US 20130219947A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2013/0219947 A1**

(43) **Pub. Date: Aug. 29, 2013**

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(54) **HEAT-EXCHANGED CABINET STRUCTURE**

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(21) Appl. No.: **13/753,090**

(22) Filed: **Jan. 29, 2013**

(30) **Foreign Application Priority Data**

Feb. 24, 2012 (TW) 101106204

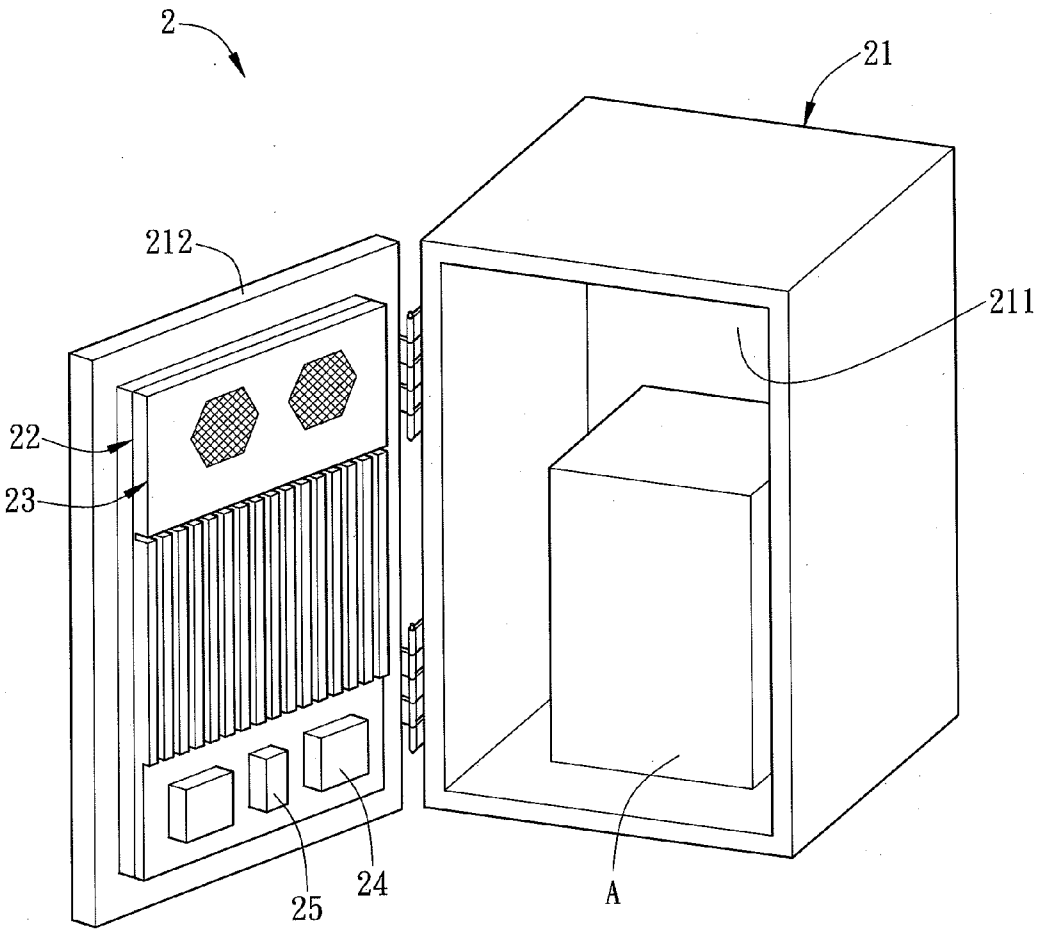
Publication Classification

(51) **Int. Cl.**
F25D 31/00 (2006.01)

(52) **U.S. Cl.**
CPC ***F25D 31/00*** (2013.01)
USPC **62/426**; 62/513

(57) **ABSTRACT**

A heat-exchanged cabinet structure is used to accommodate an electronic equipment. The heat-exchanged cabinet structure includes a main body, a first heat exchanger device and a second heat exchanger device. The main body has an accommodated space and a first housing. The electronic equipment is disposed in the accommodated space. The first heat exchanger device which has a condenser is disposed on the first housing and placed in the accommodated space. The second heat exchanger device which has an evaporator is placed in the accommodated space and is adjacent the first heat exchanger.



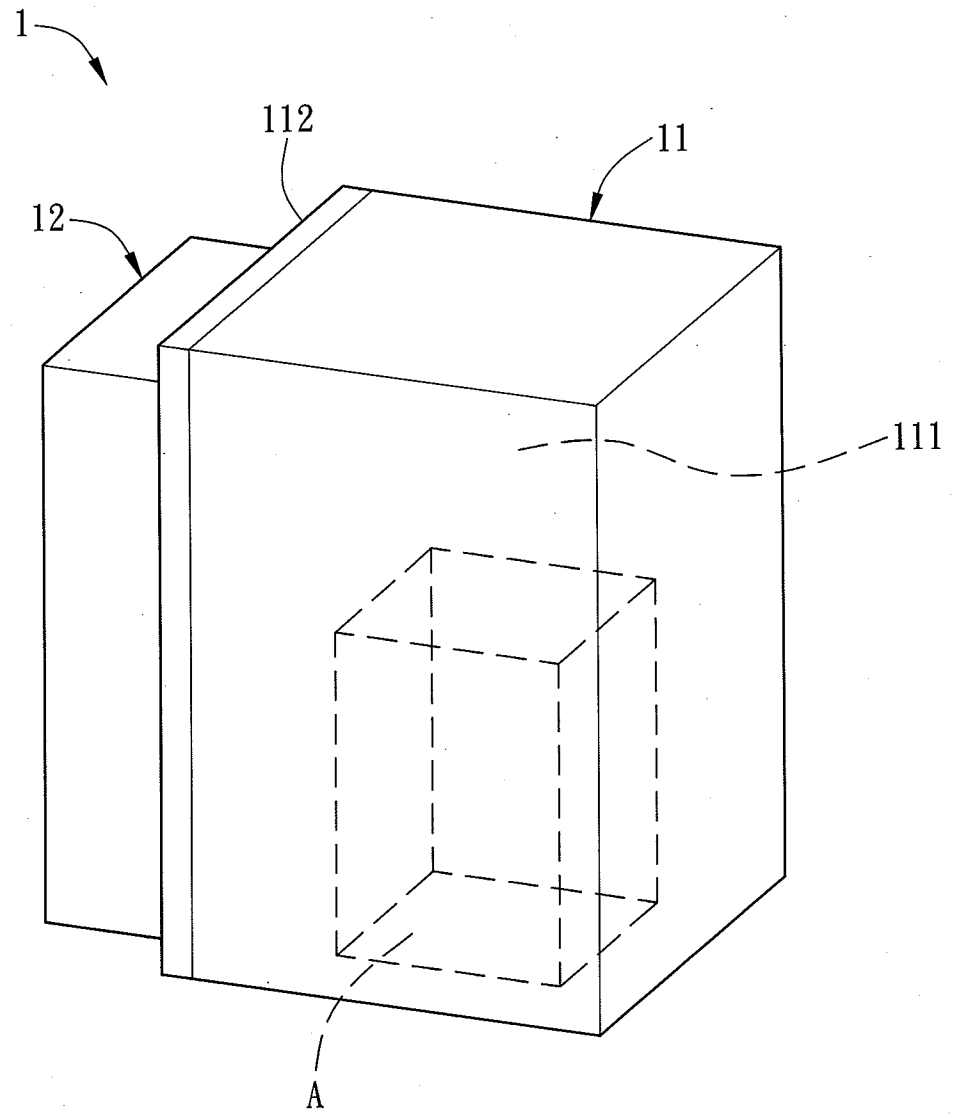


FIG. 1(Prior Art)

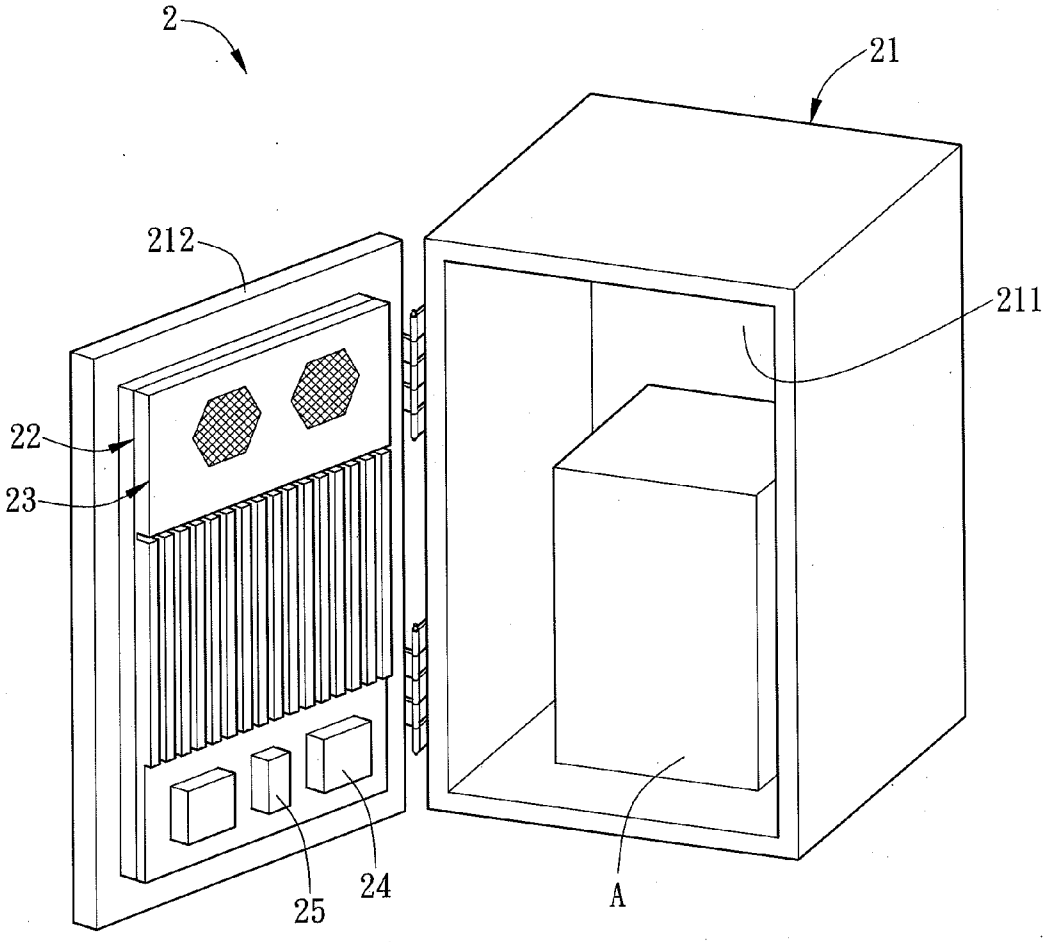


FIG. 2

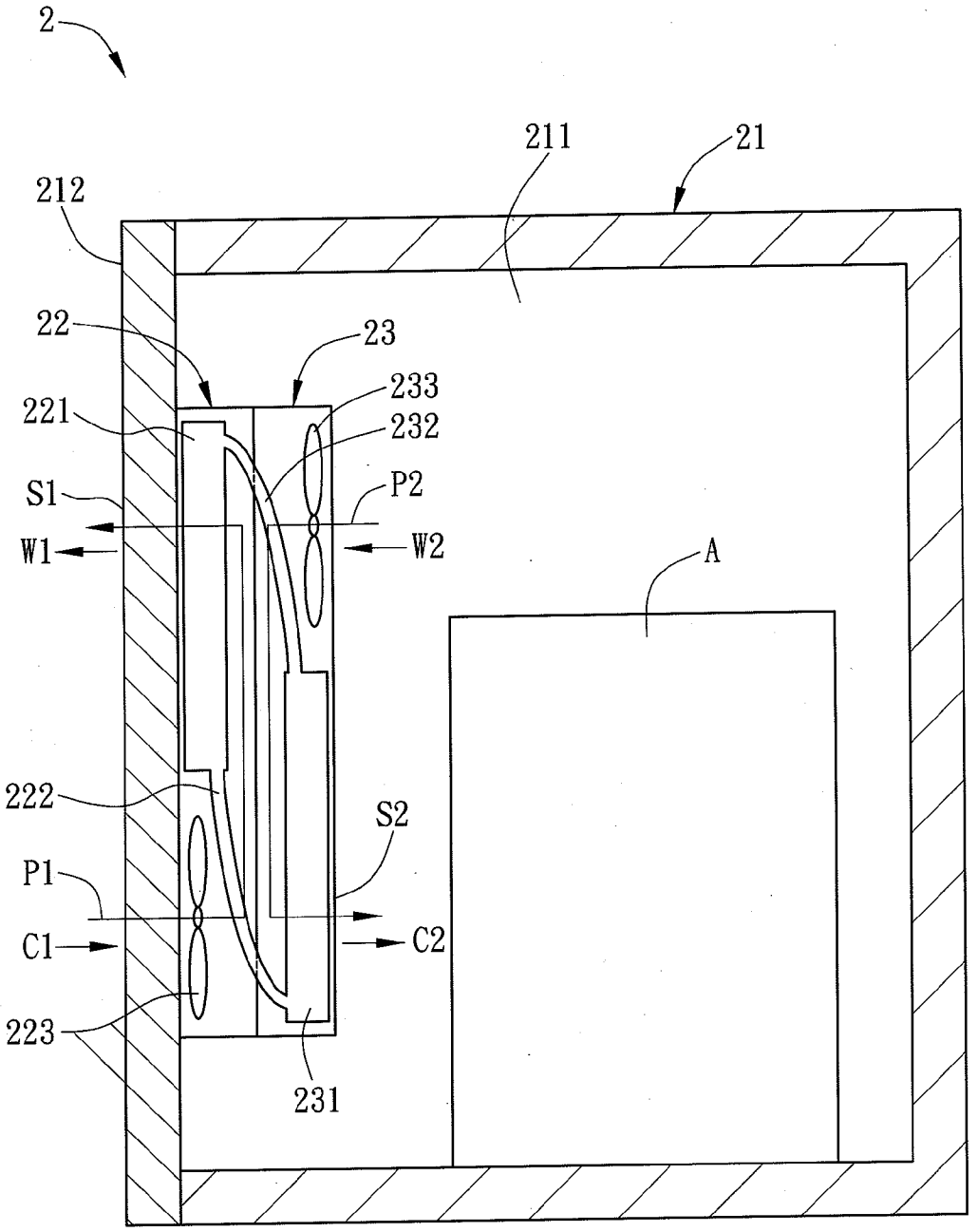


FIG. 3

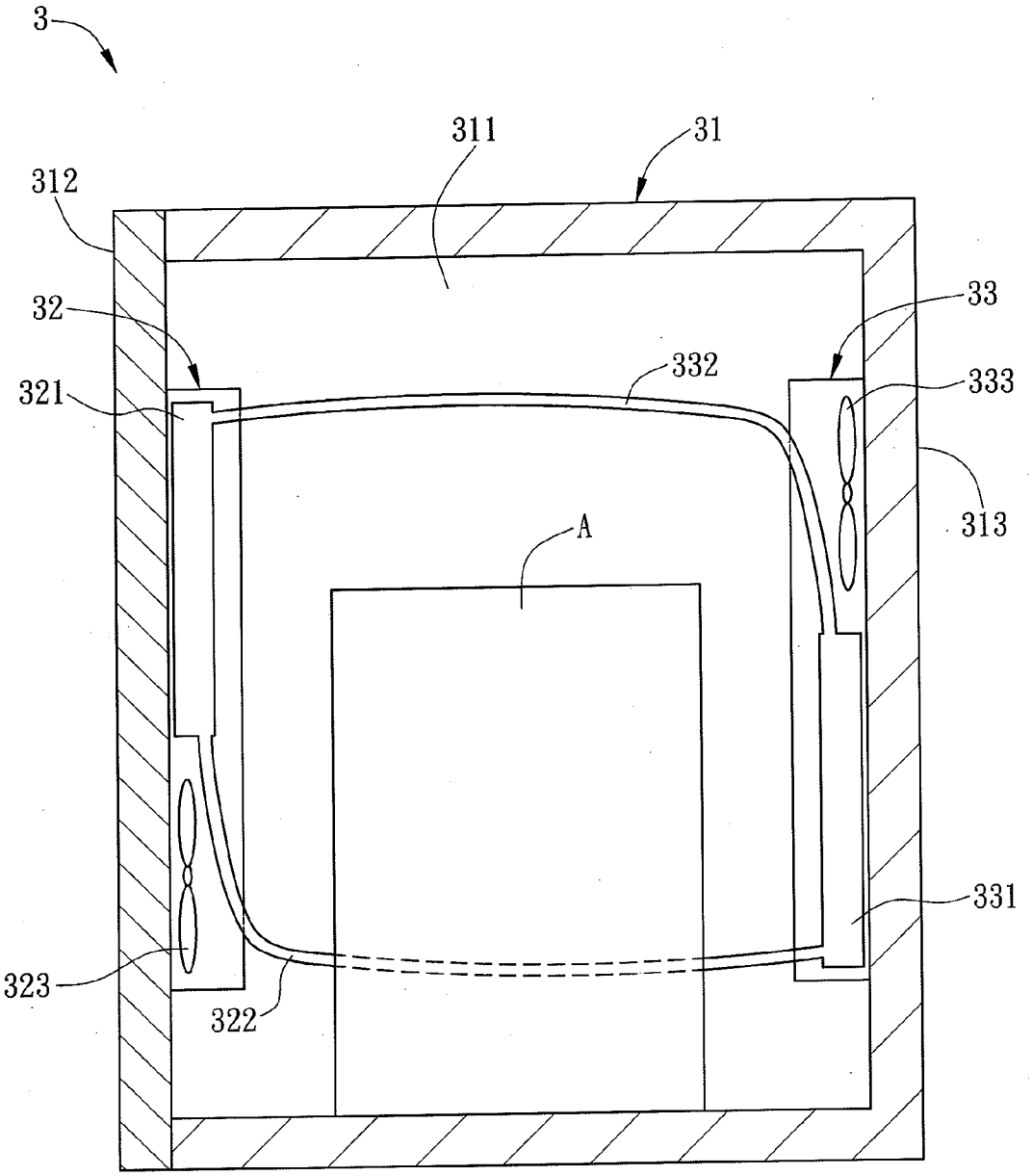


FIG. 4

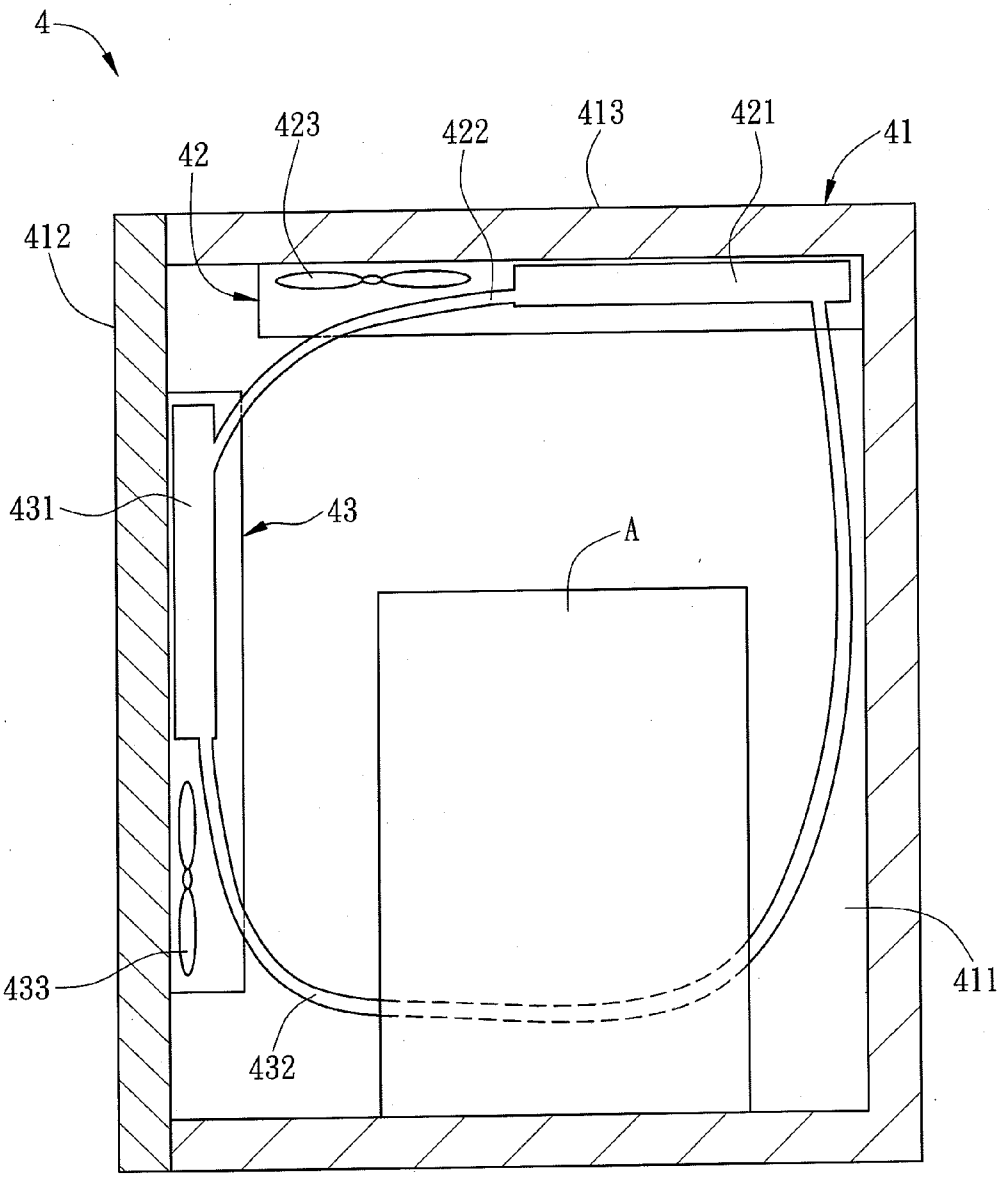


FIG. 5

HEAT-EXCHANGED CABINET STRUCTURE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This Non-provisional application claims priority under 35 U.S.C. §119(a) on Patent Application No(s). 101106204 filed in Taiwan, Republic of China on Feb. 24, 2012, the entire contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of Invention

[0003] The present invention relates to a heat-exchanged cabinet structure and, in particular, to a heat-exchanged cabinet structure with heat exchanger devices.

[0004] 2. Related Art

[0005] Heat-exchanged cabinet structures have been widely applied to outdoor communication stations or telecommunication power equipment. FIG. **1** is a schematic diagram showing a conventional heat-exchanged cabinet structure **1**, which includes a main body **11** and a heat exchanger device **12**. The heat-exchanged cabinet structure **1** is used to carry an electronic equipment A. The main body **11** has an accommodating space **111**, and the electronic equipment A is placed in the accommodating space **111**. The heat exchanger device **12** is installed on the outer surface **112** of the main body **11** and connected to the main body **11**.

[0006] Since the heat exchanger device **12** of the heat-exchanged cabinet structure **1** is installed on the outer surface **112** of the main body **11**, and it can directly contact the exterior environment, the heat exchanger device **12** fails to provide good heat dissipation and air cycling. Besides, the heat exchanger device **12** is easily interfered by the climatic and environmental factors, thereby resulting bad heat dissipation and thus causing the overheating and malfunction of the electronic equipment A. In addition, this configuration not only sufficiently enlarges the total size of the heat-exchanged cabinet structure **1** but also increases the manufacturing cost and time.

[0007] Therefore, it is an important subject to provide a heat-exchanged cabinet structure that can improve the air cycling so as to enhance the heat-dissipating performance and reduce the configuration space and manufacturing cost.

SUMMARY OF THE INVENTION

[0008] In view of the foregoing subject, an objective of the present invention is to provide a heat-exchanged cabinet structure that can improve the air cycling so as to enhance the heat-dissipating performance and reduce the configuration space/size and manufacturing cost.

[0009] To achieve the above objective, the present invention discloses a heat-exchanged cabinet structure, which is used to accommodate an electronic equipment. The heat-exchanged cabinet structure includes a main body, a first heat exchanger device and a second heat exchanger device. The main body has an accommodated space and a first housing, and the electronic equipment is disposed in the accommodated space. The first heat exchanger device has a condenser and is disposed on the first housing and placed in the accommodated space. The second heat exchanger device has an evaporator and is placed in the accommodated space and adjacent the first heat exchanger.

[0010] To achieve the above objective, the present invention also discloses a heat-exchanged cabinet structure, which is used to accommodate an electronic equipment. The heat-exchanged cabinet structure includes a main body, a first heat exchanger device and a second heat exchanger device. The main body has an accommodated space, a first housing and a second housing. The first housing is disposed opposite to the second housing, and the electronic equipment is disposed in the accommodated space. The first heat exchanger device has a condenser and is disposed on the first housing and placed in the accommodated space. The second heat exchanger device has an evaporator and is disposed on the second housing and placed in the accommodated space.

[0011] To achieve the above objective, the present invention also discloses a heat-exchanged cabinet structure, which is used to accommodate an electronic equipment. The main body has an accommodated space, a first housing and a second housing. The first housing is connected to the second housing, and the electronic equipment is disposed in the accommodated space. The first heat exchanger device has a condenser and is disposed on the first housing and placed in the accommodated space. The second heat exchanger device has an evaporator, and is disposed on the second housing and placed in the accommodated space.

[0012] As mentioned above, the first and second heat exchanger devices of the heat-exchanged cabinet structure are disposed in the accommodating space of the main body, and located corresponding to the electronic equipment. The first and second heat exchanger devices have a condenser and an evaporator, respectively, for dissipating the heat generated by the electronic equipment, thereby enhancing the heat-dissipation performance of the heat-exchanged cabinet structure. In addition, the installation positions of the first and second exchanger devices can be flexibly modified according to the dimension of the electronic equipment or the heat-exchanged cabinet structure. For example, the first and second exchanger devices are disposed on two opposite or connected housings of the heat-exchanged cabinet structure, respectively. These configurations can also increase the air cycling performance and thus improve the heat-dissipation performance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The present invention will become more fully understood from the subsequent detailed description and accompanying drawings, which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

[0014] FIG. **1** is a schematic diagram showing a conventional heat-exchanged cabinet structure;

[0015] FIG. **2** is a schematic diagram showing a heat-exchanged cabinet structure according to a first embodiment of the present invention;

[0016] FIG. **3** is a sectional side view of the heat-exchanged cabinet structure of FIG. **2**;

[0017] FIG. **4** is a sectional side view of a heat-exchanged cabinet structure according to a second embodiment of the present invention; and

[0018] FIG. **5** is a sectional side view of a heat-exchanged cabinet structure according to a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] The present invention will be apparent from the following detailed description, which proceeds with reference to the accompanying drawings, wherein the same references relate to the same elements.

First Embodiment

[0020] FIG. **2** is a schematic diagram showing a heat-exchanged cabinet structure **2** according to a first embodiment of the present invention. The heat-exchanged cabinet structure **2** is installed at outdoor or in the equipment room for carrying an electronic equipment A. In this case, the electronic equipment A is, for example, an electronic communication equipment, a communication station or the likes. The heat-exchanged cabinet structure **2** includes a main body **21**, a first heat exchanger device **22**, and a second heat exchanger device **23**. The first heat exchanger device **22**, the second heat exchanger device **23** and the electronic equipment A are disposed in the main body **21**. In addition, the heat-exchanged cabinet structure **2** may further include a heating device **24** and a control device **25**. The heating device **24** is installed on the main body **21** and connected to the first exchanger device **22** or the second heat exchanger device **23**. The control device **25** is connected to the heating device **24** for controlling the operation of the heating device **24** so as to adjust the temperature.

[0021] The main body **21** has an accommodated space **211** and a first housing **212**. For example, the first housing **212** can be a cap, a rear plate, a side plate, a top plate, or a bottom plate. In this embodiment, the first housing **212** is, for example but not limited to, a cap. The electronic equipment A is disposed in the accommodated space **211**, so that the main body **21** can protect the electronic equipment A as well as the components thereof from being damped or damaged by the environment, corrosive gas or external force.

[0022] The first heat exchanger device **22** is disposed on the first housing **212** and placed in the accommodated space **211**, and the second heat exchanger device **23** is disposed adjacent to (stacked on) the first heat exchanger device **22** and also disposed in the accommodated space **211**. In this embodiment, the first heat exchanger device **22** and the second heat exchanger device **23** are all installed inside the main body **21**, so that they can directly perform the heat dissipation of the electronic equipment A. This configuration can reduce the environmental interference, enhance the air cycling and heat-dissipating performance, minimize the assembling dimension of the heat-exchanged cabinet structure **2**, and decrease the manufacturing cost.

[0023] FIG. **3** is a sectional side view of the heat-exchanged cabinet structure **2** of FIG. **2**. To be noted, the heating device **24** and the control device **25** are not shown in FIG. **3** for clearly illustrating other components, and the shown components may be not shown in the actual dimensions and are for illustrations only. The first heat exchanger device **22** includes a condenser **221**, a pipe **222** and a fan **223**, and the second heat exchanger device **23** includes an evaporator **231**, a pipe **232** and a fan **233**. The pipes **222** and **232** are connected to the condenser **221** and the evaporator **231**, respectively. In more specific, the pipe **222** is configured to transfer a fluid (e.g. a liquid) from the condenser **221** to the evaporator **231**, and the pipe **232** is configured to transfer a fluid (e.g. a gas) from the evaporator **231** to the condenser **221**. To be noted, the lengths of the pipes **222** and **232** are not limited to this invention, and they can be adjusted based on the distance between the condenser **221** and the evaporator **231**. In the heat-exchanged cabinet structure **2** of this embodiment, the first heat exchanger device **22** has two pipes **222**, and the second heat exchanger device **23** has two pipes **232**. The configurations of the pipes **222** and **232** are to improve the transmission efficiency of the fluid (liquid or gas) between the condenser **221** and the evaporator **231**. To be noted, the numbers of the pipes **222** and **232** are not limited to this invention, and they can be adjusted according to the dimensions of the first heat exchanger device **22** or the second heat exchanger device **23**.

[0024] In other embodiments, it is possible to configure additional condenser and/or evaporator in the in the first heat exchanger device **22** and/or the second heat exchanger device **23**. For example, the first heat exchanger device **22** includes two condensers, and the second heat exchanger device **23** includes two evaporators, thereby enhancing the performance of heat dissipation and air cycling. Herein, the numbers of the condensers and evaporators are not limited in the invention.

[0025] The fans **223** and **233** of this embodiment are centrifugal fans. In other embodiments, the fans **223** and **233** can be selected from other types of fans (e.g. axial flow fans, oblique flow fans, or cross flow fans) based on the positions thereof or the shapes and volumes of the heat-exchanged cabinet structure **2**. To be noted, the first heat exchanger device **22** and the second heat exchanger device **23** are individually configured, and they are separated by, for example, at least one partition and connected only through the pipes **222** and **232**, which connect the condenser **221** and the evaporator **231**. In the heat-exchanged cabinet structure **2** of this embodiment, the first heat exchanger device **22** and the second heat exchanger device **23** respectively include two fans **223** and two fans **233** for increasing the air input quantity. Herein, the numbers of the fans **223** and **233** are not limited in this invention.

[0026] The heating device **24** is connected to at least one of the first heat exchanger device **22** and the second heat exchanger device **23**, and the control device **25** is connected to the heating device **24**. In this embodiment, the heating device **24** and the control device **25** are disposed in the first housing **212**. Of course, the configurations and positions of the heating device **24** and the control device **25** are not limited in this invention. In other embodiments, the heating device **24** and the control device **25** may be disposed in the same housing or different housings. The control device **25** can control the heating device **24** according to the climate or environmental temperature so as to adjust the temperatures of the first heat exchanger device **22** and the second heat exchanger device **23**. Accordingly, the second heat exchanger device **23** can output cold air to cool down the electronic equipment A.

[0027] The operation of the first heat exchanger device **22** and the second heat exchanger device **23** and the heat-dissipating process of the electronic equipment A will be described hereinafter with reference to FIG. **3**. The fan **223** sucks the cold air C**1** from the outside into the first heat exchanger device **22**. The cold air C**1** flows to the condenser **221** along the path P**1** in the first heat exchanger device **22**, and then the cold air C**1** carries the heat out from the condenser **221** to form a warm air W**1**, which is outputted through the output side S**1**. In more specific, the first housing **212** has an opening (not shown) disposed corresponding to the condenser **221**, so that the warm air W**1** can be outputted through

the output side S1. Besides, the condenser **221** can condense the fluid to liquid, and the liquid then flows to the evaporator **231** through the pipe **222**.

[0028] On the contrary, the fan **233** sucks the warm air W2 generated by the electronic equipment A into the second heat exchanger device **23**. The warm air W2 flows to the evaporator **231** along the path P2 in the second heat exchanger device **23**, and then the evaporator **231** can carry the heat from the warm air W2 to form a cold air C2, which is outputted through the output side S2 along a path P2. The cold air C2 is sent to the electronic equipment A for dissipating the heat generated by the electronic equipment A. Herein, the liquid fluid flowing to the evaporator **231** is evaporated into gas fluid, which then flows to the condenser **221** through the pipe **232**. The established gas cycling can dissipate the heat (generated by the electronic equipment A or the main body **21**) carried by the warm air W2 to the outside, thereby enhancing the heat-dissipation efficiency of the main body **21**.

[0029] To be noted, the temperatures of the cold airs C1 and C2 and the warm airs W1 and W2 are not limited to this embodiment. The most important condition is to keep the temperature of the warm air W1 from the first heat exchanger device **22** to be higher than the temperature of the cold air C1 flowing into the first heat exchanger device **22**. Similarly, the temperature of the warm air W2 flowing into the second heat exchanger device **23** to be higher than the temperature of the cold air C2 from the second heat exchanger device **23**.

Second Embodiment

[0030] FIG. **4** is a sectional side view of a heat-exchanged cabinet structure **3** according to a second embodiment of the present invention. The heat-exchanged cabinet structure **3** is installed at outdoor or in the equipment room for carrying an electronic equipment A. In this case, the electronic equipment A is, for example, an electronic communication equipment, a network exchanger or a transformer apparatus. The heat-exchanged cabinet structure **3** includes a main body **31**, a first heat exchanger device **32**, and a second heat exchanger device **33**. The first heat exchanger device **32**, the second heat exchanger device **33**, and the electronic equipment A are disposed in the main body **31**. In addition, the heat-exchanged cabinet structure **3** may further include a heating device and a control device (not shown). The heating device is installed on the main body **31** and connected to the first exchanger device **32** or the second heat exchanger device **33**. The control device is connected to the heating device for controlling the operation of the heating device so as to adjust the temperature inside the heat-exchanged cabinet structure **3**.

[0031] The main body **31** has an accommodated space **311**, a first housing **312** and a second housing **313**. The first housing **312** and the second housing **313** are disposed opposite to each other. For example, each of the first housing **312** and the second housing **313** can be a cap, a rear plate, a side plate, a top plate, or a bottom plate. In this embodiment, the first housing **312** is, for example but not limited to, a cap, and the second housing **313** is correspondingly a rear plate.

[0032] The electronic equipment A is disposed in the accommodated space **311**. The first heat exchanger device **32** is disposed on the first housing **312**, and the second heat exchanger device **33** is disposed on the second housing **313** and located opposite to the first heat exchanger device **32**. In this embodiment, the first heat exchanger device **32** is disposed on the first housing **312** and the second heat exchanger device **33** is disposed on the second housing **313**, which are all installed inside the main body **31**, so that they can directly perform the heat dissipation of the electronic equipment A. This configuration can enhance the air cycling and heat-dissipating performance and prevent the interference of external environmental factors, which can affect the normal operation of the heat exchanger devices. In addition, the positions of the first heat exchanger device **32** and the second heat exchanger device **33** can be flexibly changed based on the heat-dissipation requirement of the electronic equipment A. Furthermore, this configuration can minimize the assembling dimension of the heat-exchanged cabinet structure **3** and decrease the manufacturing cost.

[0033] The first heat exchanger device **32** includes a condenser **321**, a pipe **322** and a fan **323**. The condenser **321** is connected to the pipe **322**, and the pipe **322** is configured to transfer a fluid (e.g. a liquid) from the condenser **321** to an evaporator **331**. The fan **323** and the condenser **321** are disposed in the first housing **312**. The second heat exchanger device **33** includes the evaporator **331**, a pipe **332** and a fan **333**. The evaporator **331** is connected to the pipe **332**, and the pipe **332** is configured to transfer a fluid (e.g. a gas) from the evaporator **331** to the condenser **321**. The fan **333** and the evaporator **331** are disposed in the second housing **313**. In this embodiment, the fans **323** and **333** are, for example but not limited to, centrifugal fans. Of course, the fans **323** and **333** can be any applicable fan such as axial flow fans or oblique flow fans.

[0034] To be noted, the first heat exchanger device **32** and the second heat exchanger device **33** are individually configured, and they are connected only through the pipes **322** and **332**, which connect the condenser **321** and the evaporator **331**. Besides, the technical features of the evaporator **331**, the condenser **321**, the pipes **322** and **332**, and the fans **323** and **333** are the same as those of the evaporator **231**, the condenser **221**, the pipes **222** and **232**, and the fans **223** and **233** of the first embodiment, so the detailed descriptions thereof will be omitted.

Third Embodiment

[0035] FIG. **5** is a sectional side view of a heat-exchanged cabinet structure **4** according to a third embodiment of the present invention. The heat-exchanged cabinet structure **4** is used to carry an electronic equipment A. The heat-exchanged cabinet structure **4** includes a main body **41**, a first heat exchanger device **42**, and a second heat exchanger device **43**. In addition, the heat-exchanged cabinet structure **4** may further include a heating device and a control device (not shown). The technical features of the electronic equipment A, heating device and control device of the third embodiment are the same as those of the electronic equipment A, the heating device **24** and the control device **25** of the first embodiment, so the detailed descriptions thereof will be omitted.

[0036] The main body **41** has an accommodated space **411**, a first housing **412** and a second housing **413**. The first housing **412** and the second housing **413** are connected to each other. For example, each of the first housing **412** and the second housing **413** can be a cap, a rear plate, a side plate, a top plate, or a bottom plate. In this embodiment, the first housing **412** is disposed adjacent to and connected to the second housing **413**. Besides, the first housing **412** is, for example but not limited to, a cap, and the second housing **413** is correspondingly a top plate. Otherwise, in another aspect, the first housing **412** is a side plate, and the second housing **413** is a bottom plate connected to the side plate. Alterna-

tively, in still another aspect, the first housing **412** is a top plate, and the second housing **413** is a side plate connected to the top plate.

[0037] The electronic equipment A is disposed in the accommodated space **411**. The first heat exchanger device **42** is disposed on the second housing **413**, and the second heat exchanger device **43** is disposed on the first housing **412** and located adjacent to the first heat exchanger device **42**. In this embodiment, the positions of the first heat exchanger device **42** and the second heat exchanger device **43** can be flexibly changed based on the heat-dissipation requirement of the electronic equipment A. Furthermore, since the first heat exchanger device **42** and the second heat exchanger device **43** are both disposed inside the main body, the assembling dimension and volume of the heat-exchanged cabinet structure **4** can minimized, thereby decreasing the manufacturing cost.

[0038] The first heat exchanger device **42** includes a condenser **421**, a pipe **422** and a fan **423**. The condenser **421** is connected to the pipe **422**, and the pipe **422** is configured to transfer a fluid (e.g. a liquid) from the condenser **421** to an evaporator **431**. The fan **423** and the condenser **421** are disposed in the second housing **413**. The second heat exchanger device **43** includes the evaporator **431**, a pipe **432** and a fan **433**. The evaporator **431** is connected to the pipe **432**, and the pipe **432** is configured to transfer a fluid (e.g. a gas) from the evaporator **431** to the condenser **421**. The fan **433** and the evaporator **431** are disposed in the first housing **412**. In this embodiment, the fans **423** and **433** are, for example, centrifugal fans. Of course, based on the heat-dissipation requirement of the electronic equipment A or the positions of the fans **423** and **433**, the fans **423** and **433** can be any applicable fan such as axial flow fans or oblique flow fans.

[0039] To be noted, the first heat exchanger device **42** and the second heat exchanger device **43** are individually configured, and they are connected only through the pipes **422** and **432**, which connect the condenser **421** and the evaporator **431**. Besides, the technical features of the evaporator **431**, the condenser **421**, the pipes **422** and **432**, and the fans **423** and **433** are the same as those of the evaporator **231**, the condenser **221**, the pipes **222** and **232**, and the fans **223** and **233** of the first embodiment, so the detailed descriptions thereof will be omitted.

[0040] In summary, the first and second heat exchanger devices of the heat-exchanged cabinet structure are disposed in the accommodating space of the main body, and located corresponding to the electronic equipment. The first and second heat exchanger devices have a condenser and an evaporator, respectively, for dissipating the heat generated by the electronic equipment, thereby enhancing the heat-dissipation performance of the heat-exchanged cabinet structure. Compared with the conventional art, the heat-exchanged cabinet structure of the invention can improve the issues of poor heat-dissipation performance and interference of external environmental factors, and minimize the installation volume and space so as to decrease the manufacturing cost. In addition, the installation positions of the first and second exchanger devices can be flexibly modified according to the dimension of the electronic equipment or the heat-exchanged cabinet structure. For example, the first and second exchanger devices are disposed on two opposite or connected housings of the heat-exchanged cabinet structure, respectively. These configurations can also increase the air cycling performance and thus improve the heat-dissipation performance.

[0041] Although the present invention has been described with reference to specific embodiments, this description is not meant to be construed in a limiting sense. Various modifications of the disclosed embodiments, as well as alternative embodiments, will be apparent to persons skilled in the art. It is, therefore, contemplated that the appended claims will cover all modifications that fall within the true scope of the present invention.

What is claimed is:

1. A heat-exchanged cabinet structure, which is used to accommodate an electronic equipment, comprising:
- a main body having an accommodated space and a first housing, wherein the electronic equipment is disposed in the accommodated space;
- a first heat exchanger device disposed on the first housing and placed in the accommodated space, wherein the first heat exchanger device has a condenser; and
- a second heat exchanger device placed in the accommodated space and adjacent the first heat exchanger, wherein the second heat exchanger device has an evaporator.

2. The heat-exchanged cabinet structure of claim **1**, wherein the first heat exchanger device further has a pipe and a fan, and the pipe connects the condenser and the evaporator for transmitting a fluid from the condenser to the evaporator.

3. The heat-exchanged cabinet structure of claim **1**, wherein the second heat exchanger device further has a pipe and a fan, and the pipe connects the condenser and the evaporator for transmitting a fluid from the evaporator to the condenser.

4. The heat-exchanged cabinet structure of claim **2**, wherein the fan is a centrifugal fan.

5. The heat-exchanged cabinet structure of claim **3**, wherein the fan is a centrifugal fan.

6. The heat-exchanged cabinet structure of claim **1**, further comprising:
- a heating device connecting to the first heat exchanger device or the second heat exchanger device; and
- a control device connecting to and controlling the heating device.

7. The heat-exchanged cabinet structure of claim **1**, wherein the first housing is a cap, a rear plate, a side plate, a top plate, or a bottom plate.

8. A heat-exchanged cabinet structure, which is used to accommodate an electronic equipment, comprising:
- a main body having an accommodated space, a first housing and a second housing, wherein the first housing is disposed opposite to the second housing, and the electronic equipment is disposed in the accommodated space;
- a first heat exchanger device disposed on the first housing and placed in the accommodated space, wherein the first heat exchanger device has a condenser; and
- a second heat exchanger device disposed on the second housing and placed in the accommodated space, wherein the second heat exchanger device has an evaporator.

9. The heat-exchanged cabinet structure of claim **8**, wherein the first heat exchanger device further has a pipe and a fan, and the pipe connects the condenser and the evaporator for transmitting a fluid from the condenser to the evaporator.

10. The heat-exchanged cabinet structure of claim **8**, wherein the second heat exchanger device further has a pipe

and a fan, and the pipe connects the condenser and the evaporator for transmitting a fluid from the evaporator to the condenser.

11. The heat-exchanged cabinet structure of claim **9**, wherein the fan is a centrifugal fan.

12. The heat-exchanged cabinet structure of claim **10**, wherein the fan is a centrifugal fan.

13. The heat-exchanged cabinet structure of claim **8**, further comprising:

a heating device connecting to the first heat exchanger device or the second heat exchanger device; and

a control device connecting to and controlling the heating device.

14. The heat-exchanged cabinet structure of claim **8**, wherein the first housing is a cap, a rear plate, a side plate, a top plate, or a bottom plate.

15. A heat-exchanged cabinet structure, which is used to accommodate an electronic equipment, comprising:

a main body having an accommodated space, a first housing and a second housing, wherein the first housing is connected to the second housing, and the electronic equipment is disposed in the accommodated space;

a first heat exchanger device disposed on the first housing and placed in the accommodated space, wherein the first heat exchanger device has a condenser; and

a second heat exchanger device disposed on the second housing and placed in the accommodated space, wherein the second heat exchanger device has an evaporator.

16. The heat-exchanged cabinet structure of claim **15**, wherein the first heat exchanger device further has a pipe and a fan, and the pipe connects the condenser and the evaporator for transmitting a fluid from the condenser to the evaporator.

17. The heat-exchanged cabinet structure of claim **15**, wherein the second heat exchanger device further has a pipe and a fan, and the pipe connects the condenser and the evaporator for transmitting a fluid from the evaporator to the condenser.

18. The heat-exchanged cabinet structure of claim **17**, wherein the fan is a centrifugal fan.

19. The heat-exchanged cabinet structure of claim **15**, further comprising:

a heating device connecting to the first heat exchanger device or the second heat exchanger device; and

a control device connecting to and controlling the heating device.

20. The heat-exchanged cabinet structure of claim **15**, wherein the first housing is a cap, a rear plate, a side plate, a top plate, or a bottom plate.

* * * * *