



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.09.2017 Bulletin 2017/38

(51) Int Cl.:
D06F 58/22 (2006.01) *D06F 58/20* (2006.01)
D06F 25/00 (2006.01)

(21) Application number: **17150087.9**

(22) Date of filing: **03.01.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
 Designated Extension States:
BA ME
 Designated Validation States:
MA MD

- **XU, Yunjiu**
Beijing, 100044 (CN)
- **WANG, Yuqing**
Qingdao, 266736 (CN)
- **ZHAN, Guoqing**
Qingdao, 266736 (CN)
- **LI, Songhui**
Qingdao, 266736 (CN)
- **LIU, Yuchun**
Qingdao, 266736 (CN)
- **LIU, Xueliang**
Qingdao, 266736 (CN)

(30) Priority: **14.03.2016 CN 201610142616**
14.03.2016 CN 201610142580
14.03.2016 CN 201610142577
14.03.2016 CN 201610142697

(74) Representative: **Pfenning, Meinig & Partner mbB**
Patent- und Rechtsanwälte
Theresienhöhe 11a
80339 München (DE)

(71) Applicant: **Hisense (shandong) Refrigerator Co., Ltd.**
Qingdao, Shandong 266736 (CN)

(72) Inventors:
 • **LI, Ningning**
Qingdao, 266736 (CN)

(54) **CLOTHES CARE APPARATUS WITH SMOKE FILTER**

(57) The present application discloses a clothes care apparatus such as a washing machine or a washing drying machine, to remove dust and smoke particles on clothes; such apparatus comprising a drum (1); an air channel (2) communicated with the drum (1); a filter ap-

paratus, communicated with the air channel (2); and a draught fan (4), the draught fan (4) being capable of feeding air into the drum (1) to allow the air to filter clothes in the drum (1), and guiding smoke-carrying air into the filter apparatus to filter the air.

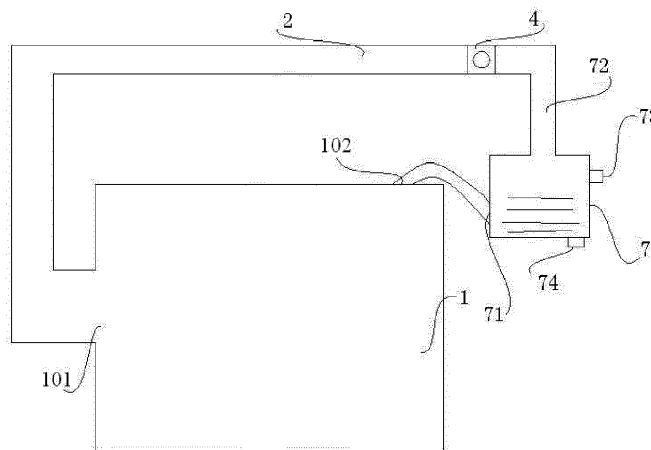


FIG. 1

Description

[0001] The present application claims the priority of Chinese Patent Application No. 201610142616.1, filed to the Chinese Patent Office on March 14, 2016, titled "DRYING WASHING MACHINE HAVING A CLOTHING CARE FUNCTION"; Chinese Patent Application No. 201610142580.7, filed to the Chinese Patent Office on March 14, 2016, titled "CLOTHES CARE METHOD AND ITS APPARATUS"; Chinese Patent Application No. 2016110142577.5, filed to the Chinese Patent Office on March 14, 2016, titled "WASHING MACHINE HAVING A CLOTHING CARE FUNCTION"; and Chinese Patent Application No. 201610142697.5, filed to the Chinese Patent Office on March 14, 2016, titled "DRYING WASHING MACHINE WITH CLOTHING CARE FUNCTION", which are incorporated herein by reference in their entireties.

TECHNICAL FIELD

[0002] The present invention relates to the technical field of clothes care, and more particularly to a clothes care apparatus, a washing machine, and a drying washing machine.

BACKGROUND

[0003] As the requirements of people on the quality of life are increased gradually, the requirements of users on functions of a washing machine become higher and higher. However, due to simple washing, a traditional washing machine is poorer in effect of removing a peculiar smell from clothes. Particularly, it is difficult to remove smoke particles remaining on the clothes.

[0004] At present, a steam generator is generally adopted on the market to care the clothes. The steam generator converts water into steam and then continuously sprays the steam onto the clothes, the steam may permeate into fibers of the clothes, and the fibers of the clothes absorb water vapor to make the clothes recover, thereby removing folds. Moreover, the steam may absorb partial dust and smoke particles on the fibers of the clothes, thereby achieving a function of removing dust and smoke particles from the clothes.

SUMMARY

[0005] Embodiments of the present invention provide a clothes care apparatus, a washing machine, and a drying washing machine, capable of solving the problem of poorer effect of removing, via a steam generator, dust and smoke particles on clothes in the prior art.

[0006] To this end, the embodiments of the present invention adopt the following technical solution.

[0007] Disclosed is a clothes care apparatus, including: a drum; an air channel, communicated with the drum; a filter apparatus, communicated with the air channel;

and a draught fan, the draught fan being capable of feeding air into the drum to allow the air to filter clothes in the drum, and guiding smoke-carrying air into the filter apparatus to filter the air.

[0008] The clothes care apparatus provided by an embodiment of the present invention includes the drum, the air channel communicated with the drum, the filter apparatus communicated with the air channel, and the draught fan. After clothes are put into the drum, the draught fan feeds air into the drum to squeeze out air between the clothes, and dust or smoke particles attached to the clothes will be taken away when the air flows out, thereby achieving functions of filtering and cleaning the clothes to be cared. Then, the smoke-carrying air is guided into the filter apparatus via the air channel, and after being filtered by the filter apparatus, dust or smoke in the smoke-carrying air may be absorbed by the filter apparatus to achieve a clean effect. The above-mentioned filter procedure is carried out for many times till the dust and smoke particles on the clothes are removed substantially. Therefore, the clothes care apparatus in the embodiment of the present invention is better in effect of removing the dust and smoke particles on the clothes.

[0009] Also disclosed is a washing machine having a clothes care function, including the clothes care apparatus of the above-mentioned technical solution. A drum includes an inner cylinder and an outer cylinder; a draught fan draws air from the inner cylinder into an air channel and guides the air into a container; and after being filtered by water, the air is fed into the inner cylinder via the air channel to form a circulation, and smoke in clothes is filtered.

[0010] According to the washing machine having a clothes care function, provided by an embodiment of the present invention, the drum includes the inner cylinder and the outer cylinder; during the clothes care procedure, clothes are put into the inner cylinder, and under the action of the draught fan, air in the inner cylinder may be drawn out; due to extraction of the air between the clothes, negative pressure is generated near the clothes, such that dust and smoke particles attached to the clothes are separated from the clothes and mixed into the air, and then the air containing the dust and smoke particles is guided into the container via the air channel; and since the container is filled with the water, the dust and smoke particles in the air are dissolved in the water, clean air is discharged from the container, and the clean air is re-guided into the inner cylinder so as to form a circulation. Thus, after repeated filtration, the dust and smoke particles on the clothes may be removed substantially. Therefore, the washing machine having a clothes care function in the embodiment of the present invention is better in effect of removing the dust and smoke particles on the clothes.

[0011] Also disclosed is a drying washing machine having a clothes care function, including the clothes care apparatus of the above-mentioned technical solution. A drum includes an inner cylinder and an outer cylinder; a

draught fan draws air from the inner cylinder into an air channel and guides the air into a container; and after being filtered by water, the air is drawn into the inner cylinder via a condenser and a heating apparatus to form a circulation, smoke in clothes is filtered, and the clothes are dried.

[0012] According to the drying washing machine having a clothes care function, provided by an embodiment of the present invention, a drum includes an inner cylinder and an outer cylinder, after clothes are put into the inner cylinder, under the action of the draught fan, air in the inner cylinder may be drawn out, and due to extraction of the air between the clothes, negative pressure is generated near the clothes, such that dust and smoke particles attached to the clothes are separated from the clothes and mixed into the air, and then the air containing the dust and smoke particles is guided into the container via the air channel. Since the container is filled with water, the dust and smoke particles in the air are dissolved in the water to make the air clean, the clean air enters the condenser and comes into contact with condensing water in the condenser, heat exchange is performed therebetween, water vapor in the air is condensed and taken away together with the condensing water, dry cold air is discharged from the condenser and then heated by the heating apparatus in the air channel to become high-temperature air, the high-temperature air is re-guided into the inner cylinder to form a circulation, and the clothes are dried. Thus, after repeated circulations, the dust and smoke particles on the clothes may be removed substantially. Therefore, the drying washing machine having a clothes care function in the embodiment of the present invention is better in effect of removing the dust and smoke particles on the clothes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In order to elaborate the technical solutions in the embodiments of the present invention or the prior art more clearly, the accompanying drawings needing to be used in descriptions of the embodiments or the prior art will be simply introduced below. Obviously, the accompanying drawings described below are only some embodiments of the present invention. Those of ordinary skill in the art may also obtain other accompanying drawings according to these accompanying drawings without creative work.

FIG. 1 is a structure principle diagram illustrating that an air channel is a circulating pipeline in a clothes care apparatus according to an embodiment of the present invention.

FIG. 2 is a structure principle diagram illustrating that an air channel is a non-circulating pipeline in a clothes care apparatus according to an embodiment of the present invention.

FIG. 3 is a local schematic diagram of an air door at a first position in a clothes care apparatus according

to an embodiment of the present invention.

FIG. 4 is a local schematic diagram of an air door at a second position in a clothes care apparatus according to an embodiment of the present invention.

FIG. 5 is a local schematic diagram of an air door at a third position in a clothes care apparatus according to an embodiment of the present invention.

FIG. 6 is a structural schematic diagram of a washing machine according to an embodiment of the present invention.

FIG. 7 is a structural schematic diagram of another washing machine according to an embodiment of the present invention.

FIG. 8 is a structural schematic diagram of a container in a washing machine according to an embodiment of the present invention.

FIG. 9 is a structure principle diagram of a washing machine according to an embodiment of the present invention.

FIG. 10 is a structural schematic diagram of a condenser in a washing machine according to an embodiment of the present invention.

FIG. 11 is a first structure principle diagram of a washing machine according to an embodiment of the present invention.

FIG. 12 is a structural schematic diagram of a container in a washing machine according to an embodiment of the present invention.

FIG. 13 is a second structure principle diagram of a washing machine according to an embodiment of the present invention.

FIG. 14 is a structural schematic diagram of a container mounted at an opening in a washing machine according to an embodiment of the present invention.

FIG. 15 is an A-A sectional view in FIG. 14.

FIG. 16 is a top view of a container in a washing machine according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0014] The technical solutions in the embodiments of the present invention will be described below clearly and completely in conjunction with the accompanying drawings in the embodiments of the present invention. Obviously, the described embodiments are only part of the embodiments of the present invention instead of all of the embodiments. On the basis of the embodiments in the present invention, all of the other embodiments obtained by those of ordinary skill in the art without creative work fall within the scope of protection of the present invention.

[0015] In the descriptions of the present invention, it is important to understand that locative or positional relations indicated by 'center', 'up', 'down', 'front', 'back', 'left', 'right', 'vertical', 'horizontal', 'top', 'bottom', 'inner', 'outer' and other terms are locative or positional relations shown

in the accompanying drawings, which are only intended to make it convenient to describe the present invention and to simplify the descriptions without indicating or implying that the referring apparatus or element must have a specific location and must be constructed and operated with the specific location, and accordingly it cannot be understood as limitations to the present invention.

[0016] Terms 'first' and 'second' are only used to describe the purposes, and cannot be understood as indication or implication of relative importance or implied showing of quantity of indicated technical features. Thus, features defined with 'first' and 'second' may explicitly or implicitly include one or more those features. In the descriptions of the present invention, unless otherwise noted, 'multiple' means two or more.

[0017] In the descriptions of the present invention, it is important to note that unless otherwise specified and limited, terms 'mounted', 'connected with' and 'connected' should be understood in a general conception. For instance, 'connected' may be fixed connected, detachable connected or integrated connected, or may be direct connected with, intermediate medium-based indirect connected with, or internal communication between two elements. Those of ordinary skill in the art may understand specific meanings of the above-mentioned terms in the present invention according to the specific situations.

[0018] Referring to FIG. 1 and FIG. 2, an embodiment of the present invention provides a clothes care apparatus, including a drum 1, an air channel 2, a filter apparatus, and a draught fan 4. The air channel 2 is communicated with the drum 1. The filter apparatus is communicated with the air channel 2. The draught fan 4 may feed air into the drum 1, such that the air filters clothes in the drum 1, and smoke-carrying air is guided into the filter apparatus and filtered.

[0019] The clothes care apparatus provided by the embodiment of the present invention includes the drum 1, the air channel 2 communicated with the drum 1, the filter apparatus communicated with the air channel 2, and the draught fan 4. After clothes are put into the drum 1, the draught fan 4 feeds clean air into the drum 1, such that air pressure in the drum 1 is increased, air between the clothes is squeezed out, and dust or smoke particles attached to the clothes will be taken away when the air flows out, thereby achieving a function of cleaning the clothes to be cared. Then, the air is guided into the filter apparatus via the air channel 2, and after being filtered by the filter apparatus, dust or smoke in the air may be absorbed by the filter apparatus to achieve a clean effect. Thus, the above-mentioned filter procedure is carried out for many times till the dust and smoke particles on the clothes are removed substantially. Therefore, the clothes care apparatus in the embodiment of the present invention is better in effect of removing the dust and smoke particles on the clothes.

[0020] The above-mentioned clothes care apparatus adopts a clothes care method, including the following steps: putting clothes to be cared into a closed drum 1;

feeding air into the drum 1 by means of a draught fan 4; and filtering the clothes to be cared, and guiding smoke-carrying air into a filter apparatus to filter the air. However, the above-mentioned clothes care method not only is applied to this clothes care apparatus, but also may be applied to other apparatuses.

[0021] The above-mentioned drum 1 includes an inner cylinder and an outer cylinder, wherein the inner cylinder may rotationally move relative to the outer cylinder. The clothes to be cared are put into the inner cylinder, such that during clothes care, the clothes may be fully shaken to be loose by means of rotation of the inner cylinder, smoke on the clothes is quickly separated from the clothes along with shaking of the clothes to enter the air, and therefore the efficiency of smoke filtration for the clothes to be cared is improved.

[0022] Referring to FIG. 2, a further embodiment of the present invention provides a clothes care apparatus, including a housing 14. The above-mentioned drum 1, air channel 2, filter apparatus and draught fan 4 are all provided within the housing 14. An air inlet 141 and an air outlet 142 are provided on the housing 14. The air outlet 141 of the housing 14 is communicated with the air channel 2, and the draught fan 4 draws air outside the housing 14 into the air channel 2 via the air inlet 141, and feeds the air into the drum 1.

[0023] Optionally, the air outlet 142 of the housing 14 is communicated with an air outlet of the filter apparatus. Thus, air blown from the drum 1 is filtered by the filter apparatus and then may be discharged out of the clothes care apparatus from the air outlet 142.

[0024] If the quality of the air fed into the drum 1 by the draught fan 4 is poorer, the clothes to be cared will be secondarily polluted. Optionally, in an embodiment of the present invention, an air purification apparatus 10 is provided at the air inlet 141 of the housing 14, and the draught fan 4 feeds the air filtered by the air purification apparatus 10 into the drum 1. Due to better quality of the air, a clothes filtration care function may be achieved.

[0025] In case of good weather and higher air quality, air may be directly fed into the drum for filtration. Optionally, in an embodiment of the present invention, the air inlet 141 of the housing 14 includes a first air inlet 1411 and a second air inlet 1412, both the first air inlet 1411 and the second air inlet 1412 being communicated with the air channel 2. The air purification apparatus 10 is provided at the first air inlet 1411, and an air door 11 is provided in the air channel 2. When the air quality outside the clothes care apparatus is higher, the air door 11 is located at a first position, and the air door 11 allows the second air inlet 1412 to communicate with the air channel 2, and allows the first air inlet 1411 to disconnect from the air channel 2. As shown in FIG. 3, the draught fan 4 may draw the air into the air channel 2 via the second air inlet 1412. In case of poorer air quality outside the clothes care apparatus (e.g., hazy weather), the air door 11 is located at a second position, and the air door 11 allows the first air inlet 1411 communicate with the air channel

2, and allows the second air inlet 1412 disconnect from the air channel 2. As shown in FIG. 4, the draught fan 4 may draw the air into the first air inlet 1411, and the air is filtered by the air purification apparatus 10 and then fed into the air channel 2. In case of ordinary air quality (e.g., mild pollution), the air door 4 may be controlled to move to a third position, and both the first air inlet 1411 and the second air inlet 1412 are communicated with the air channel 2, as shown in FIG. 5. The clothes care apparatus of the embodiment of the present invention may select different air inlet modes according to a specific air situation, the effects of energy conservation and filtration being better. Position switching of the above-mentioned air door 11 may adopt a rotation mode or other convenient opening modes.

[0026] An air discharge apparatus 12 is connected to the air outlet of the filter apparatus. As shown in FIG. 2, by opening the air discharge apparatus 12, the air filtered by the filter apparatus may be more quickly discharged, thereby improving the filter efficiency. In a specific embodiment, the air discharge apparatus 12 may adopt an air discharge pump.

[0027] In view of that the air discharged from the filter apparatus is clean air, the air channel 2 adopted in a further embodiment of the present invention is a circulating pipeline, the draught fan 4 may draw the air filtered by the filter apparatus into the drum 1 via the air channel 2 to form a circulation, as shown in FIG. 1. Since it is unnecessary to provide an additional device to purify the clean air, the structure of the clothes care apparatus may become simpler.

[0028] The filter apparatus in the clothes care apparatus of the embodiment of the present invention is a container 7. The container 7 is filled with water used for filtering smoke in air. The manufacturing process for the container is simple, the cost is low, and the efficiency of smoke filtration is better. Certainly, in other embodiments of the present invention, the filter apparatus may be filled with other substances such as a liquid organic solvent or the like.

[0029] The above-mentioned clothes care apparatus is elaborated below by means of a specific device applying the above-mentioned clothes care apparatus.

[0030] An embodiment of the present invention provides a washing machine having a clothes care function, including a housing and a transmission apparatus provided in the housing, the above-mentioned clothes care apparatus being provided in the housing, the housing being further internally provided with a drum 1, the drum including an outer cylinder and an inner cylinder, cylinder covers 103 are provided on the outer cylinder and the inner cylinder, and the inner cylinder being in transmission connection with the transmission apparatus. During clothes washing of the washing machine, clothes are put into the inner cylinder, the transmission apparatus drives the inner cylinder to rotate, and therefore the clothes may be cleaned.

[0031] The washing machine having a clothes care

function may be an impeller washing machine or may be a drum washing machine. Referring to FIG. 1, FIG. 6 and FIG. 7, the clothes care apparatus includes an air channel 2 communicated with the outer cylinder, a container 7 and a draught fan 4 are provided in the air channel 2, the container 7 is filled with water, the draught fan 4 may draw air within the drum 1 into the container 7, and after being filtered by the water, the air is drawn into the drum 1 by the air channel 2 to form a circulation.

[0032] During clothes care, clothes to be cared are put into the inner cylinder of the washing machine, the clothes may be fully shaken to be loose by means of rotation of the inner cylinder, smoke on the clothes is quickly separated from the clothes along with shaking of the clothes to enter the air, the filter period is shortened, and therefore the filter efficiency is improved.

[0033] If it is also necessary to remove folds from the clothes to be cared, optionally, the container 7 is filled with high-temperature water, such that air discharged from an air outlet 72 of the container 7 contains more water vapor, and after the air returns to the inner cylinder, the water vapor in the air permeates into fibers of the clothes in the inner cylinder, so as to be capable of removing the folds on the clothes.

[0034] In an embodiment of the present invention, an air inlet 71 of the container 7 is communicated with an air outlet 102 of the drum 1, and the liquid level of the water in the container 7 may be set to be higher than the air inlet 71, as shown in FIG. 1. Thus, the air drawn from the drum 1 must be filtered by the water in the container 7.

[0035] In order to prevent the water from flowing into the drums 1 through the air outlet 102 of the drum 1 from the air inlet 71 of the container 7 to soak the clothes, optionally, an embodiment of the present invention is implemented by arranging the air outlet 102 of the drum 1 to be higher than the air inlet 71 of the container 7 and controlling the liquid level of the water to be lower than the air outlet 102 of the drum 1, or adopts a technical solution of mounting a one-way valve in a pipeline between the air inlet 71 of the container 7 and the air outlet 102 of the drum 1. It is necessary to adopt the one-way valve specially used for guiding air into liquid in the latter technical solution, this one-way valve being complicated in structure and high in requirement on processing precision, so the former technical solution is adopted in the embodiment of the present invention and advantageous in simple structure, easy manufacture and large in air outlet quantity.

[0036] In order to shorten the air channel as much as possible to further shorten the filter circulation period, optionally, in an embodiment of the present invention, the air outlet 102 of the drum 1 is arranged near the draught fan 4. For instance, according to the solution shown in FIG. 1, the draught fan 4 is located above the drum 1, the right upper corner of the drum 1 being closest to the draught fan 4. Thus, the air outlet 102 of the drum 1 is provided at this position, and oppositely, the air outlet 102 is provided at the right lower corner of the drum 1.

The air channel of the clothes care apparatus is shorter, and because the air outlet 102 is closer to the draught fan 4, the suction force of the draught fan 4 on air in the drum 1 is larger, thereby increasing the speed of air at the air outlet 102 of the drum 1.

[0037] Referring to FIG. 8, in an embodiment of the present invention, the container 7 is provided with a water inlet 73 and a water outlet 74, wherein a water inlet valve (not shown in the figure) used for controlling the water inlet 73 to be opened or closed is connected to the water inlet 73, and water may be automatically fed into the container 7 by controlling the water inlet valve to be opened or closed; a water drain valve (not shown in the figure) used for controlling the water outlet 74 to be opened or closed is connected to the water outlet 74, and water may be automatically drained from the container 7 by controlling the water outlet valve to be opened or closed; and besides, the water inlet 73 is communicated with a water inlet pipe of the washing machine, and the water outlet 74 is communicated with a water drain pipe of the washing machine, such that it is unnecessary to additionally provide a water inlet pipe specially used for injecting water into the container and a water drain pipe used for draining the water, thereby saving the cost and making the washing machine compact structurally.

[0038] In view of limited diameter of the water outlet 74 of the container 7, when the water quantity of the container 7 is larger, it consumes a longer time under in case that the water is drained only under the action of gravity. Hence, the water drain valve is further connected with a water drain pump (not shown in the figure). When it is necessary to replace the water, drain of the water may be accelerated by opening the water drain valve and the water drain pump, thereby saving the water drain time.

[0039] A further optional embodiment of the present invention provides a drying washing machine having caring and drying functions, which is similar to the above-mentioned washing machine having a clothes care function structurally. The drum washing machine adopted as the drying washing machine having caring and drying functions is distinguished from the above-mentioned washing machine in that: referring to FIG. 7 and FIG. 9, a closed drum 1 consists of an inner cylinder, an outer cylinder and a cylinder cover, wherein the inner cylinder may rotationally move relative to the outer cylinder, a door seal 104 is provided at a cylinder opening of the outer cylinder, an air inlet 101 of the drum 1 is provided on the door seal 104, an air outlet 102 of the drum 1 is provided on a cylinder wall of the outer cylinder, the air outlet 102 on the outer cylinder is communicated with the air channel 2, and a heating apparatus 3 is mounted in the air channel 2, the heating apparatus 3 being located between the air outlet 72 of the container 7 and the air inlet 101 of the drum 1. Air discharged from the air outlet 72 of the container 7 is heated, by the heating apparatus 3, to form high-temperature air, the high-temperature air is fed into the inner cylinder, clothes may be dried, and therefore a clothes drying function is achieved. The

above-mentioned heating apparatus 3 may adopt a cheap heating wire.

[0040] Optionally, in a clothes care process, the heating apparatus 3 is kept in a closed state, air blown out of the air outlet 102 of the drum 1 is filtered by water in the container 7, dust and smoke particles on clothes may be removed, and if it is also necessary to remove folds from the clothes, the container 7 should be filled with high-temperature water and the humidity of air returning to the inner cylinder is improved. Thus, care functions of removing dust or smoke particles as well as folds on clothes may be achieved. During a drying procedure, the heating apparatus 3 is opened, after being heated, air in the air channel 2 returns into the inner cylinder, high-temperature air may dry the clothes, and therefore the drying function of the washing machine is achieved. Compared with a traditional washing-drying integrated machine, the above-mentioned washing machine does not need to be provided with an independent drying system, and thus has a more compact structure as well as a clothes care function.

[0041] In order to further enhance the clothes drying effect, optionally, in an embodiment of the present invention, a condenser 5 is provided in the air channel 2, the condenser 5 being located between the air outlet of the container 7 and the heating apparatus 3, as shown in FIG. 9 and FIG. 10. In a drying process, condensing water is continuously injected from a water inlet of the condenser 5, heat exchange is carried out between air discharged from the container 7 and the condensing water in the condenser 5, moisture in the air is absorbed by the condensing water, air blown out of the condenser 5 and entering the air channel 2 is dry cold air, after being heated by the heating wire, the dry cold air becomes high-temperature dry air, and the high-temperature dry air enters the drum 1 finally. The clothes are dried by using the high-temperature dry air, so the drying efficiency of the washing machine is higher. The condensing water in the above-mentioned condenser may be replaced with other coolants such as ethyl alcohol or glycerin or the like. Optionally, in a clothes care process, the condensing water is controlled to stop from entering the condenser 5, and the heating wire is powered off.

[0042] Optionally, the above-mentioned condenser may adopt the structure shown in FIG. 10, or other air-cooled type condensers directly mounted in the air channel may be adopted. The embodiment of the present invention adopts the former solution, an air inlet 51 of the condenser 5 is communicated with the air outlet 72 of the container 7, and an air outlet 52 of the condenser 5 is communicated with the heating apparatus 3. As shown in FIG. 9, the manufacturing cost is low, and the structure is simple.

[0043] Generally, the condensing water in the condenser of the washing machine may be directly drained from a water outlet (not shown in the figure) of the condenser 5. In view of that air entering the condenser 5 is relatively clean, the condensing water in the condenser

5 is in contact with the clean air for heat exchange, and then the water quality of the drained condensing water is better. Optionally, in an embodiment of the present invention, the water outlet of the condenser is eliminated or blocked, the air inlet 51 is provided at the bottom of the condenser 5, and the air inlet 51 of the condenser 5 is communicated with the air outlet 72 of the container 7, such that the condensing water subjected to heat exchange in the condenser 5 flows into the container 7 through the air outlet 72 of the container 7 from the air inlet 51 of the condenser 5 and is used as the water in the container 7. The above-mentioned solution achieves secondary utilization of the condensing water, reduces the consumption of water for clothes care of the washing machine, and saves water resources.

[0044] Furthermore, in an embodiment of the present invention, a reversing valve is adopted to control both the water inlet 73 of the container 7 and the water inlet 53 of the condenser 5 to be opened and closed. When the drying procedure of the washing machine is started, the reversing valve switches, the water inlet 53 of the condenser 5 is opened, the water inlet 73 of the container 7 is closed, new condensing water enters the condenser 5, the condensing water in the condenser 5 and the air carry out heat exchange, and then the condensing water continuously flows into the container 7 via the air inlet 51 of the condenser 5. When the water in the container 7 reaches a first set water level, a controller of the washing machine controls the water drain valve to be opened, and controls the water drain pump to work, the water in the container 7 is quickly discharged from the water outlet 74 under the action of the water drain pump, then the controller controls the water drain pump to stop working, the reversing valve switches, the water inlet 73 of the container 7 is opened, the water inlet 53 of the condenser 5 is closed, and new water is injected into the container 7 from the water inlet 73 of the container 7 till the condensing water in the container 7 reaches a second set water level (the first set water level is higher than the second set water level). In conclusion, the washing machine controls the reversing valve and the water drain pump to cooperatively work, thereby making the water level of the condensing water in the container 7 within a certain range all the time, and ensuring the stability of the effect of filtering dust and smoke particles on clothes by the washing machine. Moreover, the water in the container 7 is replaced to prevent the problems of poor filter effect of the water, deterioration of the water and pollution of the container caused by the fact that the water cannot be replaced for a long time and impurities in the water are continuously accumulated.

[0045] Certainly, both of the water inlet 73 of the above-mentioned container 7 and the water inlet 53 of the condenser 5 may be independently controlled. In a further embodiment of the present invention, a first water inlet valve is provided at the water inlet 73 of the container 7, and a second water inlet valve is provided at the water inlet 53 of the condenser 5. During the drying process of

the washing machine, the first water inlet valve is closed to stop feeding water into the container while the second water inlet valve is opened to feed water into the condenser; and when the water in the container is replaced, the first water inlet valve is opened to supplement the water in the container while the second water inlet valve is closed to stop feeding water to the condenser.

[0046] Optionally, in the embodiment of the present invention, the air inlet 71 of the container 7 is connected with the air outlet 102 on the outer cylinder by means of a third flexible connecting pipe 6, and the third flexible connecting pipe 6 may be made from polyamide, polyethylene or polypropylene or the like, and is low in price and convenient to mount and dismount. The air outlet 72 of the container 7 is connected with the air inlet 51 of the condenser 5 by means of a fourth flexible connecting pipe 8, and the fourth flexible connecting pipe 8 and the third flexible connecting pipe 6 may be made from identical or different materials. In an embodiment of the present invention, the fourth flexible connecting pipe 8 and the third flexible connecting pipe 6 are made from polyamide, low in price, and easy to process and operate.

[0047] Due to a long distance between the draught fan 4 and the container 7, in order to quickly discharge air in the container 7 from the container 7, it is necessary to increase the discharge speed of air at the air outlet 72 of the container 7, and the pipe diameter of an end, connected with the container 7, of the fourth flexible connecting pipe 8 is designed to be smaller than that of an end, connected with the condenser 5, of the fourth flexible connecting pipe 8. Thus, the air speed of the air outlet 72 of the container 7 is increased to a certain extent, and because the pipe diameter of the end, connected with the condenser 5, of the fourth flexible connecting pipe 8 is larger, air resistance of the air inlet 51 of the condenser 5 may be reduced.

[0048] Yet a further embodiment of the present invention provides a drying washing machine of which caring and drying air channels in a container are independent of each other. The drying washing machine is similar to the above-mentioned drying washing machine having caring and drying functions structurally. The difference therebetween lies in that: referring to FIG. 11 and FIG. 12, the air inlet 71 of the container 7 includes a first air inlet 711 and a second air inlet 712, both the first air inlet 711 and the second air inlet 712 are communicated with the air outlet 102 of the drum 1, and these three components may be connected with each other by a three-way pipe 60. The liquid level of the water in the container 7 is higher than the first air inlet 711 and lower than the second air inlet 712, and a first valve for controlling the flow direction of airflow is provided at a position, between the air outlet 102 of the drum 1 and the air inlet 71 of the container 7, on the air channel 2. Thus, in a care procedure, the first valve is controlled to open the first air inlet 711, air discharged from the drum 1 enters the container 7 via the first air inlet 711, dust and smoke particles in the air are taken away by the water, and a clothes care

function is achieved. During the drying procedure, the first valve is controlled to open the second air inlet 712, and air discharged from the drum 1 enters the container 7 via the second air inlet 712, directly enters the condenser 5 from the air outlet 72 of the container 7 without being filtered by the water, and is condensed. The staying time of the air in the container 7 is short, the drying time is shortened as compared to embodiment 2, and the drying efficiency of the washing machine is improved.

[0049] The above-mentioned first valve for controlling the flow direction of airflow at the position, between the air outlet 102 of the drum 1 and the air inlet 71 of the container 7, on the air channel 2 may specifically adopt a solenoid valve, an internally piloted valve, an electrically operated valve or the like. Optionally, the solenoid valve is adopted in the embodiment of the present invention. That is because a valve rod of the internally piloted valve usually stretches out, a valve core is controlled to rotate or move by means of electric, pneumatic and hydraulic actuating mechanisms, and external leakage easily occurs due to dynamic seal of the valve rod; and internal leakage easily occurs due to improper torque control of the electrically operated valve. The solenoid valve exerts an electromagnetic force on an iron core sealed in a flux-insulation casing, dynamic seal does not exist, external leakage is easy to stop, and the structural internal leakage is also easy to control; moreover, and a control system of the solenoid valve is simple, sensitive in reaction, and high in control precision. In an application occasion of the embodiment of the present invention, the adopted solenoid valve is a two-position three-way solenoid valve, and controls only a single path of the first air inlet 711 or the second air inlet 712 to be communicated at the same time, thereby implementing switching of the clothes care function and drying function of the washing machine.

[0050] Referring to FIG. 13, in an embodiment of the present invention, a direct-through pipeline 13 is provided between the drum 1 and the condenser 5, the air outlet 102 of the drum 1 is communicated with an air inlet 131 of the direct-through pipeline 13 and the air inlet 71 of the container 7 respectively, the air inlet 51 of the condenser 5 is communicated with an air outlet 132 of the direct-through pipeline 13 and the air outlet 72 of the container 7 respectively, and a second valve (not shown in the figure) is provided at the air outlet 102 of the drum 1, the second valve being used for controlling the air outlet 102 of the drum 1 to be communicated with the air inlet 71 of the container 7 or communicated with the air inlet 51 of the condenser 5. In this solution, the second valve controls air discharged from the drum 1 to enter the direct-through pipeline 13, so the drying function of the washing machine may be achieved; and the second valve controls air discharged from the drum 1 to enter the container 7, the air may be filtered, and the clothes care function of the washing machine is achieved. Besides, the second valve may also adopt the solenoid valve. In a specific application occasion, the adopted solenoid valve is a two-

position three-way solenoid valve, controls only a single path of the air inlet 131 of the direct-through pipeline 13 or the air inlet 71 of the container 7 to be communicated at the same time, thereby implementing switching of the clothes care function and drying function of the washing machine.

[0051] Optionally, in an embodiment of the present invention, caring and drying air channels in the container are separated. A specific structure is that: a partition board 75 is provided in the container 7, the partition board 75 may partition the container 7 into a filter chamber 78 and an air outlet chamber 79, and the air outlet 72 of the container 7 includes a first air outlet 721 and a second air outlet 722, wherein the first air inlet 711 and the first air outlet 721 are located on the filter chamber 78, the filter chamber 78 is communicated with the air inlet 51 of the condenser 5 via the first air outlet 721, the second air inlet 712 and the second air outlet 722 are located on the air outlet chamber 79, the air outlet chamber 79 is communicated with the air inlet 51 of the condenser 5 via the second air outlet 722, and the position of the first air outlet 721 is higher than the liquid level of the water and lower than the position of the second air outlet 722, as shown in FIG. 12. Thus, the caring and drying air channels are divided into two independent air channels, and the caring procedure and filtering procedure of the washing machine do not interfere with each other.

[0052] Optionally, the water inlet 73 of the container 7 is located on the filter chamber 78 and is arranged to be higher than the first air inlet 711; and the condensing water in the condenser 5 may enter the container 7 from the first air outlet 721, thereby improving the utilization rate of the condensing water.

[0053] Optionally, the first air outlet 721 of the container 7 is connected with the air inlet 51 of the condenser 5 by means of a first flexible connecting pipe 801, the second air outlet 722 of the container 7 is connected with the air inlet 51 of the condenser 5 by means of a second flexible connecting pipe 802, and the first flexible connecting pipe 801 and the second flexible connecting pipe 802 may be made from polyamide, polyethylene or polypropylene or the like, and are low in price and convenient to mount and dismount.

[0054] Due to a long distance between the draught fan 4 and the container 7, in order to quickly discharge air in the container 7 from the container 7, it is necessary to increase the discharge speed of air at the air outlet 72 of the container 7. Optionally, in the embodiment of the present invention, the pipe diameter of an end, connected with the container 7, of the first flexible connecting pipe 801 is smaller than that of an end, connected with the condenser 5, of the first flexible connecting pipe, and the pipe diameter of an end, connected with the container 7, of the second flexible connecting pipe 802 is smaller than that of an end, connected with the condenser 5, of the second flexible connecting pipe. Thus, the air speeds of air discharged from the first air outlet 721 and second air outlet 722 of the container 7 are increased to a certain

extent, and since the pipe diameters of the ends, connected with the condenser 5, of the first flexible connecting pipe 801 and the second flexible connecting pipe 802 are larger, air resistance of the air inlet 51 of the condenser 5 may be reduced.

[0055] Yet a further embodiment of the present invention provides a washing machine including the above-mentioned clothes care apparatus and a detachable container. The container may be detached and cleaned conveniently and periodically. The washing machine is similar to the above-mentioned drying washing machine having a clothes care function structurally. The difference therebetween lies in that: referring to FIG. 14 to FIG. 16, the container 7 in the embodiment of the present invention includes a housing 76 and a water storage drawer 77 detachably mounted within the housing 76, the housing 76 is provided with an opening, the water storage drawer 77 may be pulled out from or pushed into the housing via the opening, a first seal ring 761 is provided between the opening and the water storage drawer 77, and the first seal ring 761 may prevent the problem of abrasion caused by impact between the water storage drawer 77 and the opening of the housing 76 when the water storage drawer 77 is pushed in. The air inlet 71 and air outlet 72 of the container 7 are both provided on the housing 76, a second seal ring 762 is provided at the air inlet 71 of the container 7, a joint 771 is provided at a position, opposite to the air inlet 71, on a sidewall of the water storage drawer 77, and an end, located outside the water storage drawer 77, of the joint 771 is an outer end of the joint 771. When the water storage drawer 77 is pushed into the housing 76, the outer end of the joint 771 may be adaptively inserted into the second seal ring 762, and the first seal ring 761 may seal a clearance between the water storage drawer 77 and the opening, thereby implementing connection between the air inlet 71 and a corresponding pipeline on the outer side of the container 7. Because the second seal ring 762 is provided at the air inlet 71 of the container 7, the sealing performance of the air inlet 71 is better, and air is hardly to leak. Moreover, arrangement of the first seal ring 761 seals the clearance between the water storage drawer 77 and the opening, so as to prevent from influencing the sealing performance of connection between the container and the corresponding pipeline due to accumulation of dust in the second seal ring 762 after entering the container 7 from the clearance. Besides, a connecting seal structure for the air outlet 72 of the container 7 on the housing 76 and the water storage drawer 77 may be identical to the above-mentioned connecting seal structure for the air inlet 71 and the water storage drawer 77.

[0056] When the water storage drawer 77 is pushed into the housing 76, if the joint 771 is of a structure in which all parts in radial direction are identical in size, after the joint 771 is inserted into the second seal ring 762 in a process of pushing the water storage drawer 77 into the housing 76, the insertion size is inconstant, and the container 7 is easy to shake in the second seal ring 762.

Particularly, if the washing machine shakes, when the joint 771 is completely inserted into the second seal ring 762, the water storage drawer 77 will hit against the housing 76 to cause abrasion. Therefore, in order to prevent occurrence of the above-mentioned situation, the outer end of the joint 771 is made into a necking structure, as shown in FIG. 15. When the water storage drawer 77 is pushed into the housing 76, only the necking structure of the outer end of the joint 771 may be inserted into the second seal ring 762. Thus, a certain distance is always kept between the water storage drawer 77 and the housing 76, thereby avoiding the occurrence of the above-mentioned situation. Moreover, the necking joint may accelerate flow of airflow into the container 7 or discharge from the container.

[0057] Optionally, an air inlet pipe 772 is connected to an end, located in the water storage drawer 77, of the joint 771, an air outlet end of the air inlet pipe 772 extends into the water storage drawer 77 and is lower than the joint 771, and the liquid level of the water in the container 7 is controlled to be higher than the air outlet end of the air inlet pipe 772. In order to prevent water from flowing out of the air inlet 71 of the container 7, the liquid level of the water in the container 7 is controlled to be lower than the air inlet 71. Correspondingly, the liquid level of the water in the container 7 is required to be lower than the air outlet 72 of the container 7 to prevent water from flowing out of the air outlet 72 of the container 7. Therefore, the water in the container may be directly and manually replaced without provision of a water inlet and a water outlet on the housing.

[0058] In order to make it convenient to pull out the container, when the water storage drawer 77 is located at a mounting position (i.e., the water storage drawer 77 is located within the housing 76), a container handle 9 is provided on a sidewall of a position, located at the opening of the housing 76, on the water storage drawer 77, thereby facilitating hand grip and force application. The container handle 9 in the embodiment of the present invention is a hand grip portion provided into the sidewall, which belongs to a hidden structure, thus the container handle slightly influences the appearance of the washing machine.

[0059] As for the impeller washing machine, the air inlet 101 and air outlet 102 of the drum 1 are both provided on the outer cylinder, air discharged from the inner cylinder flows through an area between the inner cylinder and the outer cylinder, and is discharged from the air outlet 102 provided on the outer cylinder of the drum 1, and after being filtered by the container 7, the air passes through the air channel 2 and then returns into the inner cylinder from the air inlet 101 on the outer cylinder through the area between the inner cylinder and the outer cylinder.

[0060] The above is only the specific implementation modes of the present invention. However, the scope of protection of the present invention is not limited thereto. Those skilled in the art may easily think of variations or

replacements within the disclosed technical scope of the present invention. These variations or replacements shall fall within the scope of protection of the present invention. Thus, the scope of protection of the present invention shall refer to the scope of protection of the claims.

Claims

1. A clothes care apparatus, comprising: a drum (1); an air channel (2), communicated with the drum (1); a filter apparatus, communicated with the air channel (2); and a draught fan (4), being capable of feeding air into the drum (1), and guiding the air into the filter apparatus.
2. The clothes care apparatus according to claim 1, **characterized in that** the air channel (2) is a circulating pipeline, and the draught fan (4) is able to draw the air filtered by the filter apparatus into the drum (1) via the air channel (2) to form a circulation.
3. The clothes care apparatus according to claim 2, **characterized in that** the filter apparatus is a container (7), water used for filtering smoke in the air is provided in the container (7), and the container (7) is provided with an air inlet (71) and an air outlet (72); a heating apparatus (3) is also provided in the air channel (2), and the heating apparatus (3) is located between the air outlet (72) of the container (7) and an air inlet (101) of the drum (1); a condenser (5) is further provided in the air channel (2), and the condenser (5) is located between the air outlet (72) of the container (7) and the heating apparatus (3).
4. The clothes care apparatus according to claim 3, **characterized in that** the condenser (5) is provided with an air inlet (51) and an air outlet (52), the air inlet (51) of the condenser (5) is communicated with the air outlet (72) of the container (7), and the air outlet (52) of the condenser (5) is communicated with the heating apparatus (3).
5. The clothes care apparatus according to claim 4, **characterized in that** the air inlet (51) of the condenser (5) is provided at the bottom of the condenser (5), the air inlet (51) of the condenser (5) is communicated with the air outlet (72) of the container (7), and condensing water in the condenser (5) is able to flow into the container (7) via the air inlet (51) of the condenser (5).
6. The clothes care apparatus according to claim 3, **characterized in that** the air inlet (71) of the container (7) comprises a first air inlet (711) and a second air inlet (712), both the first air inlet (711) and the second air inlet (712) are communicated with an air outlet (102) of the drum (1), the liquid level of water in the container (7) is higher than the first air inlet (711) and lower than the second air inlet (712), and a first valve for controlling the flow direction of airflow is provided at a position, between the air outlet (102) of the drum (1) and the air inlets (71) of the container (7), on the air channel (2).
7. The clothes care apparatus according to claim 6, **characterized in that** a partition board (75) is also provided in the container (7), the partition board (75) is able to partition the container (7) into a filter chamber (78) and an air outlet chamber (79), the first air inlet (711) is located on the filter chamber (78) and communicated with the air inlet (51) of the condenser (5) via a first air outlet (721), the second air inlet (712) is located on the air outlet chamber (79) and communicated with the air inlet (51) of the condenser (5) via a second air outlet (722), and the position of the first air outlet (721) is higher than the liquid level of the water and lower than the position of the second air outlet (722).
8. The clothes care apparatus according to claim 3, **characterized in that** the container (7) comprises a housing (76) and a water storage drawer (77) detachably mounted within the housing (76), the housing (76) is provided with an opening, the water storage drawer (77) is able to be pulled out from or pushed into the housing (76) via the opening, a first seal ring (761) is provided between the opening and the water storage drawer (77), the air inlet (71) and air outlet (72) of the container (7) are both provided on the housing (76), a second seal ring (762) is provided at the air inlet (72) of the container (7), a joint (771) is provided at a position, opposite to the air inlet (71) of the container (7), on a sidewall of the water storage drawer (77), when the water storage drawer (77) is pushed into the housing (76), an outer end of the joint (771) is able to be adaptively inserted into the second seal ring (762), and the first seal ring (761) is able to seal a clearance between the water storage drawer (77) and the opening.
9. The clothes care apparatus according to claim 3, **characterized in that** the container (7) comprises a water inlet (73) and a water outlet (74), a water inlet valve used for controlling the water inlet (73) to be opened or closed is connected to the water inlet (73), the water inlet (73) is communicated with a water inlet pipe of a washing machine, a water drain valve used for controlling the water outlet (74) to be opened or closed is connected to the water outlet (74) of the container (7), and the water outlet (74) is communicated with a water drain pipe of the washing machine.
10. The clothes care apparatus according to claim 8, **characterized in that** an air inlet pipe (772) is con-

ected to an end, located in the water storage drawer (77), of the joint (771), an air outlet end of the air inlet pipe (772) extends into the water storage drawer (77) and is lower than the joint (771), and the liquid level of the water is lower than the air inlet (71) of the container (7) and higher than the air outlet end of the air inlet pipe (772).

- 5
11. The clothes care apparatus according to claim 3, **characterized in that** the air inlet (71) of the container (7) is communicated with the air outlet (102) of the drum (1), the air outlet (102) of the drum (1) is higher than the air inlet (71) of the container (7), and the liquid level of the water is higher than the air inlet (71) of the container (7) and lower than the air outlet (102) of the drum (1).
- 10
- 15
12. The clothes care apparatus according to claim 6, **characterized in that** the first air outlet (721) of the container (7) is connected with the air inlet (51) of the condenser (5) by means of a first flexible connecting pipe (801), the pipe diameter of an end, connected with the container (7), of the first flexible connecting pipe (801) being smaller than that of an end, connected with the condenser (5), of the first flexible connecting pipe (801); and the second air outlet (722) of the container (7) is connected with the air inlet (51) of the condenser (5) by means of a second flexible connecting pipe (802), the pipe diameter of an end, connected with the container (7), of the second flexible connecting pipe (802) being smaller than that of an end, connected with the condenser (5), of the second flexible connecting pipe (802).
- 20
- 25
- 30
13. A washing machine having a clothes care function, comprising the clothes care apparatus according to claim 3, a drum (1) comprising an inner cylinder and an outer cylinder, wherein a draught fan (4) draws air from the inner cylinder into an air channel (2) and guides the air into a container (7); and after being filtered by water, the air is fed into the inner cylinder via the air channel (2) to form a circulation.
- 35
- 40
14. A drying washing machine having a clothes care function, comprising the clothes care apparatus according to claim 3, a drum (1) comprising an inner cylinder and an outer cylinder, wherein a draught fan (4) draws air from the inner cylinder into an air channel (2) and guides the air into a container (7); and after being filtered by water, the air is fed into the inner cylinder via a condenser (5) and a heating apparatus (3) to form a circulation.
- 45
- 50
15. The drying washing machine having a clothes care function according to claim 14, **characterized in that** an air outlet (102) communicated with the air channel (2) is provided on a cylinder wall of the outer cylinder, an air inlet (71) of the container (7) is connected with
- 55

the air outlet (102) on the outer cylinder by means of a third flexible connecting pipe (6), an air outlet (72) of the container (7) is connected with an air inlet (51) of the condenser (5) by means of a fourth flexible connecting pipe (8), and the pipe diameter of an end, connected with the container (7), of the fourth flexible connecting pipe (8) is smaller than that of an end, connected with the condenser (5), of the fourth flexible connecting pipe (8).

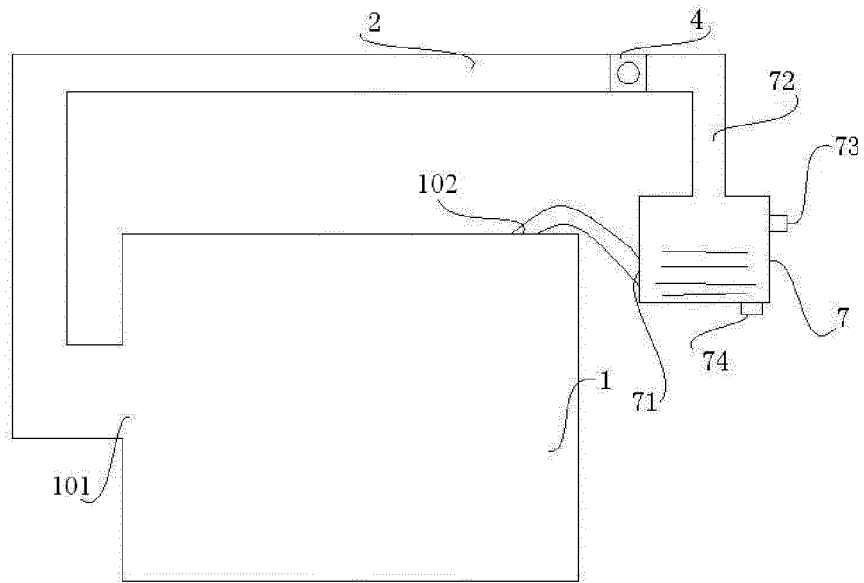


FIG. 1

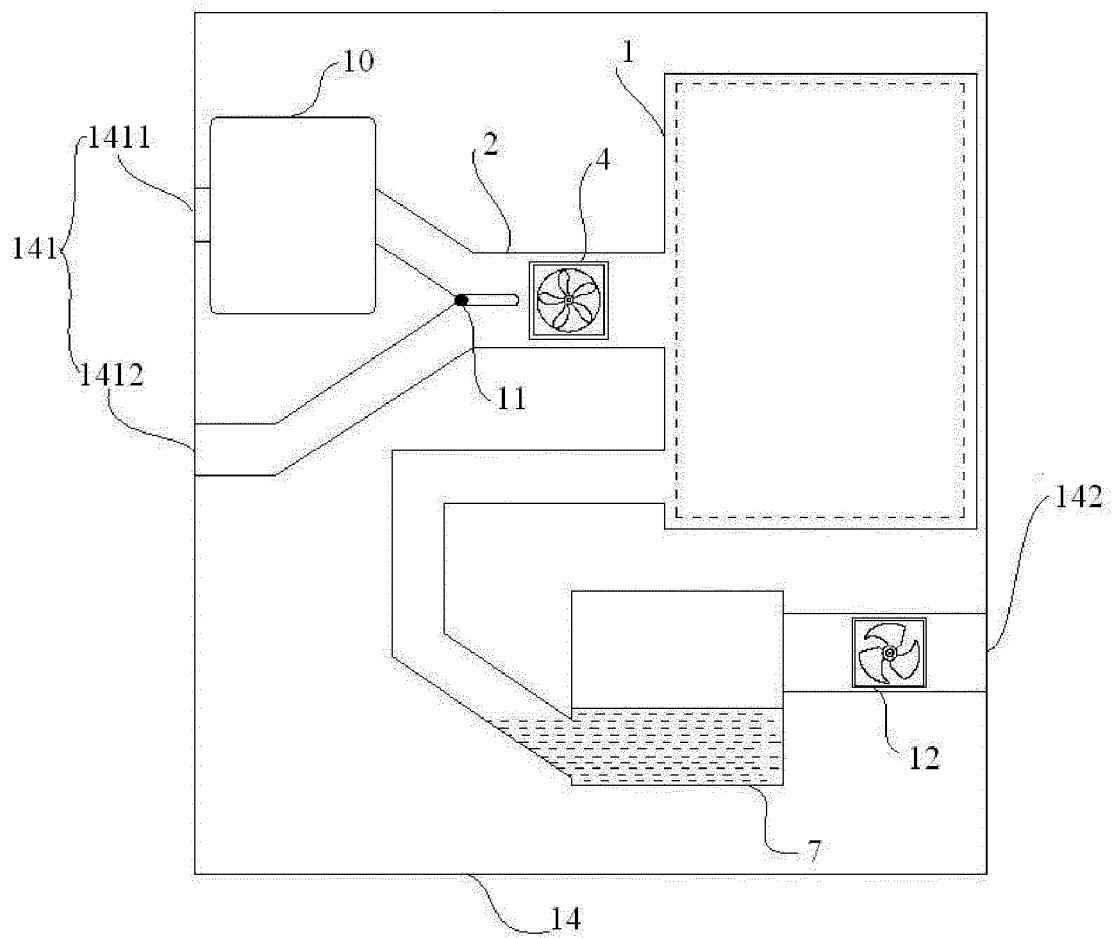


FIG. 2

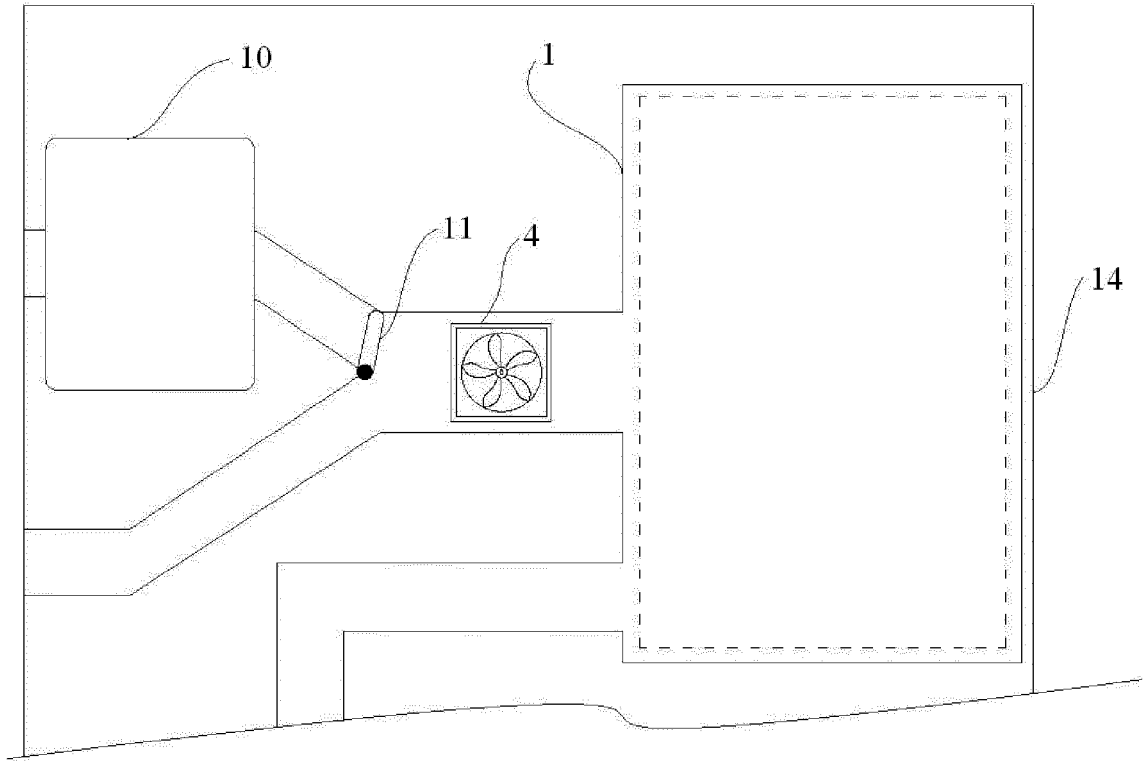


FIG. 3

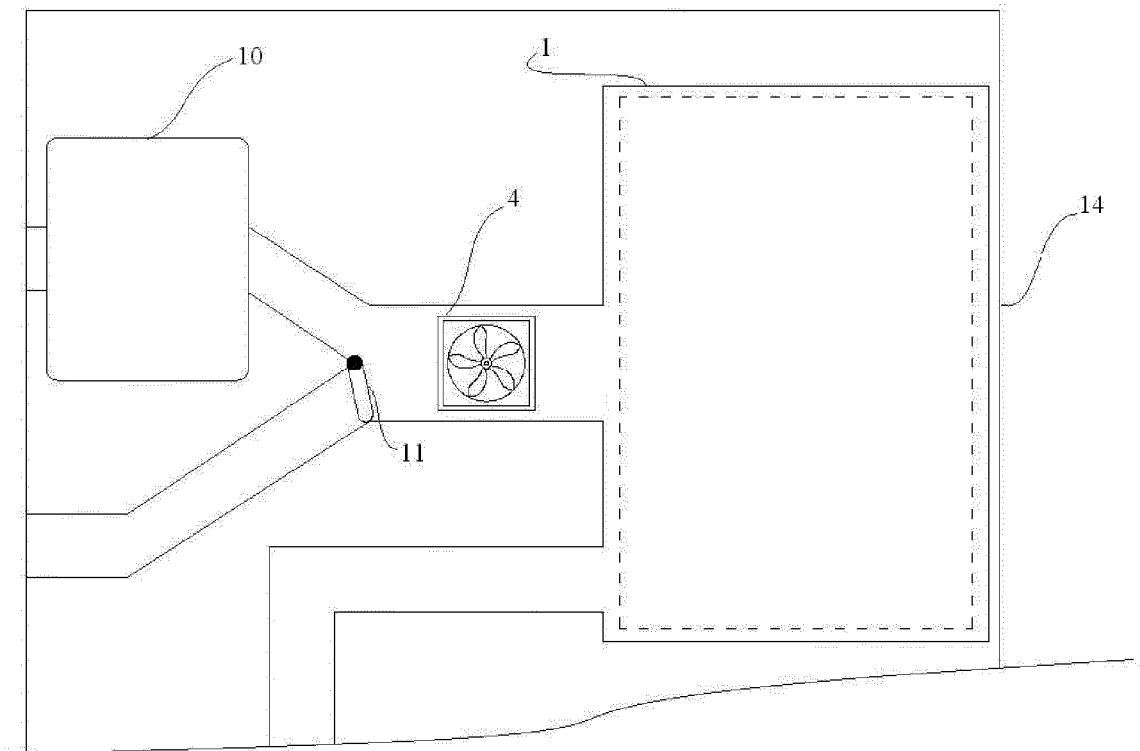


FIG. 4

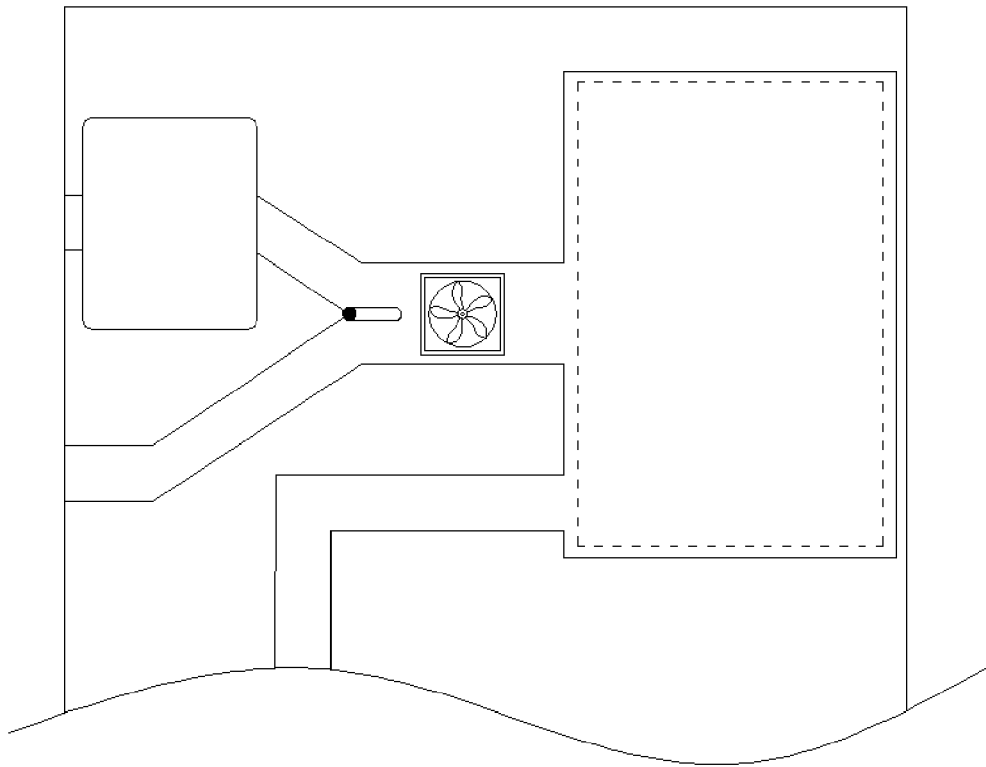


FIG. 5

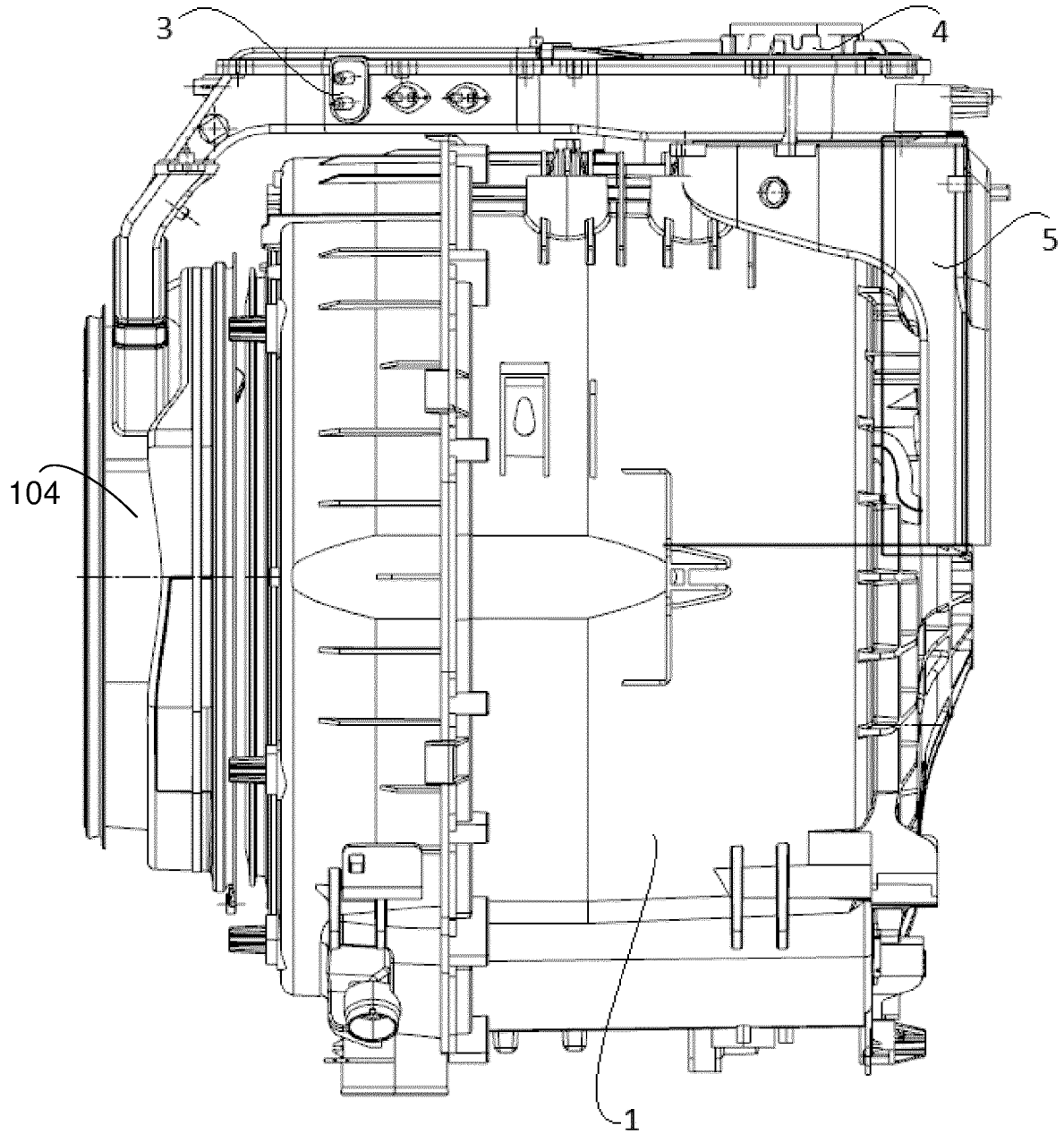


FIG. 6

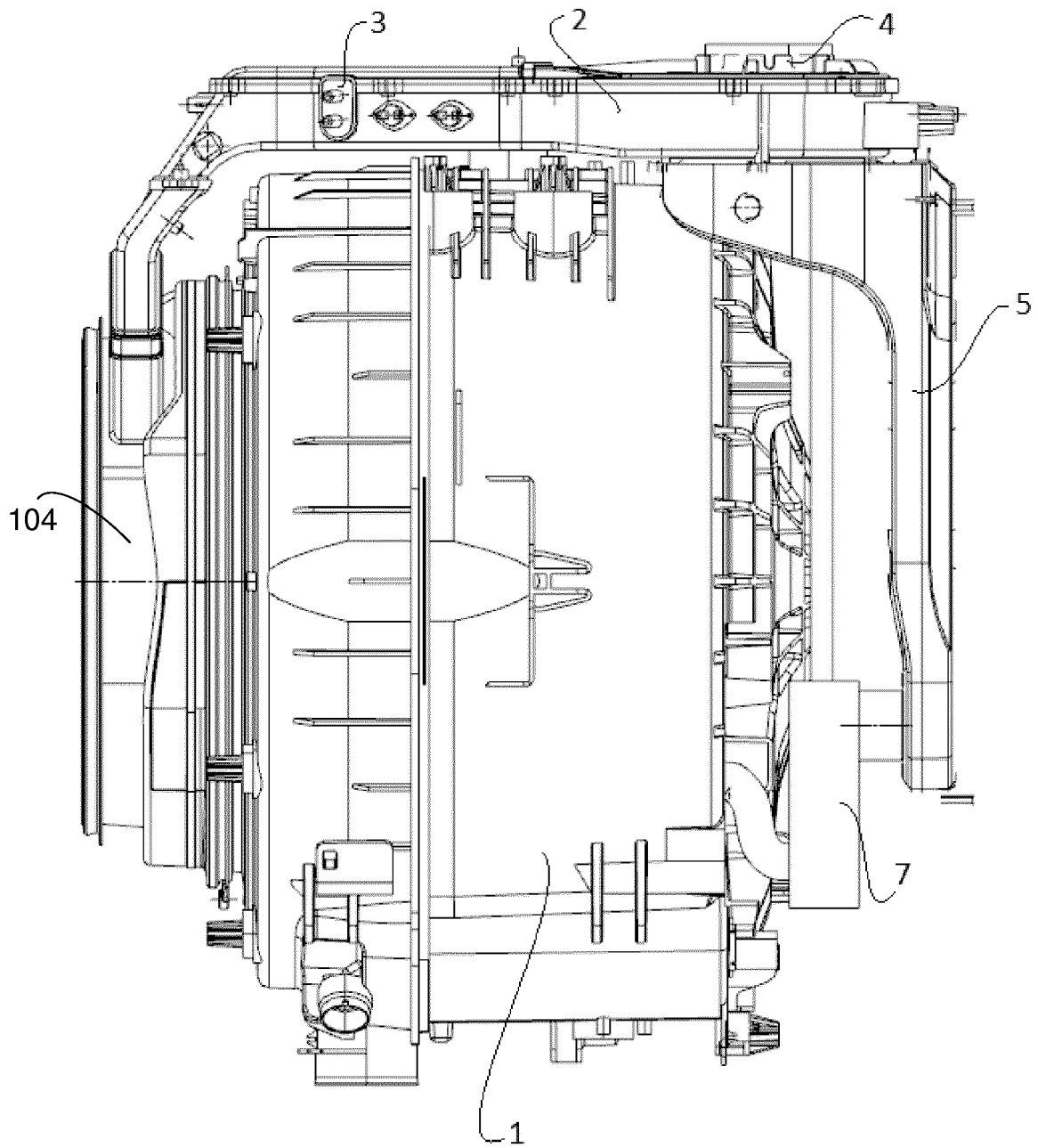


FIG. 7

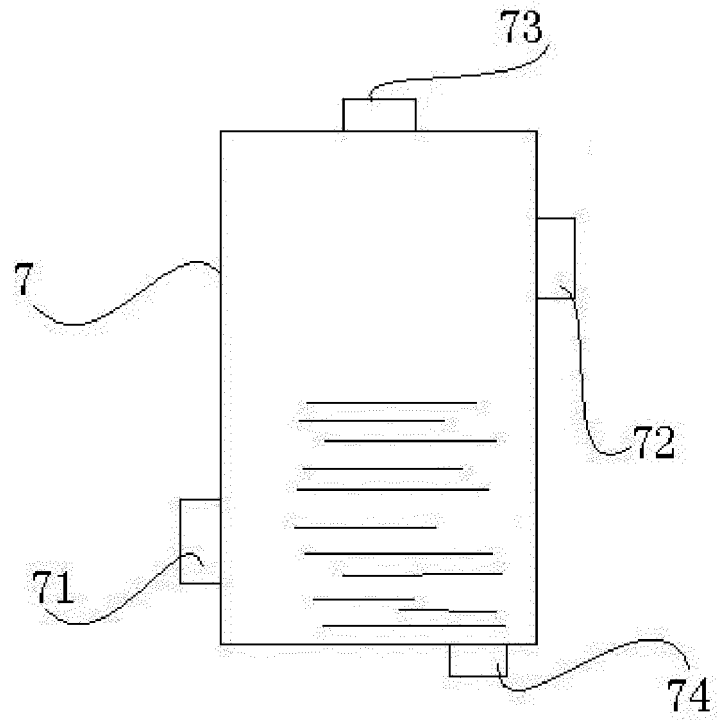


FIG. 8

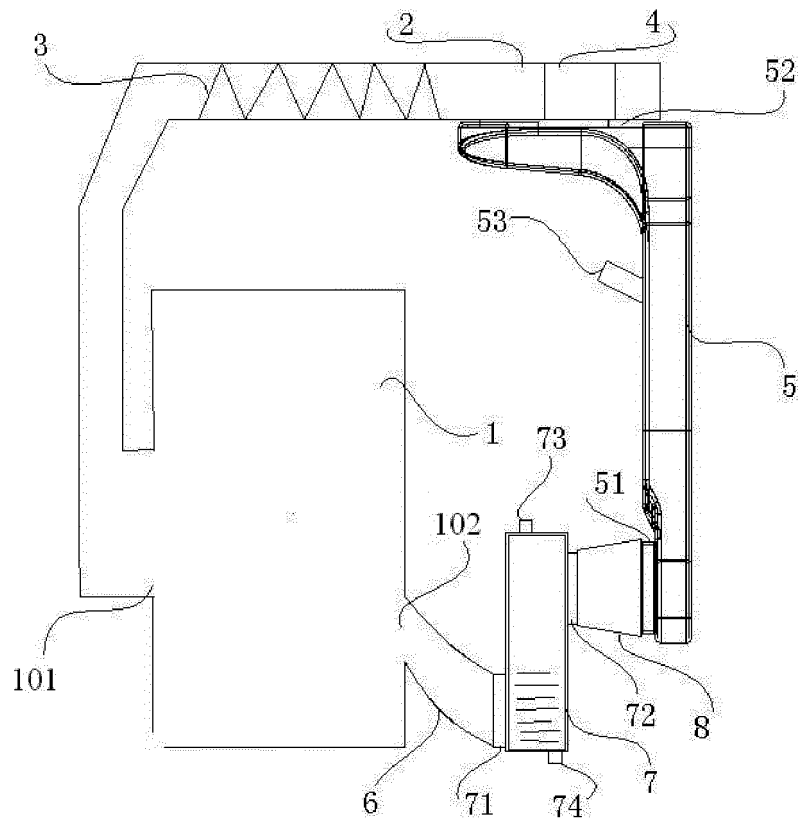


FIG. 9

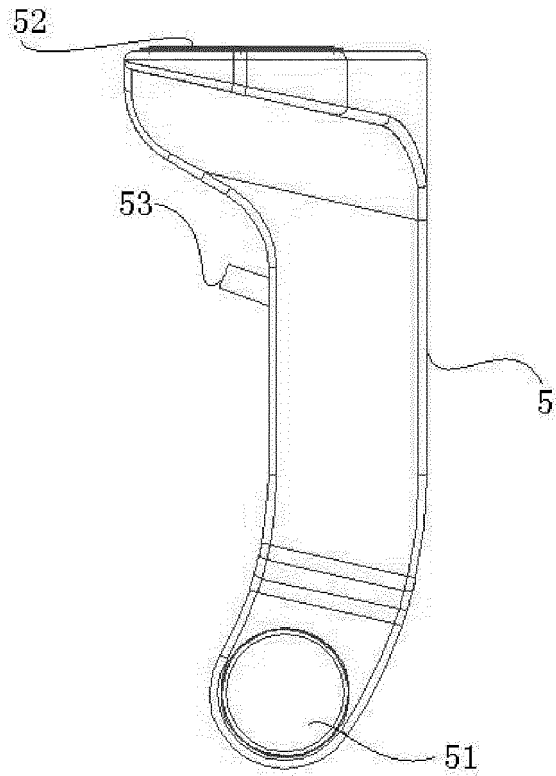


FIG. 10

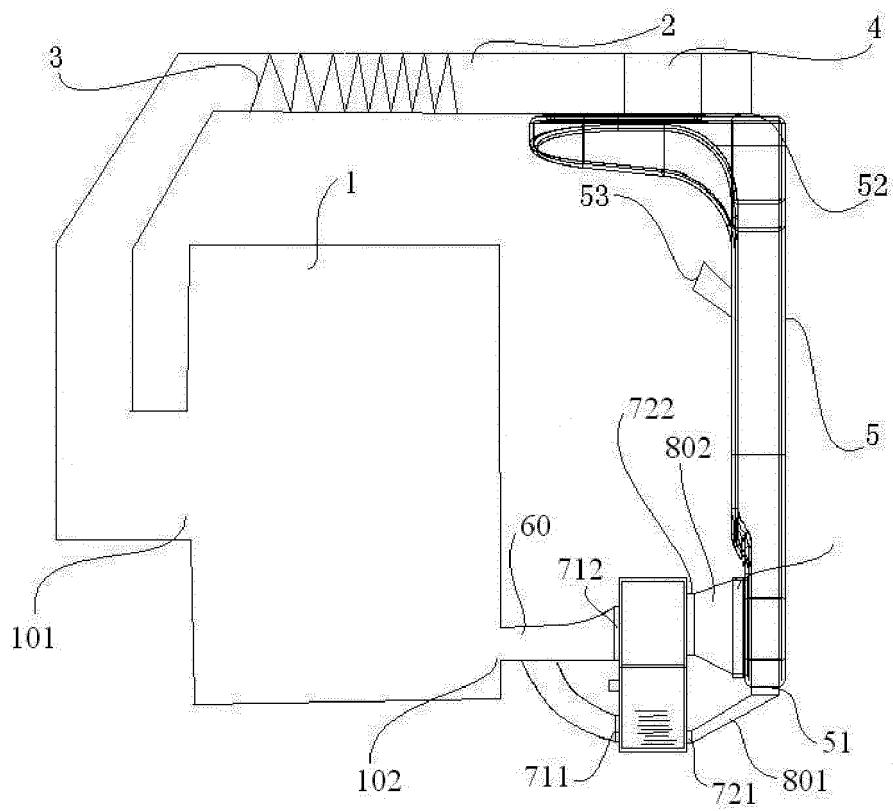


FIG. 11

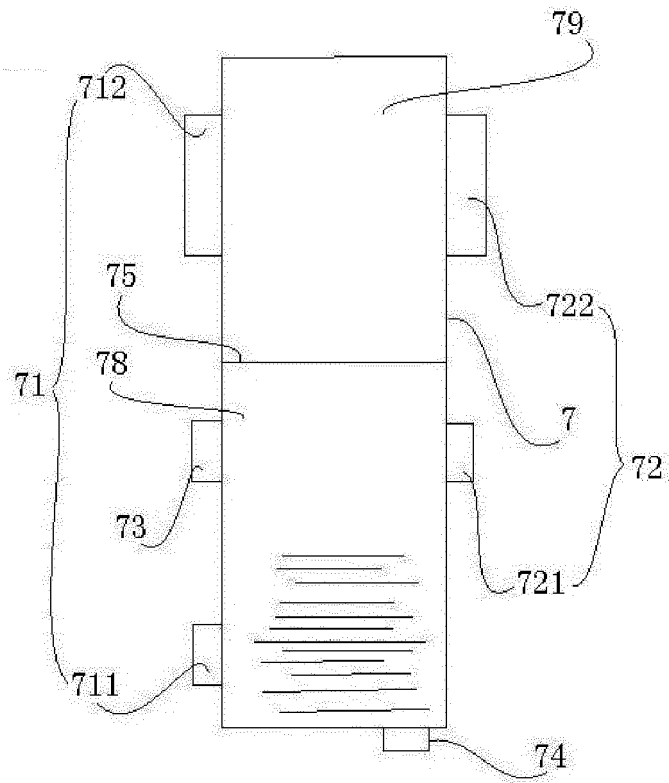


FIG. 12

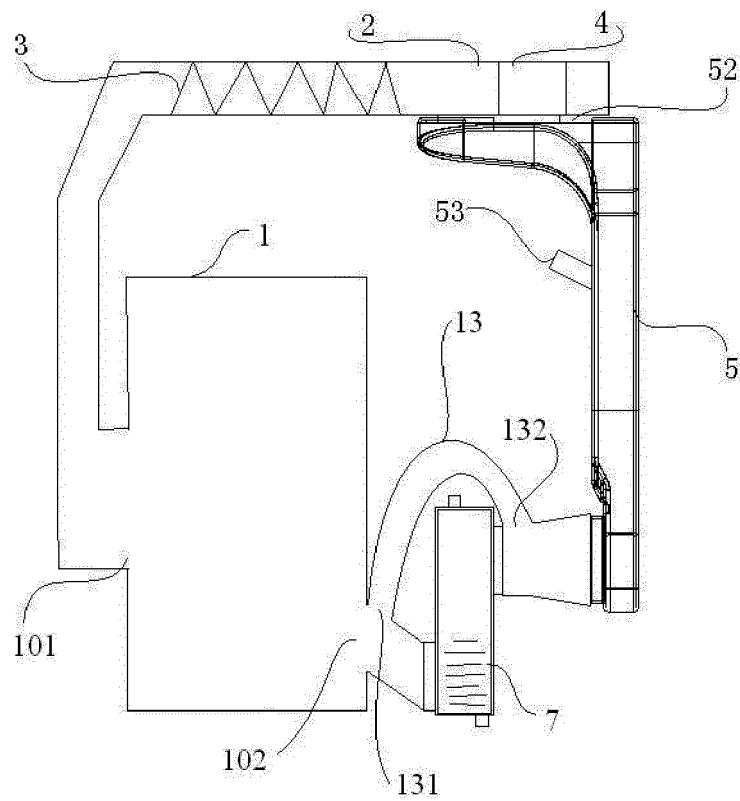


FIG. 13

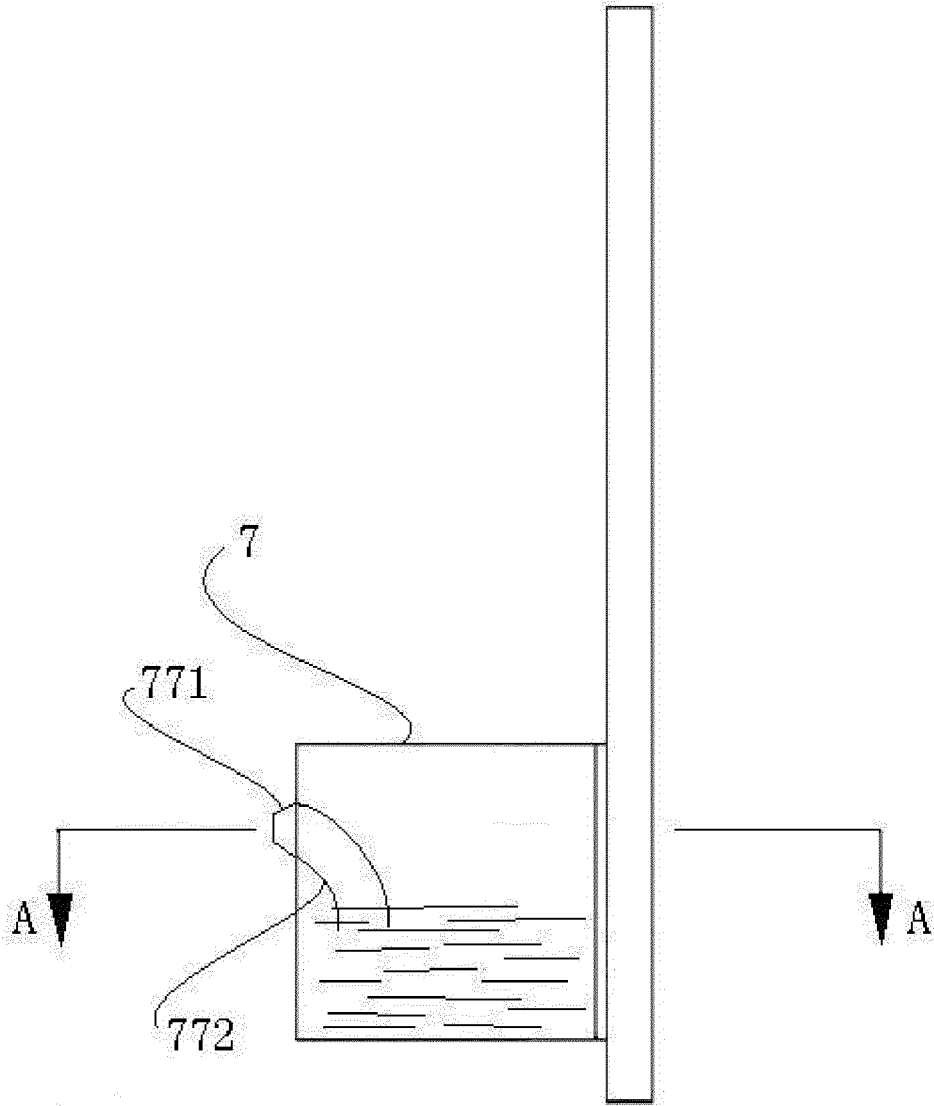


FIG. 14

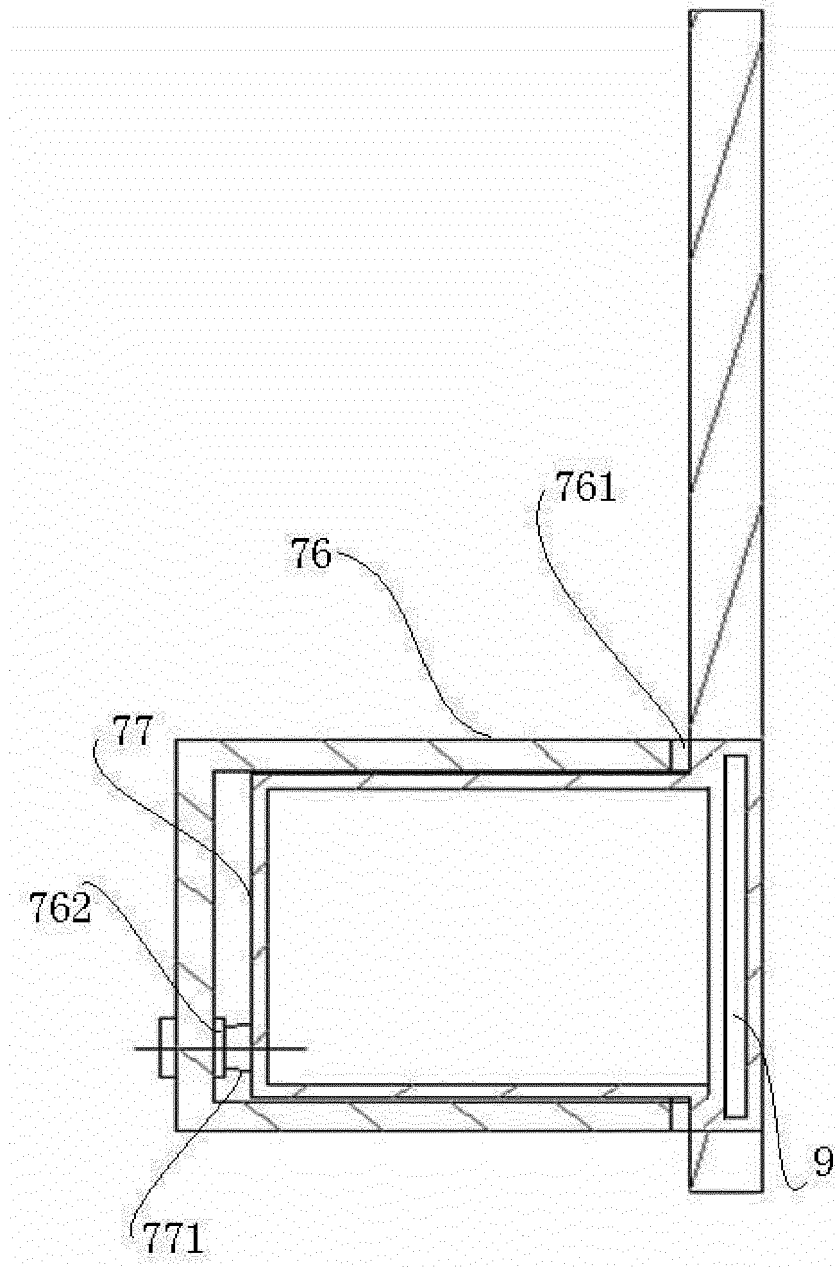


FIG. 15

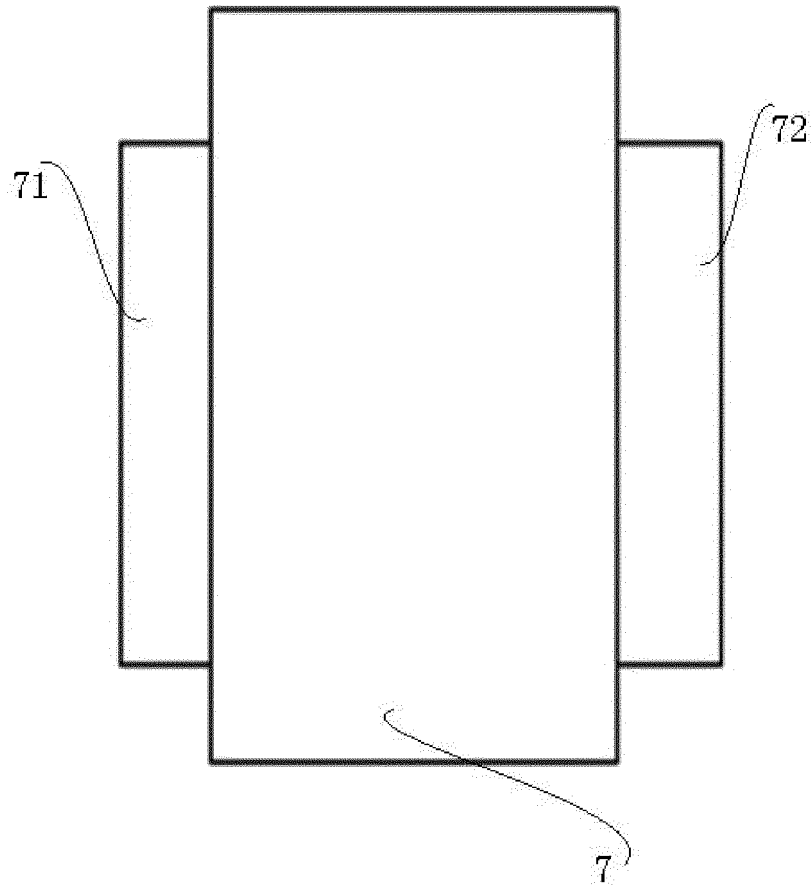


FIG. 16



EUROPEAN SEARCH REPORT

Application Number
EP 17 15 0087

5

10

15

20

25

30

35

40

45

50

55

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 A	US 5 146 693 A (DOTTOR GIAMBATTISTA [IT] ET AL) 15 September 1992 (1992-09-15) * column 3, line 34 - column 4, line 8 * * figures 1, 2 *	1-5, 13-15 6-12	INV. D06F58/22 ADD. D06F58/20 D06F25/00
X	EP 1 612 318 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 4 January 2006 (2006-01-04) * paragraph [0020] - paragraph [0032] * * paragraph [0038] - paragraph [0041] * * figures 1-4 *	1-5, 13-15	
X A	EP 2 386 674 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 16 November 2011 (2011-11-16) * abstract; figures 1-7 *	1 3	
X A	US 2 865 620 A (WOODLAND EDWARD F) 23 December 1958 (1958-12-23) * column 1, lines 15-49; figures 1, 2 *	1 8-11	
A	JP S60 129519 A (HITACHI SHIPBUILDING ENG CO) 10 July 1985 (1985-07-10) * figure 1 *	3	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 May 2017	Examiner Bermejo, Marco
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.02 (P04C01)

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

EP 17 15 0087

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-05-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5146693 A	15-09-1992	IT 221382 Z2 US 5146693 A	16-03-1994 15-09-1992
EP 1612318 A2	04-01-2006	CN 1715536 A EP 1612318 A2 JP 2006015118 A KR 20060002565 A US 2006000111 A1	04-01-2006 04-01-2006 19-01-2006 09-01-2006 05-01-2006
EP 2386674 A2	16-11-2011	CN 102242481 A EP 2386674 A2 KR 20110124505 A US 2011277513 A1	16-11-2011 16-11-2011 17-11-2011 17-11-2011
US 2865620 A	23-12-1958	NONE	
JP S60129519 A	10-07-1985	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 201610142616 [0001]
- CN 201610142580 [0001]
- CN 2016110142577 [0001]
- CN 201610142697 [0001]