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Remarks:
A request for correction of the numbering of the claims has been filed pursuant to Rule 88 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

(54) Fixed temperature cabinet

(57) The present invention relates to a cooling device for cooling a volume (4), which device comprises a cooling agent circuit (1) with a closed pipe loop including cooling agent and a cabinet (3) with walls at least partly enclosing the volume (4), which pipe loop at least partly passes through a liquid. In the invention at least a part of the liquid is located at the cabinet (3).

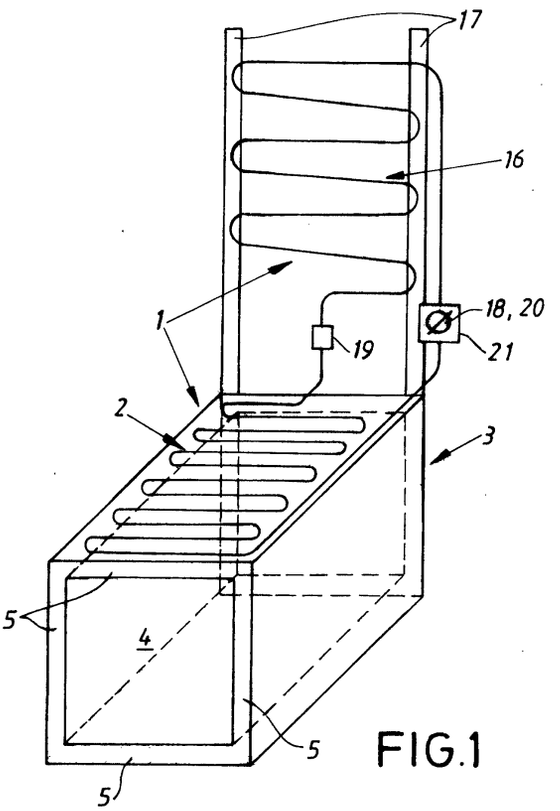

FIG.1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a cooling device for cooling a volume, which device comprises a cooling agent circuit with a closed pipe loop including cooling agent and a cabinet with walls at least partly enclosing the volume, which pipe loop at least partly passes through a liquid. In the invention at least a part of the liquid is located at the cabinet.

BACKGROUND OF THE INVENTION

[0002] Some food products need to be stored at a specific temperature that differs from the normal temperature of a cooling cabinet, such as a refrigerator cabinet. Meat for example should be stored at approximately zero degrees Celsius, which storage leads to a considerably extended storage time for the food product without needing to freeze it.

[0003] US5212962 discloses one embodiment of a cooling device for a refrigerator cabinet. The document describes a device in which air is circulated in a lower compartment in order to achieve an even, low temperature for vegetables. A fan brings the air to circulation and two sensors detect the temperature in each space. If the temperature in the lower space exceeds a certain value the fan starts rotating and the circulating air brings the temperature down.

[0004] US4539819 discloses a similar cooling device. Air circulates in a space below a storage box intended to store meat. A fan unit regulates the airflow and controls that the temperature in the box is kept at an adequate temperature.

[0005] By bringing air into circulation certain problems are raised. The cooling devices can only be used in refrigerators with an air circulation system. Moreover, the devices are depended on the functionality of the fan unit and the sensors. If the system should fail the temperature will change rapidly in the cooling device. Furthermore, it is difficult to achieve a temperature for example around zero degrees Celsius for meat, which is necessary in order to increase the storage time. Another problem occurring is that such cooling devices require a cabinet adapted for the device.

[0006] The object of the present invention is therefore to bring about a cooling device with a storage volume for food products that needs to be stored at a specific temperature, such as zero degrees Celsius for meat. The device should be easy to use, reliable in running and removable when arranged in a refrigerator cabinet or similar. Moreover, the device should be adapted for refrigerators with a cooling surface and cooperate with the cabinet in order for an operator to arrange it removable inside the cabinet. Furthermore, the cooling device should not acquire that the refrigerator cabinet needs to be adapted. The features of claim 1 solve the objects of the present invention. Preferred embodiments are disclosed in the accompanying dependent claims.

DESCRIPTION OF DRAWINGS

[0007]

Fig. 1 shows a perspective view of a cooling device according to the present invention.

Fig. 2 shows a side view of the cooling device according to claim 1.

Fig. 3 shows a cross section view of the cooling device according to claim 1.

Fig. 4 shows a cross section view at the line IV - IV in fig. 2.

AN ILLUSTRATIVE EMBODIMENT

[0008] Fig. 1 - 4 shows an embodiment of a cooling device with a storage volume for food products that needs to be stored at a specific temperature, such as zero degrees Celsius for meat. The device comprises a cooling agent circuit 1 with an agent having properties demanded for the cooling device according to the present invention. The circuit consist in a closed pipe loop enclosing the agent. The loop comprises a first part 2 located at a cooling cabinet 3. The cabinet encloses a volume 4, which is intended to store the food products. The cabinet has four wall sides 5 creating a box like shape, a backside 6 and a front side 8,9. The wall sides and the backside are connected by substantially tight connections such as welding or gluing.

[0009] In order to enclose the volume 4 a front side 8,9 is arranged. A sealing such as a gasket seals the connection between the front side and the wall sides 5. In one embodiment the front side 8 is rotatable and/or removable mounted to at least one hinge attached to a wall 5 side of the cabinet. In an alternative embodiment the lid 9 is connected to an extracting part 7 at least partly arranged in the volume, which extracting part is movable and in one position closes the cabinet 3. Alternatively, the extracting part, for example a drawer, is placed inside the volume, whereby the hinge type lid 8 encloses the volume 4.

[0010] The shape of the cabinet 3 can be varied depending on the needs. The conditions of the cabinet depend on what type of refrigerator cabinet it should be adapted for. In this embodiment the cabinet has a box like shape. All four walls 5, the backside 6 and the front side 8,9 comprises an inner wall 10 and an outer wall 11, which walls are substantially parallel. A space 12 formed between the outer and inner wall is partly filled with isolation 14. Several such spaces can be formed between outer and inner walls, some of them being partly or totally filled with isolation. Some spaces could ei-

ther be connected to each other. In this embodiment one space 12 in the upper wall side is partly filled with isolation 14. Spaces 12 in other wall sides, the backside and the front side are totally filled with isolation 13. At least one of the wall sides 5 on its outside preferably has attachments (not shown), which enables a removable attachment of the cooling device to a refrigerator cabinet.

[0011] The space 12 partly filled with isolation 14 is also filled with a liquid 15. The properties of the liquid consist especially in a well-defined freezing point, for example pure water that has a freezing point at zero degrees Celsius. It is also important to disable for organic material to start growing in the liquid and that the liquid is human and environmental friendly. Since the liquid also is in contact with parts of the cabinet such as walls and isolation, it needs to be chemically stable in order to not react with the walls. One option in order to avoid problems with the isolation is to place a wall (not shown) between the liquid and the isolation. Moreover, the isolation should be positioned between the liquid and the outer wall 11, which avoids energy from the liquid to leak out from the cabinet 3.

[0012] In this embodiment the first part 2 of the closed pipe loop is arranged in one of the sidewalls 5 in the space 12 between the outer wall 11, the isolation 14 and the inner wall 10. The liquid 15 substantially surrounds the pipe loop. Since the liquid needs space to expand when it freezes the space 12 is partly filled with air. As an alternative some of the walls or the isolation is flexible. It is possible that the first part of the pipe loop extends into other spaces between outer 11 and inner 12 walls at other sidewalls or at the backside 6. It is important that the pipe loop extends in such a matter that the thermal resistance between the cooling agent circuit 1 and the liquid 15 is as low as possible. By including flanges or similar to increase the contact surface between the liquid and the pipe the resistance could be decreased. Moreover, the first part is substantially arranged in parallel with the outer and the inner walls and fixed inside the space.

[0013] Despite the first part 2 of the pipe loop, the cooling agent circuit 1 also comprises a second part 16 of the pipe loop that extends outside the cabinet 3. In this embodiment the second part substantially extends in a vertical direction. A vertical extending direction should not be seen as definite for the invention. Instead the invention relates to extend the second part in a direction that enables a well working cooling device. The properties of the second part 16 are adapted for the type of cooling device in which it is used. The aim is to achieve a good heat transfer between the second part and the surrounding environment. Therefore, the part can be arranged on a carrying plate (not shown) that increases the heat transfer properties between the part and the environment. Using surface increasing means such as for the first part of the pipe loop can also be used. In fig. 1 the second part 16 meanders, which also increase heat transfer properties. Two carrying devices 17 support the second part of the pipe loop.

[0014] Two valves 18,19 are arranged in the cooling agent circuit 1. The first valve 18 constitutes in a manually operated valve, which controls the flow of cooling agent through the circuit. Operating the valve between different adjustment positions regulates the flow. The second valve 19 constitutes in a one-way blocking valve, which only allows the cooling agent to flow in the direction from the first part 2 of the pipe loop via the first valve 18 to the second part 16 of the pipe loop. A turnable wheel 20, which position is indicated by indications 21, operates the adjustment position of the first valve.

[0015] The method for operating the cooling device will now be described. The purpose of the device is to achieve an independent, cooled cabinet for storing food products such as meat, fish and vegetables. The products need to be stored at a specific temperature, around zero degrees Celsius for meat and vegetables, in order to achieve long possible storage durability without the need to freeze the products.

The cooling device is adapted to be detachably attached inside a refrigerator. The second part 16 of the pipe loop is placed at the cooling surface (not shown) in such a manner that a low thermal resistance between the part 16 and the surface is achieved. The carrying plate improves the heat transfer properties. Is the embodiment the cooling device intends to be placed inside a refrigerator with a vertical cooling surface (evaporator), but the extending direction of the second part 16 may be adapted in order to fit with surfaces with other extending directions. Attachments (not shown) on the outside may enable the cooling device to be attached to the shelf attachments inside the refrigerator cabinet instead of being placed on the bottom of the cabinet inside.

[0016] The first 2 and second 16 part of the pipe loop extends substantially perpendicular related to each other. This enables for the cooling device to be pushed into contact with the vertical cooling surface on the backward wall inside the refrigerator, which contact is necessary in order for the device to work. The need for the second part of the pipe loop to be placed against the cooling surface is explained by how the cooling agent circuit 1 works. This also explains why the thermal resistance needs to be low. The cooling agent inside the circuit 1 starts to circulate when the cooling surface transfers cooling energy to the cooling circuit. The flow path is as follows:

[0017] When the cooling agent is in the second part 16 of the pipe loop it receives cooling energy from the cooling surfaced. It is thereby liquefied and starts flowing downwards in the part because of the force of gravity. The liquid agent moves down through the one directional valve 19 into the first part 2 of the pipe loop. Moreover, the agent flows in the first part 2 and transfers cooling energy to the liquid 15. The agent is thereby vaporized. The vaporized agent is because of its weight forced upwards through the second valve 18 by which

the agent flow can be regulated.
Finally, the agent is again liquefied by the cooling energy received in the second part 16 of the pipe loop. The valve 19 forces the agent to flow in this mentioned direction only.

[0018] In this embodiment the liquefied agent lowers the temperature on the liquid 15 in the cabinet 3 volume 12. The temperature reaches the freezing point of the liquid and the liquid freezes to ice. The freezing point depends on the type of liquid. The cooling energy of the liquid is transferred to the volume 4, which temperature stabilizes at the temperature of the liquid. In order to stabilize the liquid temperature, the valve 18 is operated in the following manner: When the device starts receiving cooling energy the valve is operated to an adjustment position shown by the indication 20, which position is indicated in the users manual and corresponds to the temperature in the room in which the refrigerator is placed and the adjustment position of the thermostat of the refrigerator. Thereafter, after a while the valve is operated to a position, which corresponds to the temperature inside the volume 4. The cooling device is thereafter self-regulated if the temperature in the room stays substantially stable around the freezing point of the liquid.

[0019] The result is that self-regulated cooling devices using water will keep the temperature inside the volume around zero degrees Celsius. A cooling device using a liquid with a different freezing point will keep the temperature of the volume 4 at a different temperature level. Therefore, by choosing a specific liquid, cooling cabinets for different food products can be achieved.

[0020] It will be appreciated by those ordinary people skilled in the art that the present invention can be embodied in other specific forms without departing from the spirit or essential character thereof. The present disclosed embodiment is therefore considered in all respect to be illustrative and not restrictive. The appended claims rather than the foregoing description indicate the scope of the invention, and all changes that come within the meaning and range of equivalents thereof are intended to be embraced therein.

Claims

1. Cooling device for cooling a volume (4), which device comprises a cooling agent circuit (1) with a closed pipe loop including cooling agent and a cabinet (3) with walls at least partly enclosing the volume (4), which pipe loop at least partly passes through a liquid **characterized in that** at least part of the liquid (15) is located at the cabinet (3).

2. Cooling device according to claim 1 **characterized in** at least one of the walls (5) consists of an outer wall (11) and an inner wall (10) which together at least partly encloses at least one space (12).

3. Cooling device according to claim 2 **characterized in that** at least one of the enclosed spaces (12) are at least partly filled with the liquid (15), which liquid (15) has a well defined freezing point.

4. Cooling device according to claim 3 **characterized in that** the liquid (15) in one of the enclosed spaces (12) in normal conditions has a freezing point around zero degrees Celsius.

5. Cooling device according to an of the claims 2 - 4 **characterized in that** at least one of the spaces (12) is at least partly filled with isolation (13,14).

6. Cooling device according to claim 5 **characterized in that** parts of the isolation (14) is located at the outer wall (11) in at least one of the enclosed spaces (12), whereby the rest of the partly isolated space (12) is substantially filled with the liquid (15).

7. Cooling arrangement according to any of the claims 2 - 6, **characterized in that** a first part (2) of the pipe loop at least partly passes through the liquid in at least one of the enclosed spaced (12).

8. Cooling device according to any of the preceding claims **characterized in that** the cabinet (3) has two substantially parallel vertical wall sides (5) connected to each other by an upper and a lower substantially with each other parallel, horizontal sides (5), which four sides together form a box like shape, the cabinet also having a back side (6) and a front side (8) which front side is removable or rotatable mounted by at least one hinge attached at a wall side, all sides together closes the cabinet (3).

9. Cooling device according to any of the claims 1 - 7 **characterized in that** the cabinet (3) has two substantially parallel vertical wall sides (5) connected to each other by an upper and a lower substantially with each other parallel, horizontal sides (5), which four sides together form a box like shape, the cabinet also having a back side (6) and at least one extractable part (7,9) at least partly arranged in the volume (4), which extractable part (7,9) is movable and in one end position closes the cabinet (3).

10. Cooling device according to any of the preceding claims **characterized in that** the cabinet (3) comprises at least one attachment which enables removable attachment of the cooling device, which attachment cooperates with the arrangement at which the cooling device is removable attached.

11. Cooling device according to any of the preceding claims **characterized in that** the cooling agent circuit comprises a second part (16) of the pipe loop.

12. Cooling device according to claim 11 **characterized in that** the second part (16) of the pipe loop is attached to plate substantially flat and parallel with the second part, which plate when placed against a surface substantially lowers the thermal resistance between the second part (16) and the surface.

13. Cooling device according to any of the claims 11 - 12 **characterized in that** the second part (16) of the pipe loop is supported by ate least one carrying device (17) which is attached to the cabinet (3).

14. Cooling device according to any of the claims 11 - 13 **characterized in that** the second part (16) of the pipe loop extends substantially in a vertical direction.

15. Cooling device according to any of the preceding claims **characterized in that** a first valve (18) is attached to the cooling agent circuit (1) comprises means (18) for adjusting the flow of cooling agent in the circuit (1).

16. Cooling device according to any of the preceding claims **characterized in that** the first valve (18) has means which enables a manual adjustment of the temperature inside the volume.

15. Cooling device according to any of the preceding claims **characterized in that** a second valve (19) is attached to the cooling agent circuit (1) comprises means only allowing the cooling agent to flow in one direction.

16. Method for a cooling device for cooling a volume (4), which device comprises a cooling agent circuit (1) with a closed pipe loop including cooling agent air and a cabinet (3) with walls at least partly enclosing the volume (4), which pipe loop at least partly passes through liquid that at least partly is located at the cabinet (3) **characterized in** placing the device into removable contact with a cooling surface, such as a refrigerator evaporator, so that the cooling surface transfers cooling energy that brings the agent in the circuit (1) to circulate.

17. Method for a cooling device according to claims 16 **characterized in that** at a first occasion adjust a first valve (18) attached to the cooling agent circuit to a predetermined value at least corresponding to the temperature in a space enclosing the device and at a second following occasion adjust the first valve (18) to a predetermined value at least corresponding to the temperature of the volume (4), which adjustments of the first valve (18) affects the circulation of the cooling agent.

18. Use of a cooling device according to any of the claims 1 - 15 or a method according to any of the claims 16 - 17 to achieve a removable cooling cabinet for food that needs to be stored in a specific temperature.

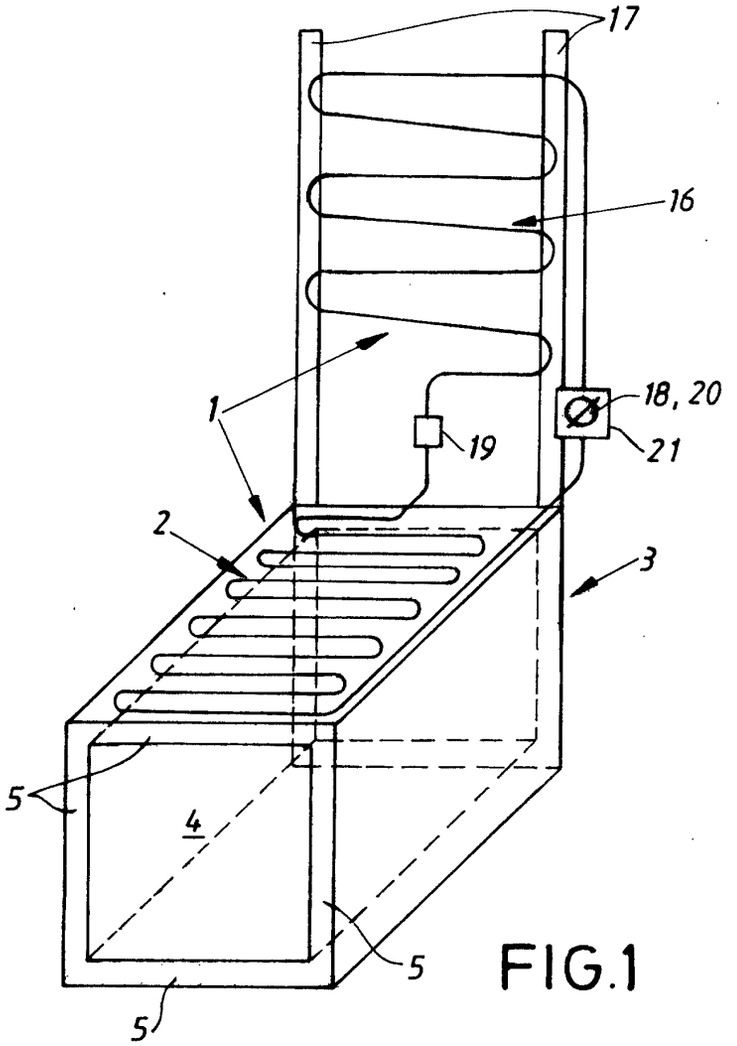

FIG.1

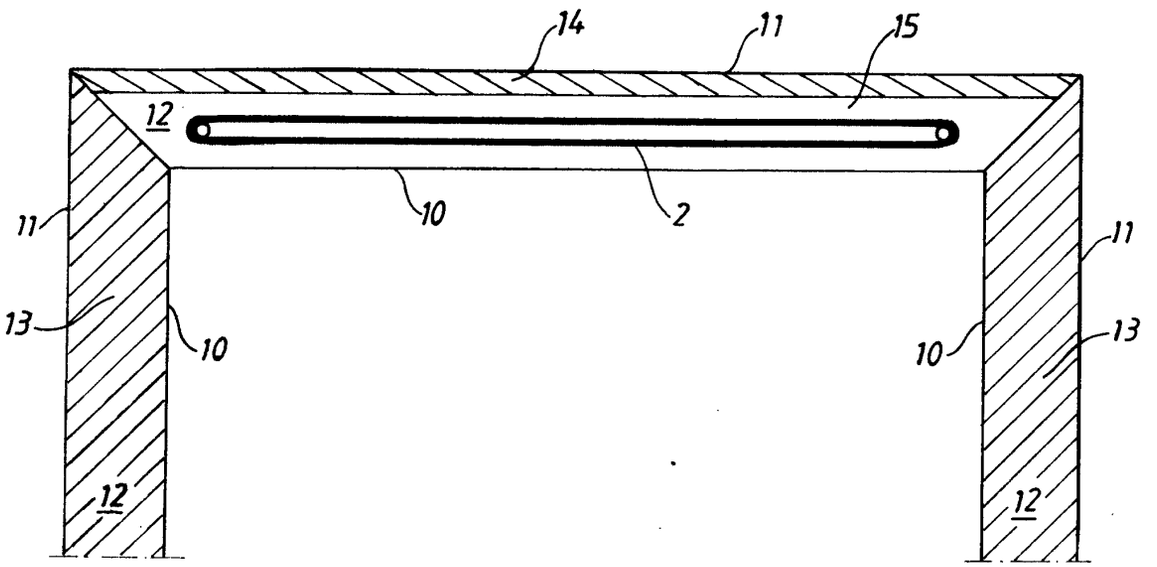

FIG. 4

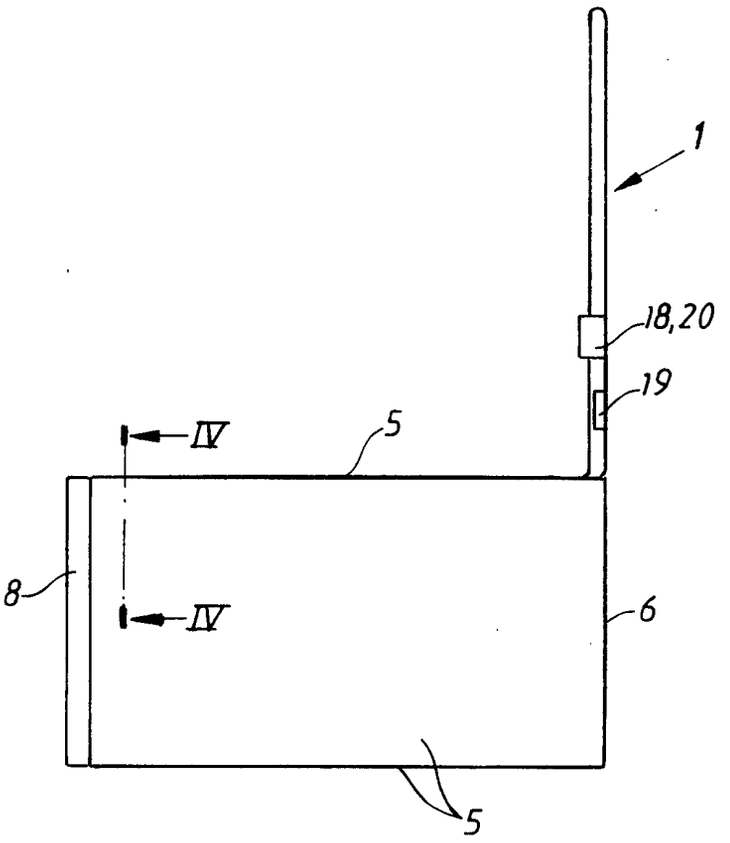

FIG. 2

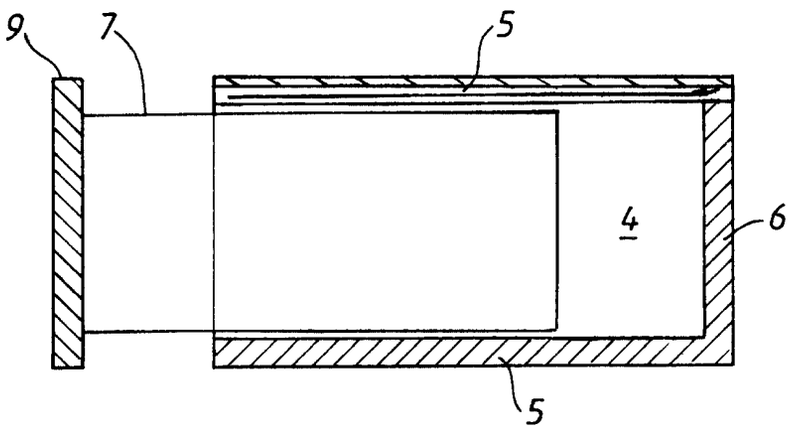

FIG. 3