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### (54) CONTAINER SYSTEM WITH A CONTROLLED ENVIRONMENT

(57) A controlled environment system (2) for storing articles (1) in a controlled environment, comprising a container system (4), a humidity regulation system (6), a temperature regulation system (8) and an electronic control system (10) connected to the humidity and temperature regulation systems for control thereof, the container system comprising a controlled environment chamber in which the temperature and degree of humidity is regulated by the temperature and humidity regulation sys-

tems, the humidity regulation system comprising at least one chamber humidity sensor arranged to measure the humidity of the gas in the controlled environment chamber, a humidity reducing system adapted to reduce the humidity of the gas in the controlled environment chamber (12) and a humidity increasing system (18) adapted to increase the humidity of the gas in the controlled environment chamber (12).

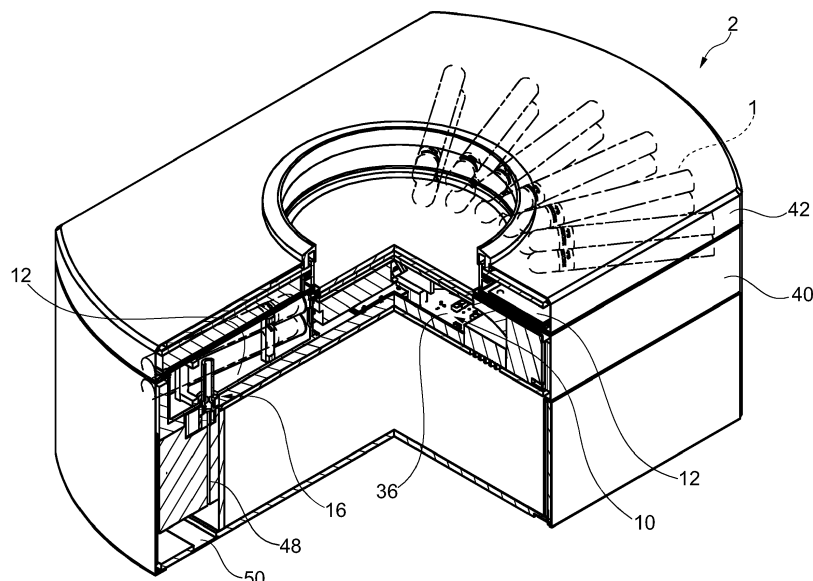


Fig. 1b

## Description

**[0001]** The present invention relates to a container system with a controlled environment for storing articles.

**[0002]** There are various applications in which a controlled environment is required in order to preserve articles in a certain state, for instance in an environment of controlled humidity and temperature. An example of the need for controlled humidity and temperature is for instance in cigar boxes in which the humidity of the environment needs to be kept in a certain range in order to better preserve the cigars. Other applications may include certain foodstuffs, works of art, certain medication, or for certain microbiological processes.

**[0003]** It is known to control the temperature, humidity and other parameters in a chamber, but generally such control systems are for large volumes in static structures and the regulation of humidity requires a water reservoir or a connection to a running source of water. In many controlled environment systems the level of humidity is not calculated to a high degree of accuracy and neither are the temperatures. For small container systems, and in particular small portable or transportable container systems, existing systems that control humidity and temperature are not particularly accurate nor convenient. For many simple systems such as cigar humidors, one of the drawbacks is the degree of attention required by the user to refill the water reservoir.

**[0004]** An objective of the invention is to provide a container system with a controlled environment, including control of humidity and temperature, in a chamber of the container system, that is easy and convenient to use and that allows to accurately control humidity and temperature of the environment.

**[0005]** It is advantageous to provide a controlled environment system that is compact and well adapted for portable applications.

**[0006]** It is advantageous to provide a controlled environment system that is efficient in a compact form.

**[0007]** It is advantageous to provide a controlled environment system that has a high degree of autonomy.

**[0008]** Objects of the invention have been achieved by providing a controlled environment system for storing articles according to claim 1.

**[0009]** Disclosed herein is a controlled environment system for storing articles in a controlled environment, comprising a container system, a humidity regulation system, a temperature regulation system and an electronic control system connected to the humidity and temperature regulation systems for control thereof. The container system comprises a controlled environment chamber in which the temperature and degree of humidity is regulated by the temperature and humidity regulation systems. The humidity regulation system comprises at least one chamber humidity sensor arranged to measure the humidity of the gas in the controlled environment chamber, a humidity reducing system adapted to reduce the humidity of the gas in the controlled environment cham-

ber and a humidity increasing system adapted to increase the humidity of the gas in the controlled environment chamber. The humidity increasing system comprises a water condenser and an evaporation pad, the water condenser comprising a cooling element in contact with air external to the container system and configured to collect water from the external air by cooling the cooling element below the dew point of the external air and collecting said water on the evaporation pad. The evaporation pad is mounted in the container system in gaseous communication with the controlled environment chamber.

**[0010]** In an advantageous embodiment, the cooling element of the water condenser of the humidity increasing system comprises one or more peltier cells.

**[0011]** In an advantageous embodiment, the evaporation pad comprises an anti-bacterial or bacteriostatic water absorbent material.

**[0012]** In an advantageous embodiment, the system may further comprise an air transfer system comprising an airflow channel interconnecting the controlled environment chamber to the external environment of the container system.

**[0013]** In an advantageous embodiment, the evaporation pad is mounted inside the airflow channel.

**[0014]** In an advantageous embodiment, the humidity reducing system comprises a water condenser including a condenser element and a cooling element, the water condenser configured to collect water from the gaseous environment inside the controlled environment chamber by cooling of the condenser element and cooling element below the dew point of the gas inside the controlled environment chamber, the humidity reducing system further comprising a water outflow channel to allow said collected water to flow out of the controlled environment chamber.

**[0015]** In an advantageous embodiment, the cooling element of the humidity reducing system comprises one or more peltier cells.

**[0016]** In an advantageous embodiment, the temperature regulation system comprises one or more thermal conductors including a heat conducting base positioned adjacent a wall of the controlled environment chamber, the heat conducting base being made of a material with a high thermal conductivity configured to distribute and homogenize the temperature within the controlled environment chamber.

**[0017]** In an advantageous embodiment, the thermal conductors may further comprise a heat transfer bridge interconnecting a cooling element and/or a heating element of the temperature regulation system to the heat conducting base.

**[0018]** In an advantageous embodiment, the heat transfer bridge may comprise a thermal dilatation compensation mechanism comprising a movable contact element mounted in a heat conducting block, the movable contact element elastically biased against the cooling element of the temperature regulation system.

**[0019]** In an advantageous embodiment, the heating element may comprise an electrical heating resistor mounted against the heat transfer bridge.

**[0020]** Further objects and advantageous features of the invention will be apparent from the claims, from the detailed description, and annexed drawings, in which:

Figure 1 a is a perspective view of an example of a controlled environment system according to an embodiment of this invention ;

Figure 1b is a partial cross-sectional view of the embodiment of figure 1a ;

Figure 1c is a perspective cross-sectional view of the embodiment of figure 1a ;

Figure 2 is a schematic cross-sectional view of a portion of a controlled environment system according to an embodiment of this invention ;

Figure 3 is a perspective cross-sectional view of a portion of the embodiment of figure 2 ;

Figure 4 is a perspective cross-sectional view of a portion of a controlled environment system according to an embodiment of this invention ;

Figure 5 is a cross-sectional view of a portion of a controlled environment system according to an embodiment of this invention.

**[0021]** Referring to the figures, a controlled environment system 2 is adapted for storage of articles 1 in a controlled environment. In the example illustrated, the controlled environment system is a cigar containing system for storing cigars in a controlled humidity and temperature environment.

**[0022]** A controlled environment system 2 according to embodiments of the invention comprises a container system 4 with a controlled environment chamber 12, a humidity regulation system 6 for regulating the humidity within the controlled environment chamber, a temperature regulation system 8 for controlling the temperature within the controlled environment chamber 12, and an electronic control system 10 configured to control various systems of the controlled environment system 2, including the temperature regulation system 8 and the humidity regulation system 6.

**[0023]** In the illustrated example, the container system comprises a base 40 and a cover 42 that can be closed together to form therein the controlled environment chamber 12. A seal 44 positioned between the base and cover may be provided to seal the base to the cover when closed. Walls forming the base 40 and cover 42 may comprise an insulating material to reduce transfer of heat between the chamber 12 and outside of the container system.

**[0024]** In a system, there may be one or more separated controlled environment chambers 12 however for the purposes of describing the invention, reference will be made to one controlled environment chamber 12 with the understanding that the system may comprise a plurality of chambers within the scope of this invention. The container system in the illustrated exemplary embodiment is for storing cigars whereby in the illustrated embodiment the cigars are arranged in a spaced apart manner within the controlled environment chamber 12 and supported in their spaced apart manner by supporting means. The supporting means prevent direct contact between cigars and ensure that they are each surrounded with the gaseous environment around them. Moreover, the spaced apart arrangement allows for an esthetically pleasing display of the cigars for the user.

**[0025]** The controlled environment system according to the present invention however can be employed in container systems of various shapes and sizes for various articles, in particular valuable articles where the accurate regulation of humidity and temperature is important for the preservation of the qualities of the article. Other possible applications may include microbiological culture or storage, storage of perishable goods such as foodstuffs, grains, seeds, and certain medication, and storage of valuable articles such as works of art that require low fluctuations in temperature and humidity. The controlled environment system according to the present invention is particularly suited for portable or transportable container systems with small volumes ranging from less than 1 liter to up to around 100 liters.

**[0026]** The temperature regulation system 8 comprises one or more temperature sensors 22, at least one temperature sensor being a chamber temperature sensor 22a positioned within the controlled environment chamber 12 or in gaseous communication with the chamber to measure the temperature of the gas (air) within the controlled environment chamber 12.

**[0027]** The temperature regulation system 8 further comprises a heating element 24 configured for increasing the temperature in the controlled environment chamber 12, and a cooling element 26 configured for reducing the temperature in the controlled environment chamber 12.

**[0028]** The temperature regulation system 8 may further comprise one or more thermal conductors 28 configured for transferring heat into or out of the chamber and/or for distributing the temperature evenly within the chamber. For the latter purpose, the thermal conductors include a heat conducting base 32 that, in the illustrated embodiment, lines the base and sidewalls of the controlled environment chamber 12. The heat conducting base 32 may be made of various materials with good thermal conduction properties such as silver, aluminium and/or copper. The heat conducting base 32 may be in the form of an essentially continuous planar structure or recipient type structure, or may form an integral structure with various holes and patterns to adapt to the container wall structure where needed or appropriate, provided that the

function of essentially evenly distributing or collecting thermal energy within the controlled environment chamber is performed. The thermal conductors may further comprise one or more heat transfer bridges 30 that form a thermal bridge between the controlled environment chamber 12, in particular the heat conducting base 32, and the heating and/or cooling elements 24, 26. The heat transfer bridge thus allows positioning heating or cooling elements outside of the controlled environment chamber, for instance at a certain distance for convenience of integration within the controlled environment system 2. The heat transfer bridge 30 may be performed by a material with good thermal conducting properties, for instance a metal such as silver, aluminium or copper in contact with the controlled environment chamber 12, and in particular the heat conducting base 32 of the controlled environment chamber on one end and with the cooling or heating element at other ends distal from the heat conducting base 32.

**[0029]** In the illustrated exemplary embodiment, the heating element comprises a heating resistor in contact with the heat transfer bridge 30. In a variant, the heating resistor may however be positioned within the controlled environment chamber 12 or in direct contact with the heat conducting base 32.

**[0030]** The heat transfer bridge 30 is also connected to the cooling element 26 which is configured to evacuate heat from the heat conducting base 32 via the heat transfer bridge 30 to the exterior of the controlled environment system 2. Heat extracted by the cooling element 26 is transferred to the air outside of the controlled environment system 2 via a heat dissipating element 34 in contact with outside air.

**[0031]** In the illustrated embodiment, the cooling element 26 may advantageously be in the form of one or more peltier cells which are advantageously very compact. Peltier cells are thermoelectric devices that directly convert electric voltage into temperature differences and are *per se* well known. Advantageously, a plurality of peltier cells may be stacked in order to increase the cooling capacity. The cool side of the peltier cell is mounted against the heat transfer bridge 30 and the hot side of the peltier cell mounted against the heat dissipating element 34. The dissipating element may have various forms and shapes for dissipating heat to the external environment via radiation and convection and may comprise fins, ribs, etc. that increase the external surface area (not shown) if needed.

**[0032]** The heat transfer bridge 30 may be provided with a thermal dilatation compensation mechanism 60 comprising for instance a movable contact element 62 movably mounted within a solid body 63, for instance a slidably mounted within the solid body and having sufficiently large surface area in contact with the solid body to ensure good thermal transfer between the movable element and the solid body 63. The movable contact element 62 is elastically biased by means of a spring 64 into contact against a conducting body mounted against

the cooling element 26, for instance via a partial spherical head to ensure a large surface area in contact between the elements for good thermal transfer. The thermal dilatation compensation mechanism 60 allows for adjustment between the different thermal expansion coefficients and the temperatures of the heat conducting base 32 relative to external parts of the container system, in particular relative the heat dissipating element 34 mounted on the external wall of the container system.

**[0033]** In a variant, the thermal dilation compensation mechanism may be provided by fixedly mounting the cooling element 26 to the heat transfer bridge 30 and have the heat dissipating element 34 mounted thereon and movable relative to the external wall of the container system. In the latter variant, the heat dissipating element and/or cooling element 26 may be sealingly mounted to the external wall of the container system via an elastically compressible or tensionable seal element, for instance made of a polymer elastomer or other similar materials.

**[0034]** The temperature sensors, heating element and cooling element may all be connected to the electronic control circuit 10 that controls the activation of the heating or cooling element as a function of the measurement from the temperature sensor in a closed-loop electronic regulation as a function of the temperature settings automatically stored in the electronic control system or inputted in the system by a user.

**[0035]** The humidity regulation system 6 comprises one or more humidity sensors 14 including at least one chamber humidity sensor 14a configured for measuring the level of humidity within the control environment chamber 12. The chamber humidity sensor 14a may be positioned within the chamber or in a passage or cavity in gaseous communication with the chamber. A plurality of humidity sensors, and also a plurality of temperature sensors may be provided in a distributed position around the container in order to take into account any inhomogeneity of temperature and/or humidity within the chamber to provide an average reading and/or as a control means to ensure proper regulation of the controlled environment chamber, for instance by activating ventilation or air recirculating means (not shown) within the controlled environment chamber 12.

**[0036]** The humidity regulation system 6 further comprises a humidity reducing system 16, a humidity increasing system 18 and an air transfer system 20 used in conjunction with the humidity increasing system 18 and/or humidity reducing system 16. The humidity reducing system 16 comprises a water condenser 46 that is mounted inside the controlled environment chamber 12, or in a cavity or channel in gaseous communication with the controlled environment chamber 12, the water condenser 46 comprising a cooling element 46b and a condenser body 46a connected to the cooling element 46b and presenting a surface on which the water from the gaseous environment may condense. Condensation occurs due to cooling of the cooling element 46b and condenser body 46a coupled thereto below the dew point of the air within

the controlled environment chamber 12. In the illustrated embodiment, the condenser element 46a is advantageously in the form of a tube provided with orifices at its base to allow water condensing on the outer surface of the tube to enter the inside of the tube. The inside of the tube connects to a water outflow channel 48 through which the water from the condenser exits the container system 4 into a water collector 50 below the device. The flow of the condensation water out of the chamber may be by gravitational forces and depending on the variant, optionally by capillary action as a function of the diameter of the outflow channel 48, or by means of a pressure differential between the chamber 12 and outside environment created by an air pressure pump.

**[0037]** In the illustrated embodiment, the condenser element 46a projects into the controlled environment chamber 12 through the base 40. The water condenser 46 may be provided with a funnel shaped base situated below the heat conducting base 32 of the chamber 12 in order to funnel the water collected on the outside surface of the tube into the inside of the tube through the lateral orifices 47a in the tube.

**[0038]** A further temperature and humidity sensor 14b, 20b, may be provided in a space below the controlled environment chamber 12. The temperature sensor 14b is proximate the water condenser 52 and configured to measure the temperature of the water condenser. A further temperature sensor may be positioned proximate the water condenser 52 of the humidity increasing system 18. A humidity sensor positioned outside of the controlled environment chamber 12 allows to measure the humidity of the air outside of the controlled environment chamber and as a consequence to determine the relative humidity difference between the inside of the chamber 12 and the outside. This may help to better control the humidity regulation within the chamber 12 taking into account the drawing in of water from the external environment in the situation where humidity in the chamber needs to be increased.

**[0039]** The humidity increasing system 18 comprises a water condenser 52 that is positioned in the container system 4 outside the controlled environment chamber 12, configured to be in contact with air outside the container system 4. The humidity increasing system 18 is thus configured to collect humidity from the external environment, namely the air surrounding the container system, and thus advantageously avoids the need for a water reservoir or a connected source of water thus providing a great degree of autonomy and portability for the controlled environment system 2. The humidity increasing system 18 comprises a water inflow passage 56 that allows condensed water produced by the water condenser 52 to drop into an airflow cavity or channel 58 gaseously connected to the controlled environment chamber 12.

**[0040]** The humidity increasing system 18 further comprises an evaporation pad 54 positioned within the airflow channel 58 configured to promote evaporation of the condensed water falling on the evaporation pad into a gas-

eous form, whereby the rate of evaporation may be increased by an active airflow in the air transfer system 20 through the airflow channel 58, for instance by means of a fan or ventilator device (not shown). In the latter variant, the rate of evaporation of the water dropping onto the evaporation pad 54 may be varied either by varying the airflow speed through the airflow channel 58, for instance by having a variable speed fan (not shown), or by switching the fan on and off in controlled intervals.

**[0041]** The evaporation of the condensed water falling on the evaporation pad may also be passive, by means of natural convection and diffusion (i.e. without forced airflow).

**[0042]** A ventilator 56 may be provided to cool the warm side of the water condenser 52a and/or to cool electronic components of the electronic control system 10. A humidity sensor may be provided in contact with the evaporation pad or in close proximity in order to provide a measurement of the degree of humidity of the evaporation pad in view of providing a fine adjustment of the degree of humidity within the controlled environment chamber 12.

**[0043]** The evaporation pad 54 may advantageously be made of a water absorbing material, for instance a water absorbing textile material such as acrylic fibre. The evaporation pad 54 may advantageously comprise antibacterial, or bacteriostatic materials such as silver that prevents the growth of micro-organisms in the evaporation pad and the spread of micro-organisms into the controlled environment chamber 12. Various suitable antibacterial materials are *per se* already known and commercially available. Other filters connecting the airflow between the external environment and the cooling element 52 may be provided (not shown) such as particle filters and active carbon filters to remove pollutants. Other type of filters or catalyzers for removing pollutants that are *per se* known in the field of air treatment and air conditioning systems may also be included in the air inflow system.

**[0044]** The water condenser 52 may advantageously comprise peltier cells whereby as described in relation to the temperature regulation system, such peltier cells may be stacked in order to lower the temperature to a level below the dew point for the range of external operating temperatures and environmental humidity levels. The peltier cells are particularly compact and easily regulated by the electronic control system 10 to provide very accurate temperatures and thus control of the amount of water condensing on the cool side of the peltier cells, or on a thermal conductor body mounted against the cool side of the peltier cell.

**[0045]** Temperature and humidity sensors may be positioned in contact with the external environment in order to better regulate the control of the water condenser 52 of the humidity increasing system 18 as a function of the external environment, in particular to determine the dew point of the external air for control of the peltier cells.

**[0046]** In the illustrated embodiment, the humidity in-

creasing system 18 is positioned centrally above the container system 4, however the humidity increasing system can be positioned in various locations on the container system 4 and there could be a plurality of humidity increasing systems connected to one or more controlled environment chambers 12 without departing from the scope of the invention.

**[0047]** In view of the high efficiency and compact size of the humidity regulation and humidity reduction systems of the present invention, in particular due to the use of the peltier cells for increasing humidity or decreasing humidity in the controlled environment system, a container system may be provided in a compact portable arrangement with a high degree of autonomy. An autonomous portable container system may including a power source in the form of one or more batteries mounted within the container system 4.

**[0048]** In the illustrated embodiment, the controlled environment system is adapted for storing cigars whereby the control of the degree of humidity and the maintenance of a stable constant temperature improves the storage life and maintenance of the aromatic properties of the cigars. The present invention may however be used in other applications where accurate control of the level of humidity and temperature within the controlled environment chamber is useful or necessary, such applications including for instance: the storage of certain foodstuffs; biological material; certain types of medication, particularly those stored at above freezing temperatures; precious articles such as works of art including paintings and photographs; and other articles that are intended to be stored in ideal ambient conditions or at temperatures above freezing point and where a certain humidity is required.

#### List of references in the drawings:

**[0049]** Articles for storage in controlled environment 1 (e.g. cigars) Controlled environment system 2 (e.g. cigar box system)

container system 4  
controlled environment chamber 12  
base 40  
cover 42  
seal 44  
humidity regulation system 6  
humidity sensor(s) 14  
chamber humidity sensor 14a  
humidity reducing system 16  
water condenser 46 condenser tube 46a  
lateral orifices 47a  
collector funnel 47b  
cooling element 46b  
peltier cell  
water outflow channel 48 collector 50  
humidity increasing system 18  
water condenser 52

peltier cell(s) 52a  
evaporation pad 54  
anti-bacterial / bacteriostatic water absorbant material airflow channels 58  
air transfer system 20  
fan 56  
temperature regulation system 8  
temperature sensor(s) 22  
chamber temperature sensor 22a  
heating element 24  
heating resistor  
cooling element 26  
peltier cell(s)  
thermal conductors 28  
heat transfer bridge 30  
thermal dilatation compensation mechanism 60  
solid body 63  
movable contact element (elastically mounted) 62  
contact surfaces 66  
spring 64  
heat conducting base 32  
heat dissipating element 34  
electronic control system 10  
circuit board 36  
microprocessor 38

#### Claims

1. A controlled environment system (2) for storing articles (1) in a controlled environment, comprising a container system (4), a humidity regulation system (6), a temperature regulation system (8) and an electronic control system (10) connected to the humidity and temperature regulation systems for control thereof, the container system comprising a controlled environment chamber in which the temperature and degree of humidity is regulated by the temperature and humidity regulation systems, the humidity regulation system comprising at least one chamber humidity sensor arranged to measure the humidity of the gas in the controlled environment chamber, a humidity reducing system adapted to reduce the humidity of the gas in the controlled environment chamber (12) and a humidity increasing system (18) adapted to increase the humidity of the gas in the controlled environment chamber (12), wherein the humidity increasing system (18) comprises a water condenser (52) and an evaporation pad (54), the water condenser comprising a cooling element (52b) in contact with air external to the container system and configured to collect water from the external air by cooling the cooling element (52b) below the dew point of the external air and collecting said water on the evaporation pad, the evaporation pad being mounted in the container system in gaseous communication with the controlled environment chamber (12).

2. System according to the preceding claim, wherein the cooling element of the water condenser of the humidity increasing system comprises one or more peltier cells.
3. System according to anyone of the preceding claims, wherein the evaporation pad comprises an anti-bacterial or bacteriostatic water absorbent material.
4. System according to anyone of the preceding claims, further comprising an air transfer system (2) comprising an airflow channel (58) interconnecting the controlled environment chamber (12) to the external environment of the container system (4).
5. System according to the preceding claim, wherein the evaporation pad is mounted inside the airflow channel.
6. System according to anyone of the preceding claims, wherein the humidity reducing system comprises a water condenser (46) including a condenser element (46a) and a cooling element (46b), the water condenser configured to collect water from the gaseous environment inside the controlled environment chamber by cooling of the condenser element and cooling element below the dew point of the gas inside the controlled environment chamber, the humidity reducing system further comprising a water outflow channel (48) to allow said collected water to flow out of the controlled environment chamber (12).
7. System according to the preceding claim, wherein the cooling element of the humidity reducing system comprises one or more peltier cells.
8. System according to anyone of the preceding claims, wherein the temperature regulation system comprises one or more thermal conductors (28) including a heat conducting base (32) positioned adjacent a wall of the controlled environment chamber (12), the heat conducting base being made of a material with a high thermal conductivity configured to distribute and homogenize the temperature within the controlled environment chamber.
9. System according to the preceding claim, wherein the thermal conductors further comprise a heat transfer bridge (30) interconnecting a cooling element (26) and/or a heating element (24) of the temperature regulation system to the heat conducting base (32).
10. System according to the preceding claim, wherein the heat transfer bridge comprises a thermal dilatation compensation mechanism (60) comprising a movable contact element mounted in a heat conducting block, the movable contact element elastically biased against the cooling element (26) of the temperature regulation system.
11. System according to anyone of the preceding claims, wherein the heating element (24) comprises an electrical heating resistor mounted against the heat transfer bridge.

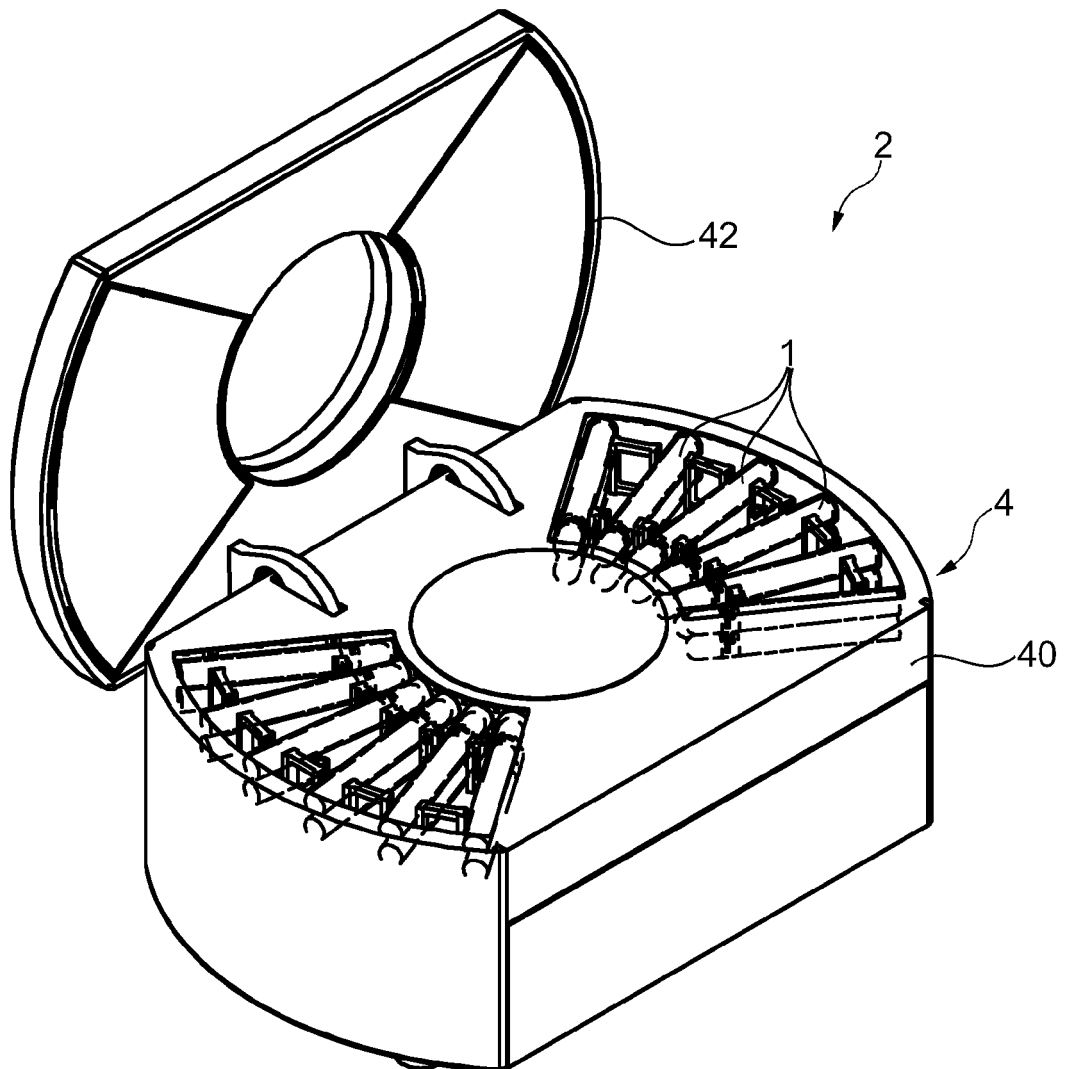


Fig. 1a



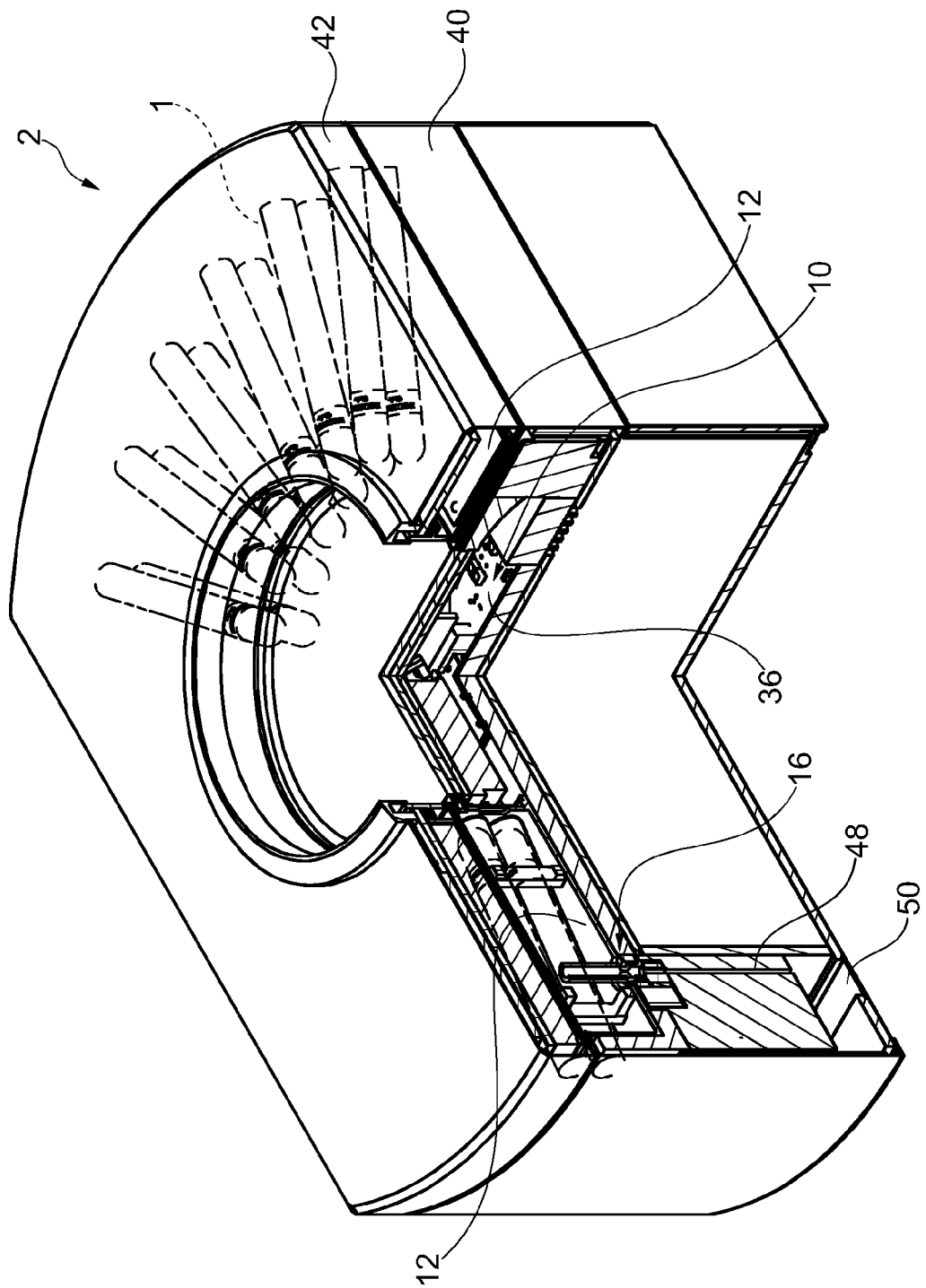


Fig. 1b

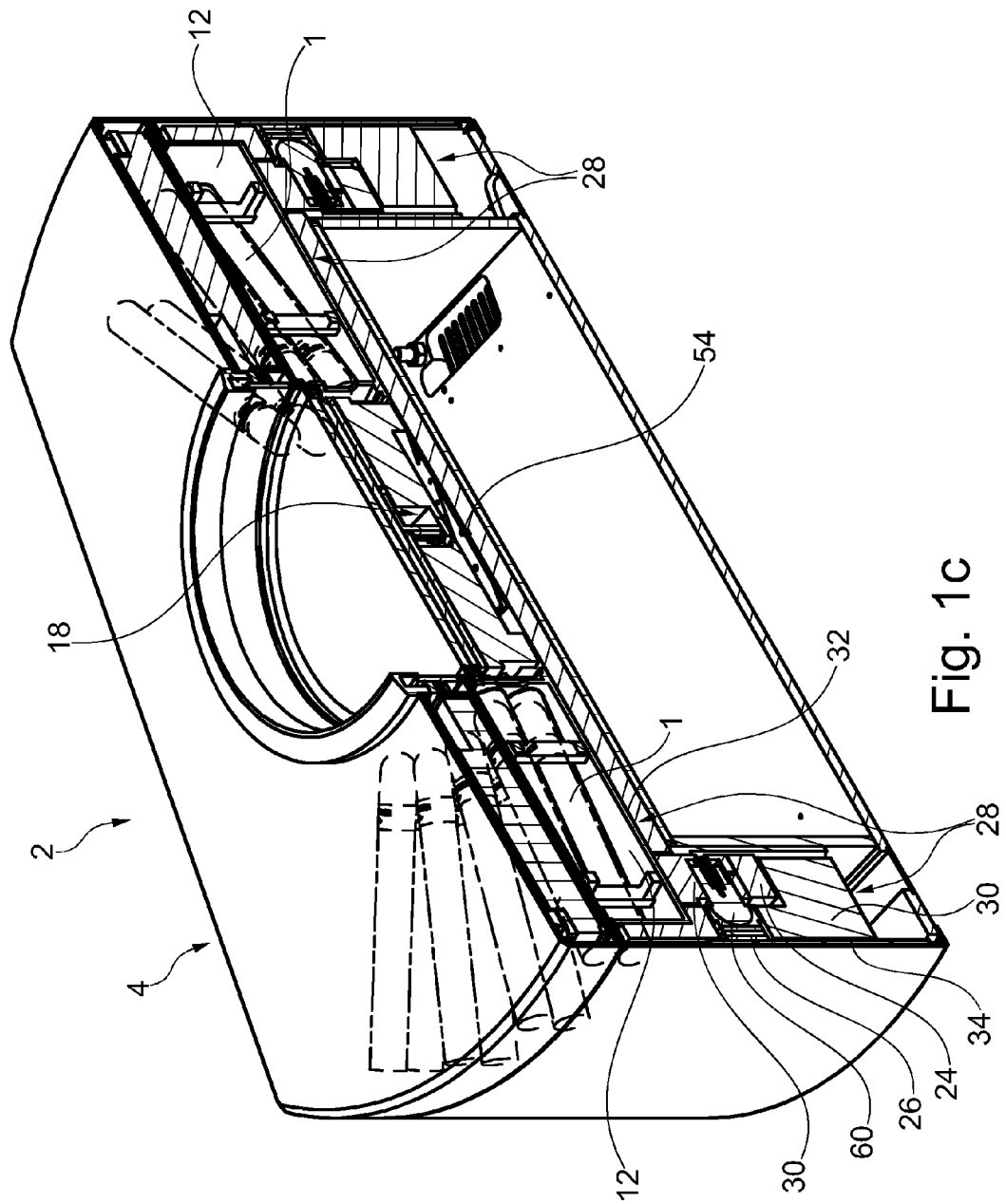


Fig. 1c

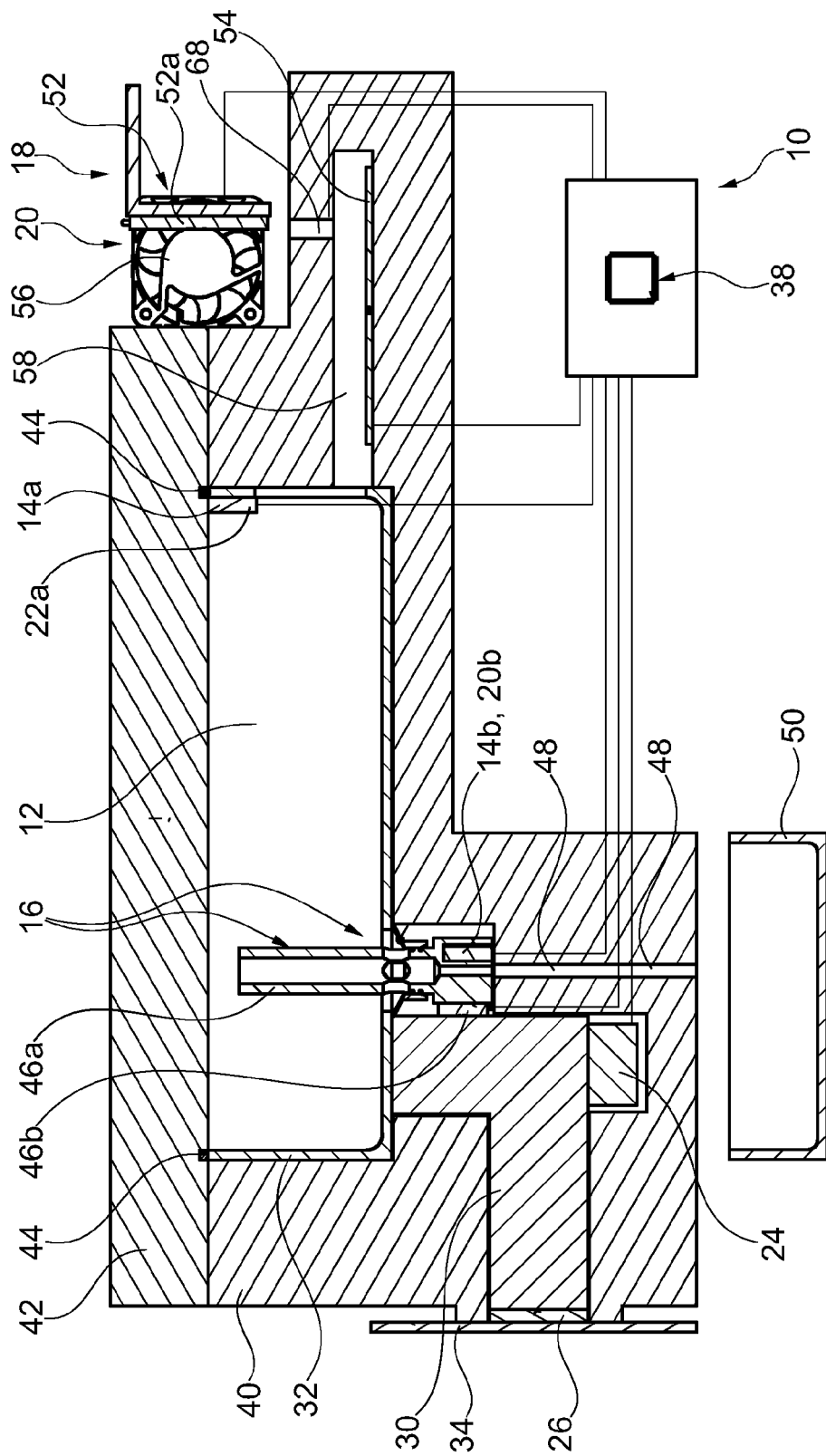
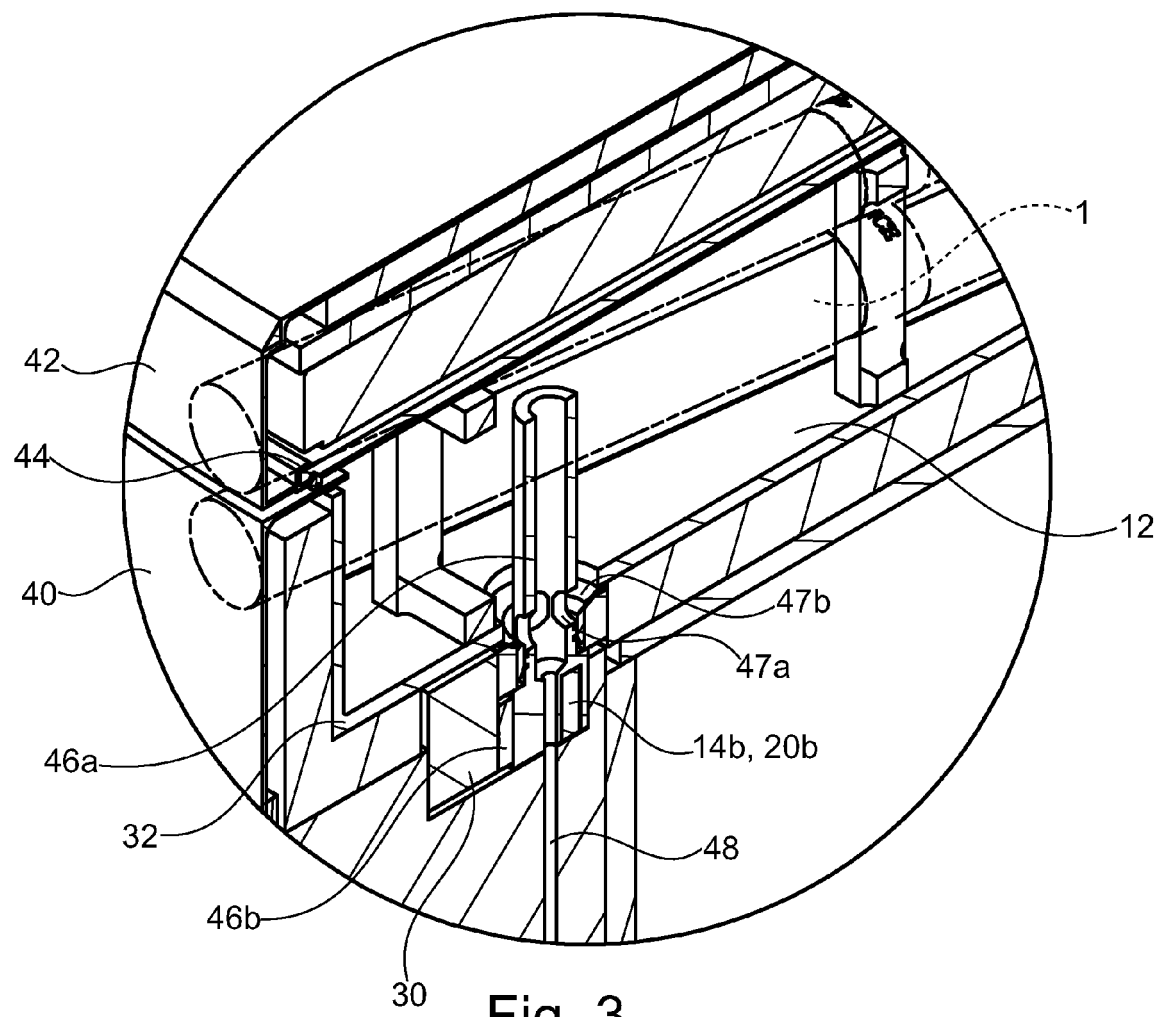


Fig. 2



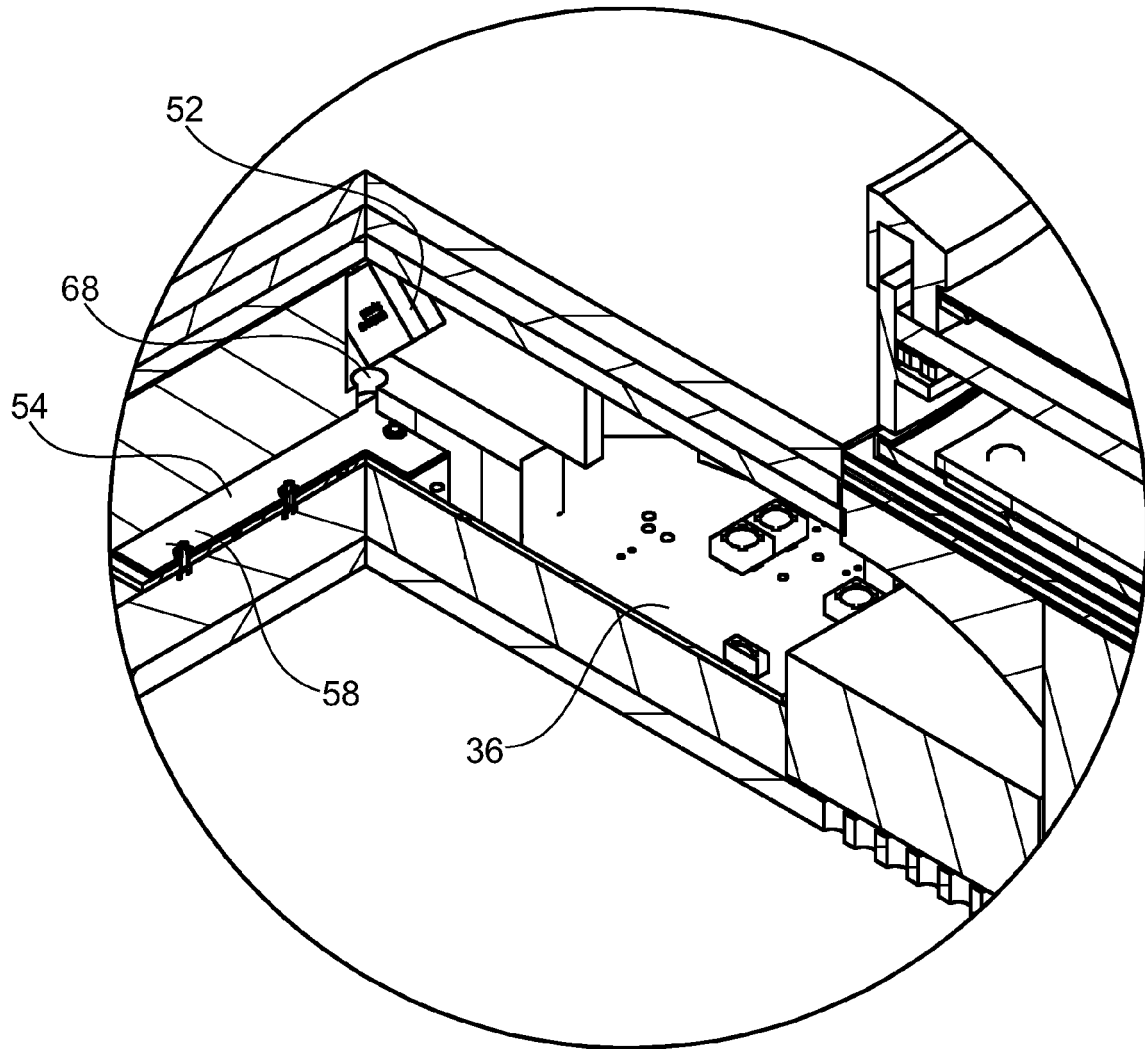


Fig. 4

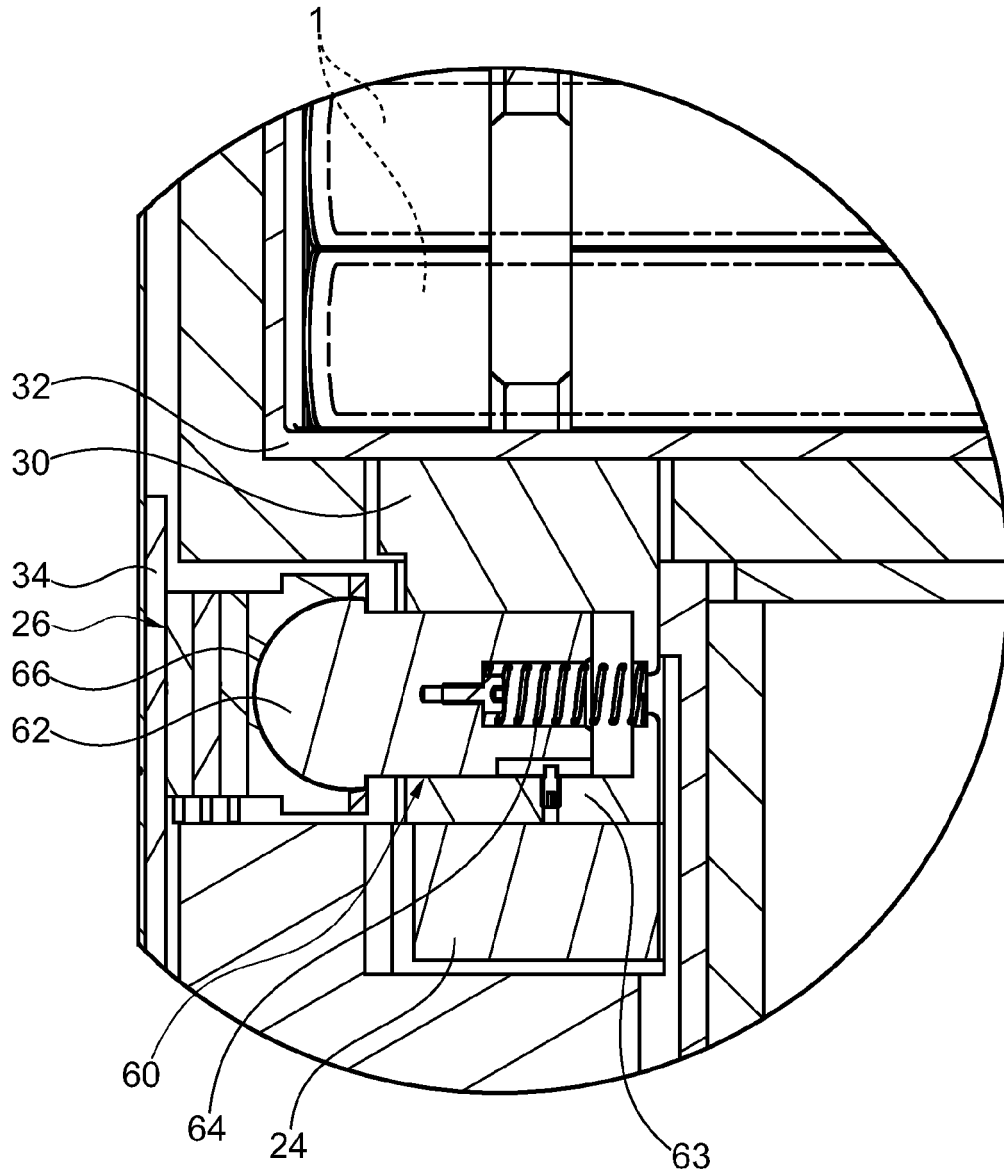


Fig. 5



## EUROPEAN SEARCH REPORT

Application Number  
EP 15 17 7434

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                       |                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                      | Relevant to claim                                                                                                                                                                                                                                                                     | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                      | US 6 089 237 A (PODOLAK JR EDWARD M [US] ET AL) 18 July 2000 (2000-07-18)<br>* column 1, line 33 - column 2, line 13 *<br>* column 2, line 43 - column 5, line 19 *<br>* figures * | 1-11                                                                                                                                                                                                                                                                                  | INV.<br>A24F25/02<br>F24F5/00           |
| A                                                                                                                                                                                                                                                      | -----<br>US 6 116 029 A (KRAWEC VICTOR [US]) 12 September 2000 (2000-09-12)<br>* column 3, line 1 - column 5, line 22;<br>figures *                                                | 1-11                                                                                                                                                                                                                                                                                  |                                         |
| A                                                                                                                                                                                                                                                      | -----<br>WO 2005/029984 A1 (EGH ELECTRONIC GMBH [DE]; POHL JOACHIM [DE]) 7 April 2005 (2005-04-07)<br>* abstract; figures *                                                        | 1                                                                                                                                                                                                                                                                                     |                                         |
| A                                                                                                                                                                                                                                                      | -----<br>DE 200 16 948 U1 (SCHNEIDER DIETMAR [DE]) 4 January 2001 (2001-01-04)<br>* the whole document *                                                                           | 1                                                                                                                                                                                                                                                                                     |                                         |
|                                                                                                                                                                                                                                                        |                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                       | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                        |                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                       | A24F<br>F24F                            |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                       |                                         |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                       |                                                                                                                                                                                    | Date of completion of the search<br><b>8 January 2016</b>                                                                                                                                                                                                                             | Examiner<br><b>Kock, Søren</b>          |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                                                    | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                         |

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 17 7434

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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