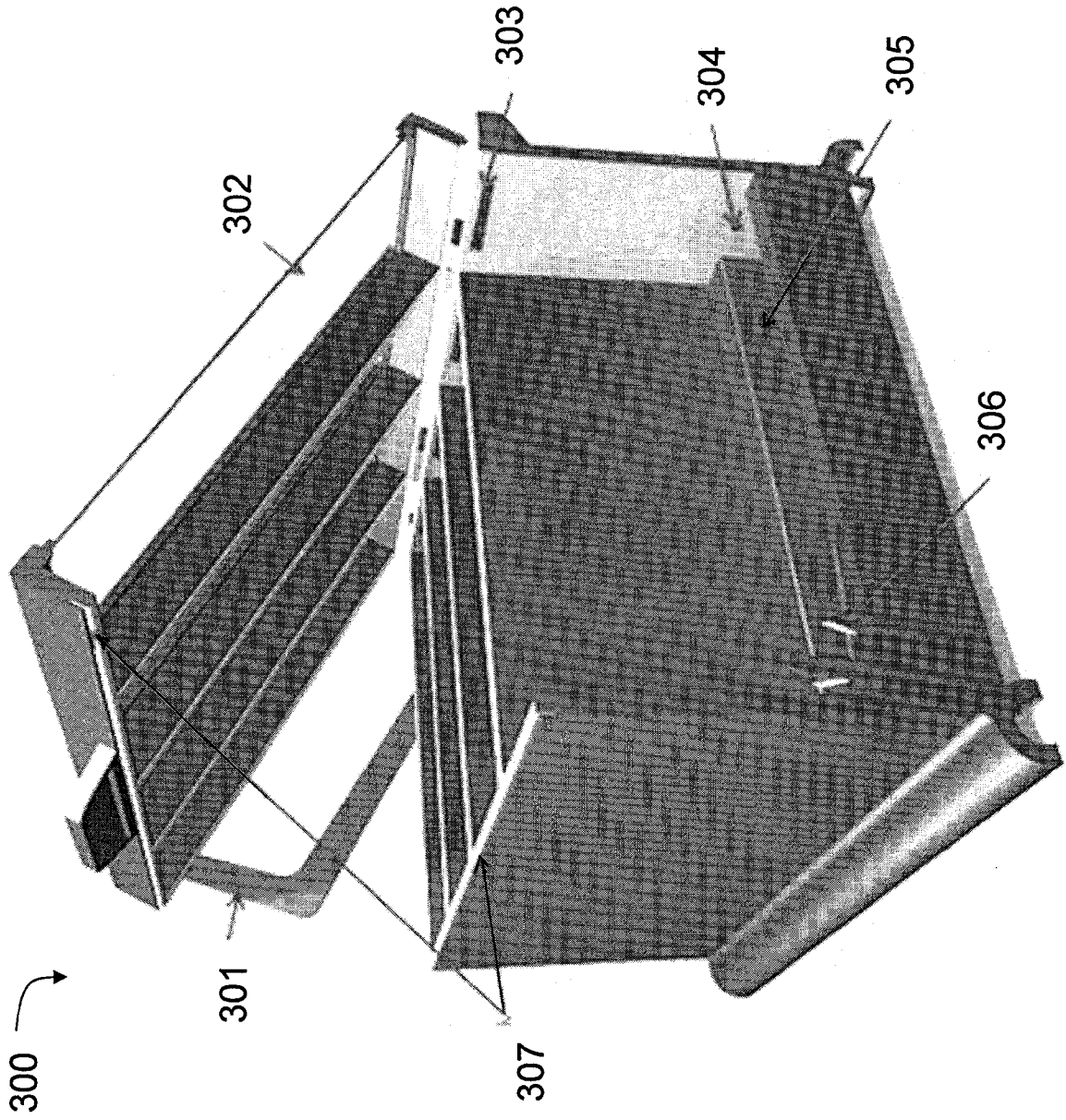
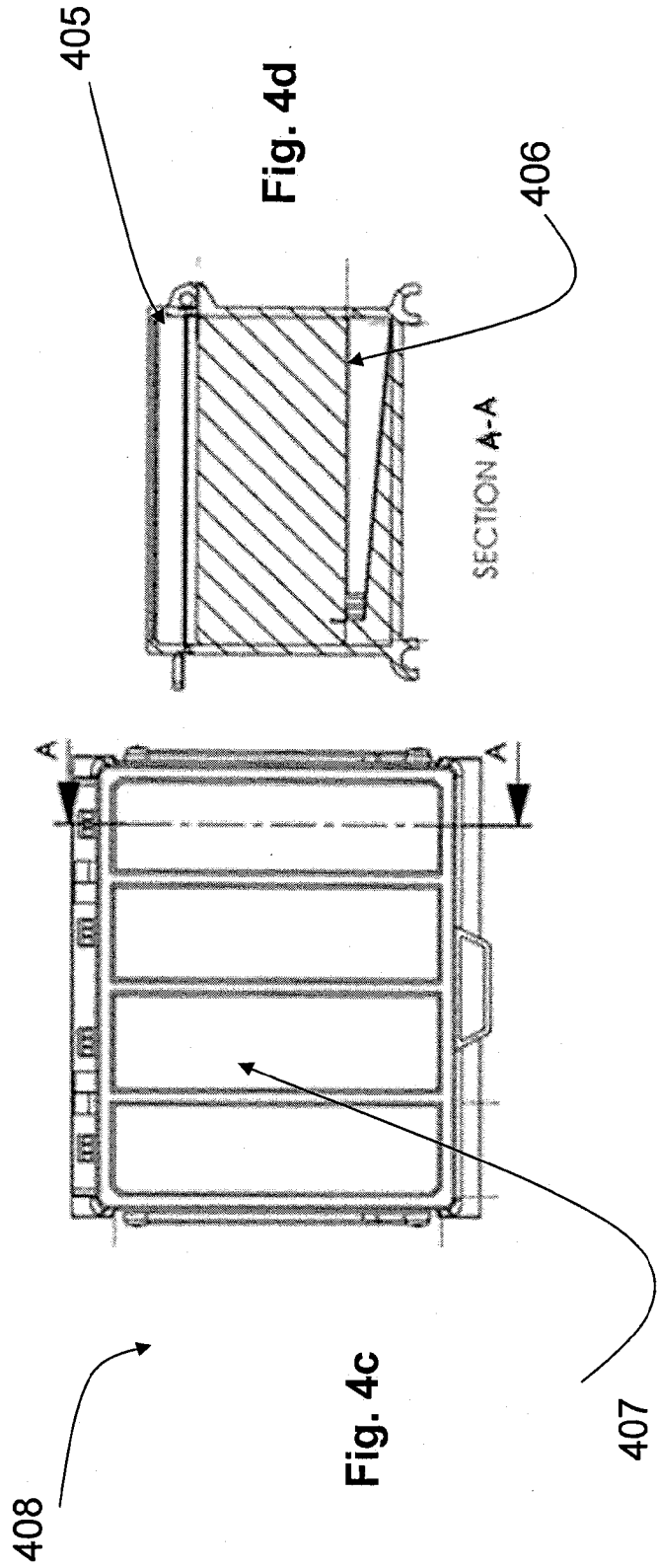
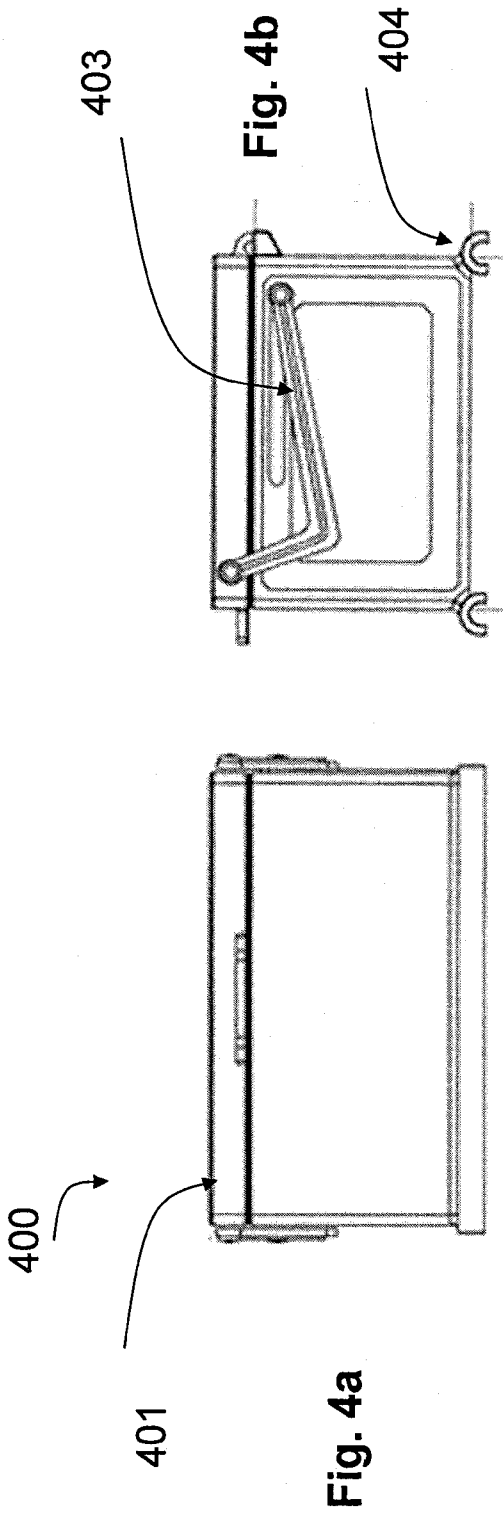
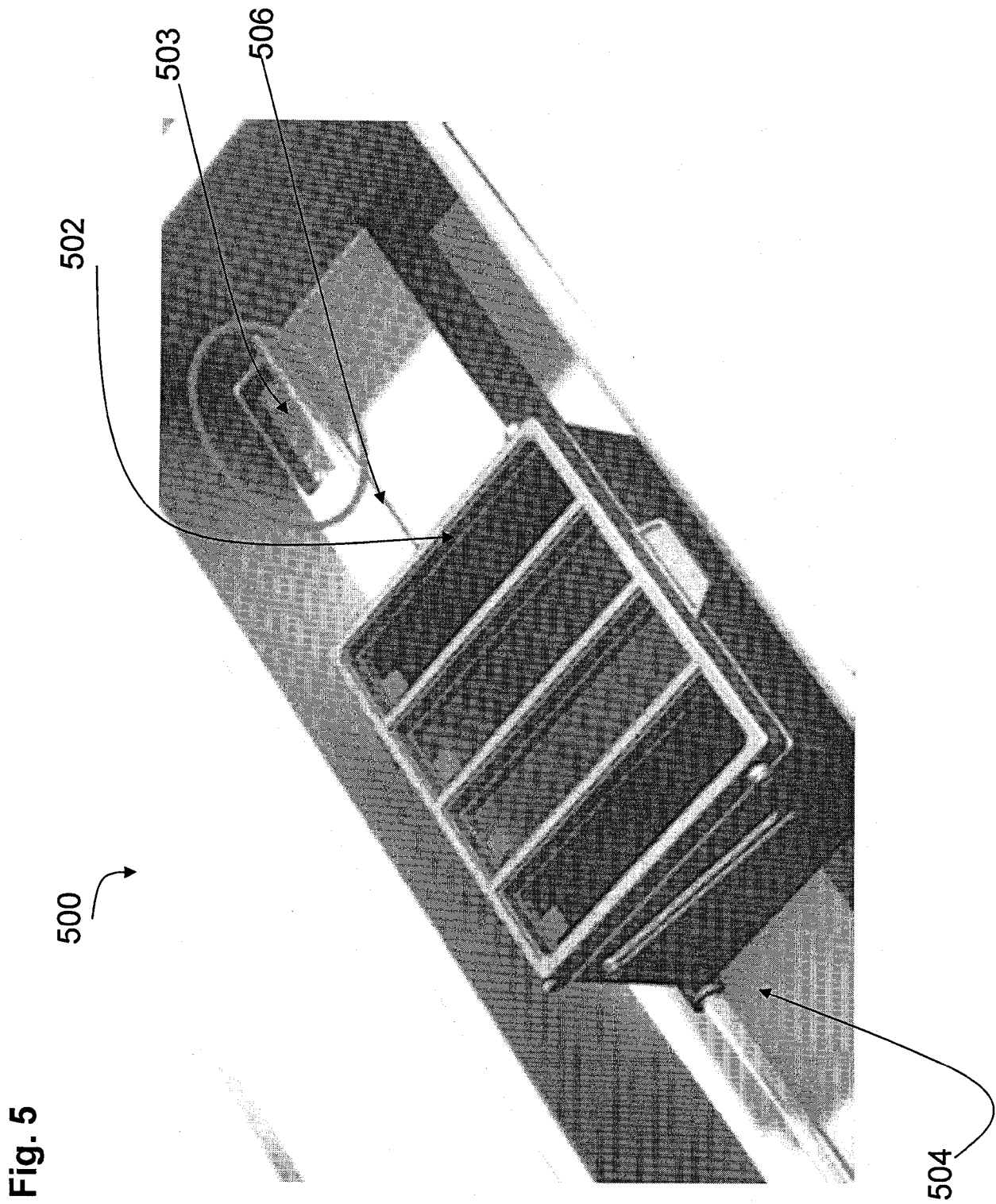
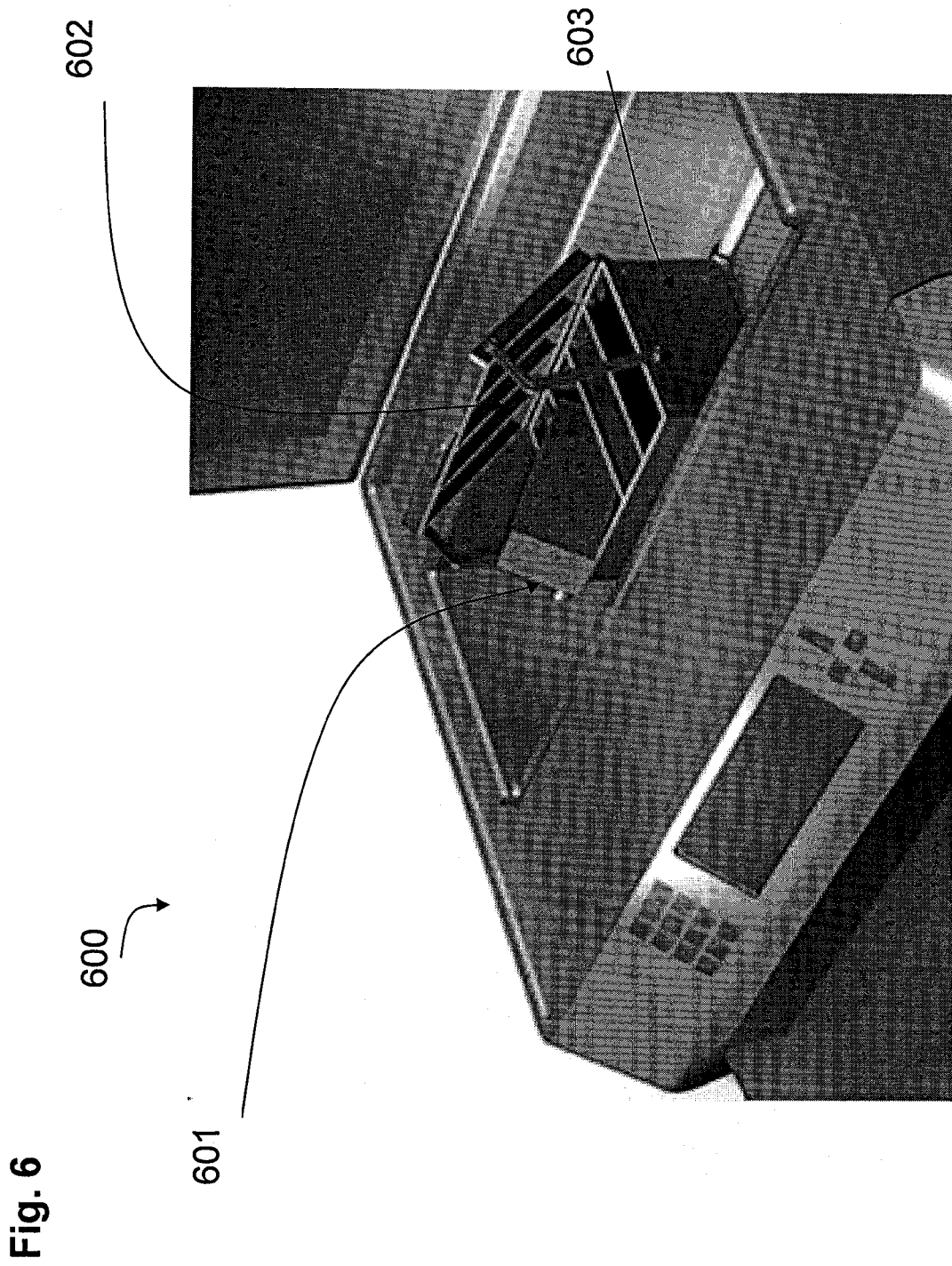


Fig. 3







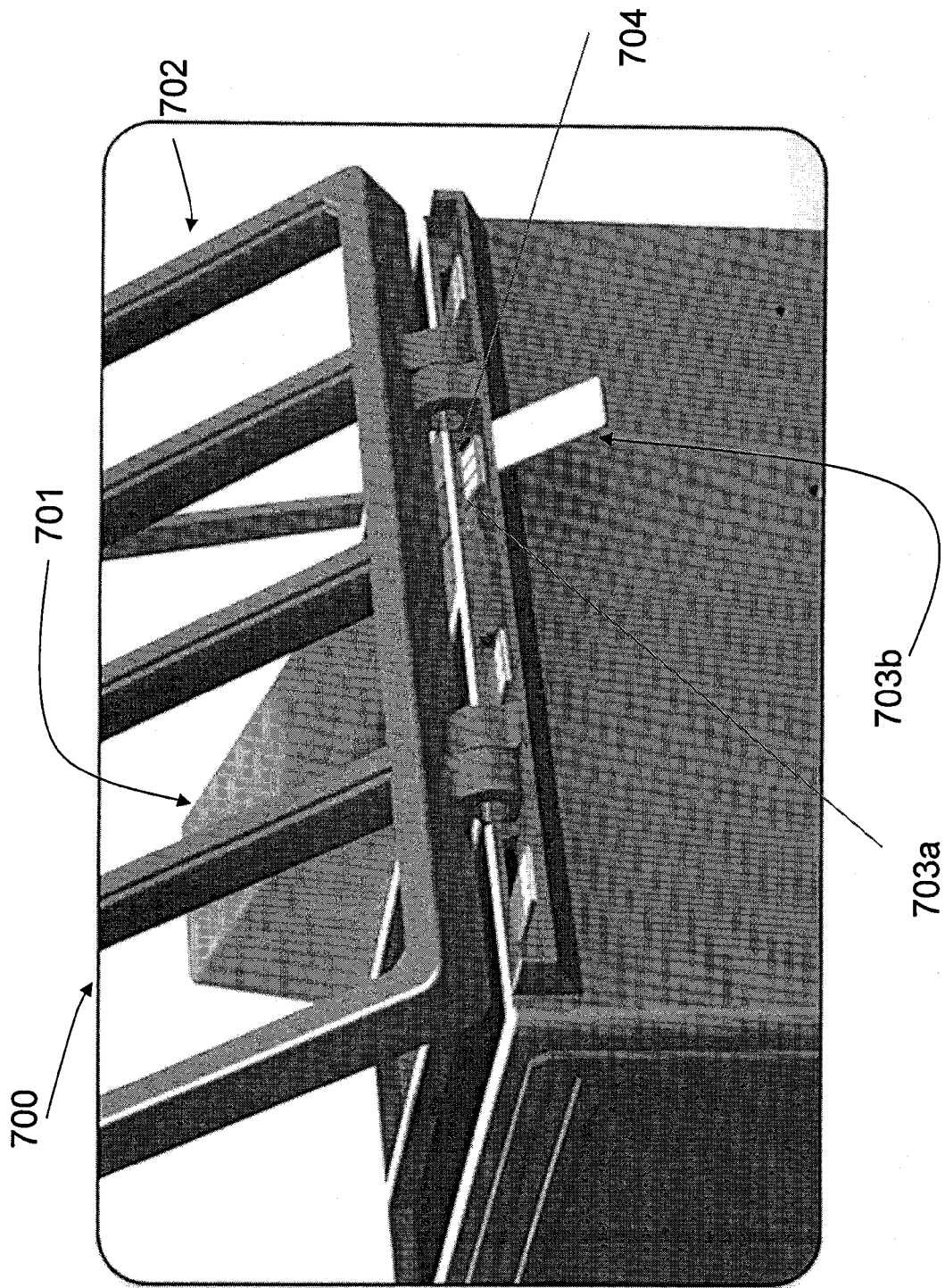
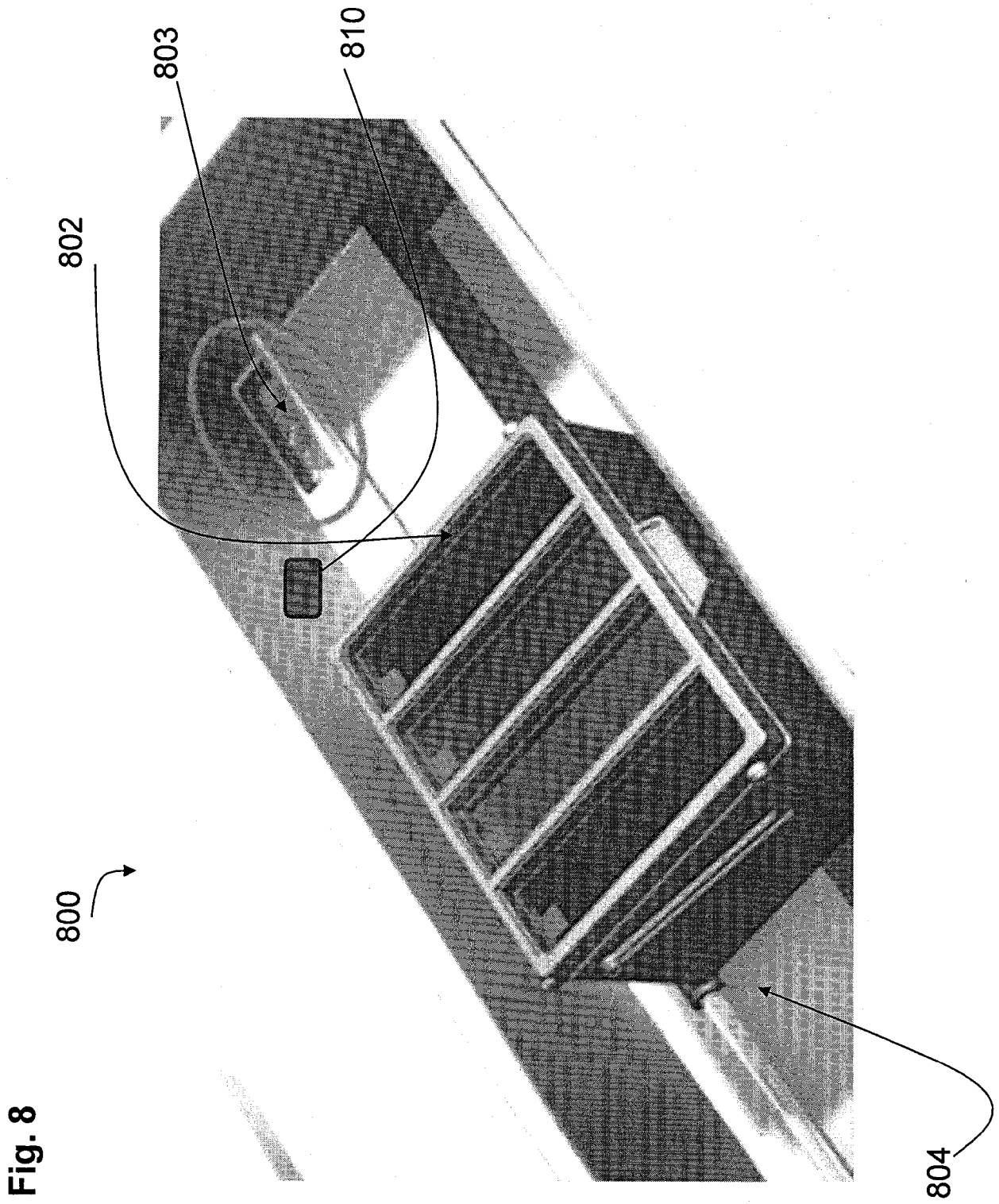


Fig. 7



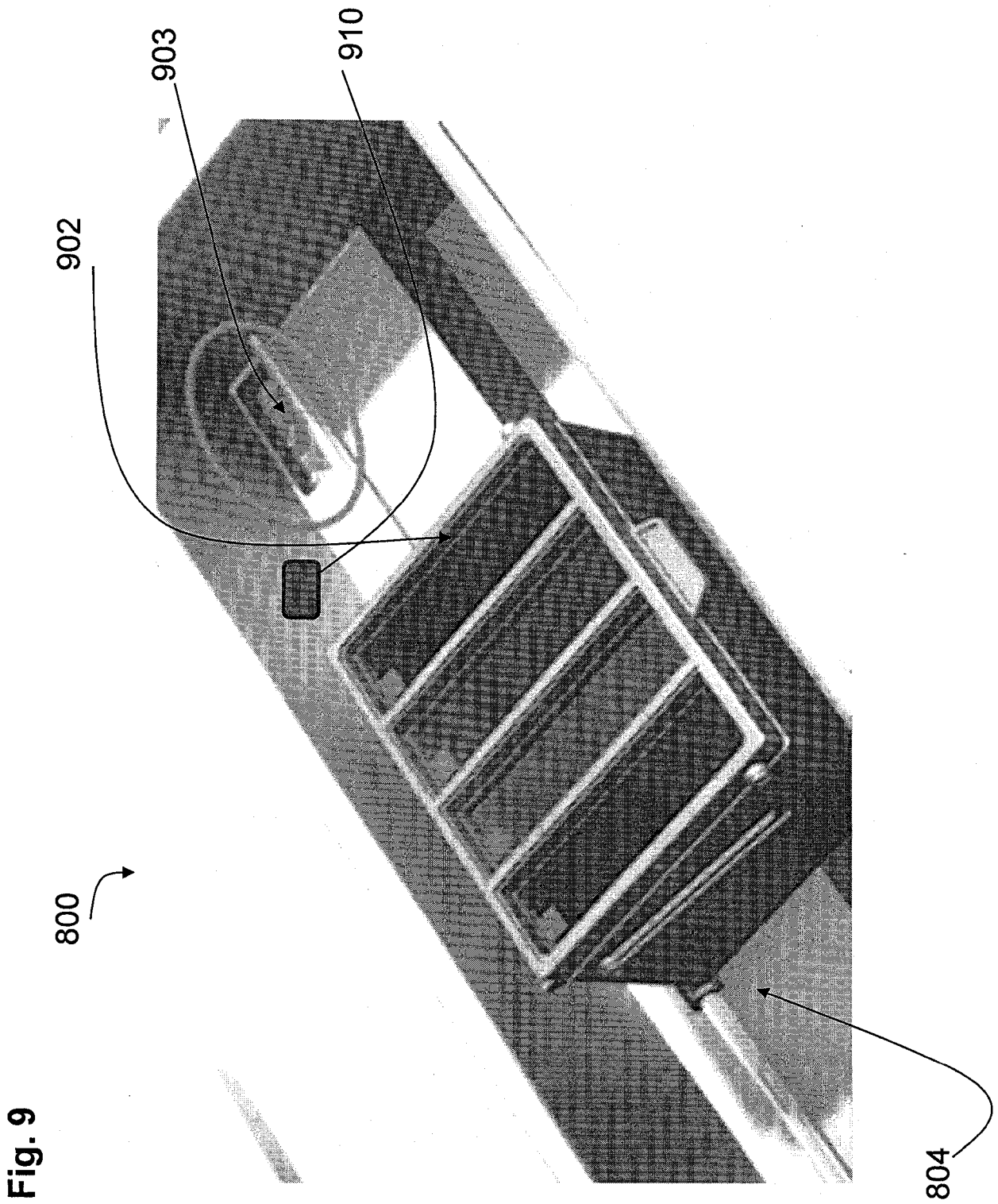


Fig. 9

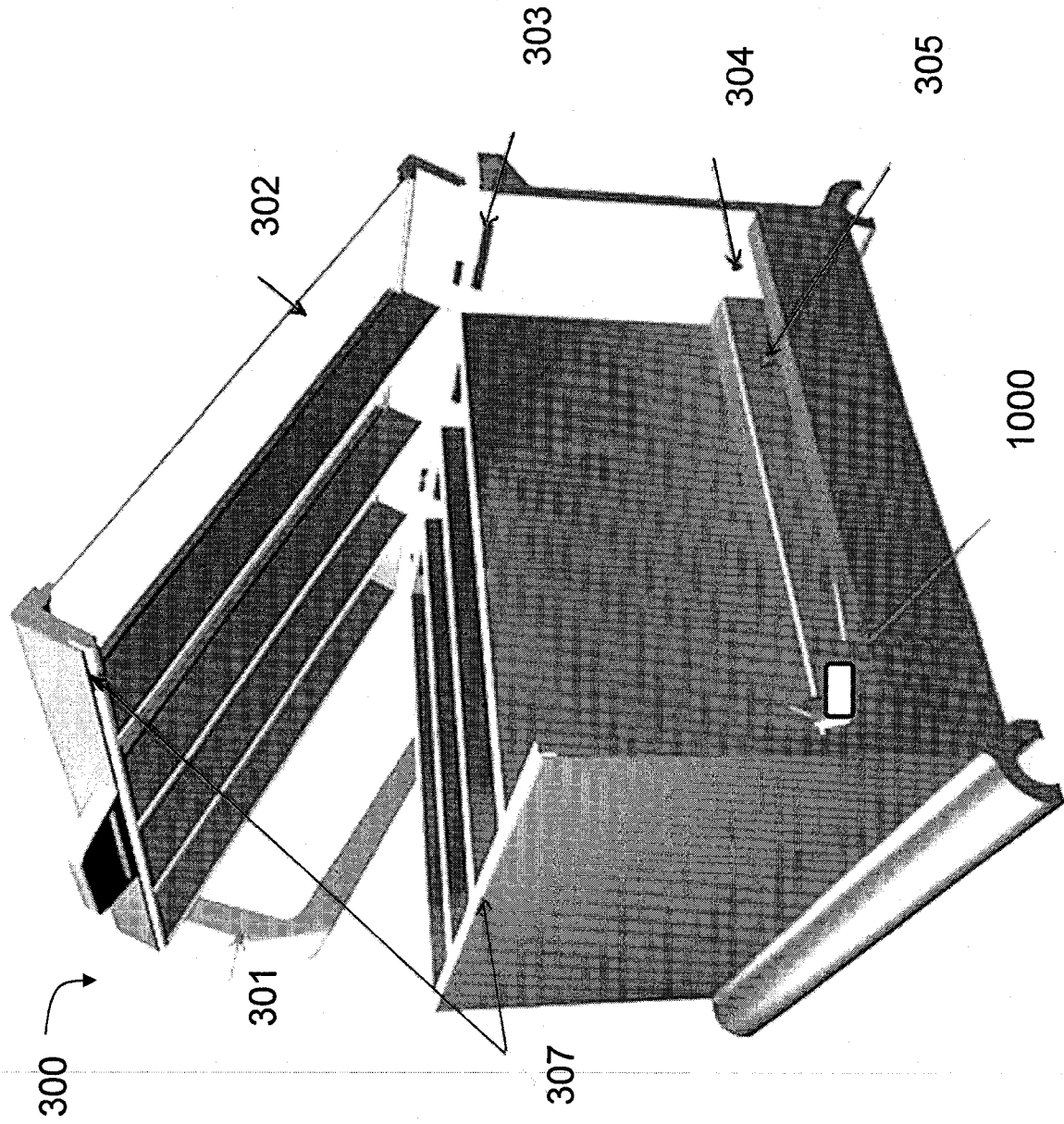


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2014/050370

A. CLASSIFICATION OF SUBJECT MATTER
IPC (2014.01) B41J 2/00, B41J 2/17, B41J 2/175

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)
IPC (2014.01) B41J 2/00, B41J 2/17, B41J 2/175

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)
Databases consulted: USPTO, Esp@cenet, Google Patents, FamPat database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	whole	2,4,6-10,12,16
A	whole	3,15
X	US 5442384 B LOOFBOUROW 15 Aug 1995 (1995/08/15) whole	1,5,11,13,14,17
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Y	US 2012086760 A JONES 12 Apr 2012 (2012/04/12) abstract, fig.1,3,parag.0040	2,12

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
“A” document defining the general state of the art which is not considered to be of particular relevance	“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
“E” earlier application or patent but published on or after the international filing date	“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
“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)	“&” document member of the same patent family
“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 04 Aug 2014	Date of mailing of the international search report 10 Aug 2014
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Name and mailing address of the ISA: Israel Patent Office Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel Facsimile No. 972-2-5651616	Authorized officer GUTKIN Solomon Telephone No. 972-2-5651763
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2014/050370

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Information on patent family members

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