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(54) **AIR CONDITIONER**

(57) An air conditioner, comprising: a housing (101) having an upper air outlet (11) and a lower air outlet (12), wherein the upper air outlet (11) has an air outlet capacity greater than that of the lower air outlet (12). The upper air outlet (11) is provided to have an air outlet capacity greater than that of the lower air outlet (12), such that during the heating, the air conditioner may realize an effect in which an air stream blown from the upper air outlet (11) suppresses an air stream blown at the lower air outlet (12), and can effectively enlarge a grounding area of hot air and enhance a blasting comfort of the air conditioner.

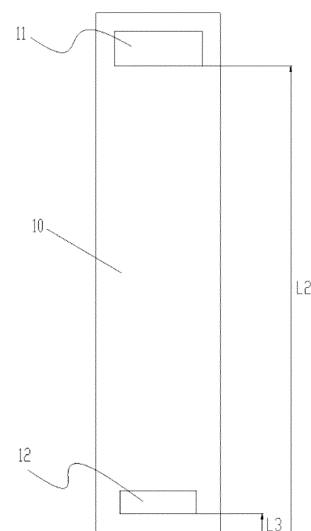


Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the technical field of an air conditioner device, and specifically an air conditioner.

BACKGROUND OF THE INVENTION

[0002] In the prior art, the blasting comfort of the air conditioner affects the user experience. However, the blasting manner of the air conditioner directly affects the indoor comfort. In order to resolve that the blasting manner of the air conditioner cannot satisfy the needs for reasonable airflow organization during the cooling/heating at the same time such that the indoor airflow organization conforms more to the requirements for the comfort of human body, it is a general practice in the prior art that the front air outlet is closed and the upper air outlet is opened for blasting during the cooling, and the upper air outlet is closed and the front air outlet is opened for blasting during the heating. Although the blasting manner may satisfy the cooling and heating requirements at the same time, there is still a problem that it is impossible to satisfy the personalized blasting requirements of the air conditioner, which causes a poor blasting comfort of the air conditioner and reduces the user experience.

SUMMARY OF THE INVENTION

[0003] The main object of the present invention is to provide an air conditioner to solve the problem of a poor blasting comfort of an air conditioner in the prior art.

[0004] In order to achieve the above-described object, according to one aspect of the present invention, an air conditioner is provided. The air conditioner includes: a housing having an upper air outlet and a lower air outlet, wherein the upper air outlet has an air outlet capacity greater than an air outlet capacity of the lower air outlet.

[0005] In some embodiments, the housing has an air inlet having an air inlet capacity φ , and the upper air outlet has an air outlet capacity φ_1 , wherein $53\%\varphi \leq \varphi_1 \leq 70\%\varphi$.

[0006] In some embodiments, the lower air outlet has an air outlet capacity φ_2 , wherein $30\%\varphi \leq \varphi_2 \leq 47\%\varphi$.

[0007] In some embodiments, the air inlet has a lower edge at a distance L_1 from ground, wherein $0.3m \leq L_1 \leq 0.5m$.

[0008] In some embodiments, the air inlet has a width W_1 , wherein $0.1m \leq W_1 \leq 0.4m$.

[0009] In some embodiments, the air conditioner further includes: a temperature sensing means connected to the housing, and configured to monitor an indoor temperature; and an opening-and-closing member disposed at the lower air outlet, and configured to close the lower air outlet when the indoor temperature monitored by the temperature sensing means reaches a preset value.

[0010] In some embodiments, the upper air outlet has

a lower edge at a distance L_2 from ground, wherein $1.6m \leq L_2 \leq 1.9m$, and/or the lower air outlet has a lower edge at a distance L_3 from the ground, wherein $0 < L_3 \leq 0.2m$.

[0011] In some embodiments, the upper air outlet and the lower air outlet are sequentially arranged along a vertical axis direction of the housing, and the upper air outlet and the lower air outlet are located on a same side of the housing, wherein the lower air outlet is symmetrically arranged with respect to an extension line of a geometric centerline of the upper air outlet extending along a vertical direction.

[0012] In some embodiments, the air conditioner has a cooling mode and a heating mode, wherein ADPI > 83% when the air conditioner is in the cooling mode or the heating mode.

[0013] In some embodiments, the housing has a circular, elliptical or quadrate cross-section.

[0014] By applying the technical solution of the present invention, the air conditioner includes a housing. The housing has an upper air outlet and a lower air outlet, wherein the upper air outlet has an air outlet capacity greater than that of the lower air outlet. The air outlet capacity of the upper air outlet is set to be greater than that of the lower air outlet, such that during the heating, the air conditioner may realize an effect in which an air stream blown from the upper air outlet suppresses an air stream blown from the lower air outlet, a floor covering area of hot air can be an effectively enlarged and a blasting comfort of the air conditioner can be enhanced.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0015] The accompanying drawings of the description that constitute a part of the present application, are used to provide a further understanding of the present invention. The illustrative embodiments of the present invention as well as the descriptions thereof, which are used for explaining the present invention, do not constitute improper definitions on the present invention. In the accompanying drawings:

Fig. 1 shows a schematic structural diagram in a first perspective view of a first embodiment of an air conditioner according to the present invention;

Fig. 2 shows a schematic structural diagram in a second perspective view of an embodiment of the air conditioner of Fig. 1;

Fig. 3 shows a schematic structural diagram in a third perspective view of an embodiment of the air conditioner of Fig. 1;

Fig. 4 shows a schematic diagram of a first blasting mode of the air conditioner when the air conditioner is operating indoor in Fig. 1;

Fig. 5 shows a schematic diagram of a second blasting mode of the air conditioner when the air conditioner is operating indoor in Fig. 1;

Fig. 6 shows a schematic diagram of a third blasting mode of the air conditioner when the air conditioner is operating indoor in Fig. 1;

Fig. 7 shows a schematic diagram of a fourth blasting mode of the air conditioner when the air conditioner is operating indoor in Fig. 1;

Fig. 8 shows a schematic structural diagram of a second embodiment of an air conditioner according to the present invention;

Fig. 9 shows a schematic structural diagram of a third embodiment of an air conditioner according to the present invention.

[0016] The above-described accompanying drawings include the following reference signs: 10. housing; 11. upper air outlet; 12. lower air outlet; 13. air inlet.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] It should be noted that, in the case without a conflict, the embodiments in the present application and the features in the embodiments may be combined with each other. The present invention will be described in detail below with reference to the drawings and in conjunction with the embodiments.

[0018] It is to be noted that the terms used here are only for the purpose of describing particular embodiments, and not intended to limit the exemplary embodiments according to the present application. As used here, the singular forms are also intended to include plural forms unless specified additionally in the context. In addition, it should also be understood that when the term "contains" and/or "includes" is used in the present specification, it is intended to indicate the presence of features, steps, operations, devices, assemblies, and/or combinations thereof.

[0019] It should be noted that the terms "first", "second" and the like in the specification and claims of the present application and the drawings are used to distinguish similar objects, and not necessarily used to describe a specific order or sequence. It is to be understood that the terms thus used are interchangeable as appropriate, such that the embodiments of the present application described here can be implemented, for example, in a sequence other than those illustrated or described here. In addition, the terms "include/comprise" and "have/has" as well as any of their deformations are intended to cover a nonexclusive inclusion. For example, the process, method, system, product, or device that contains a series of steps or units is not necessarily limited to those steps or units that are explicitly listed, but may include other steps or units that are not explicitly listed or that are inherent to such processes, methods, products or devices.

[0020] For ease of description, spatially relative terms such as "over", "above", "on an upper surface of", "upper", and the like, may be used here to describe the spatial positional relationship of one device or feature

shown in the drawings with other devices or features. It should be understood that, the spatially relative terms are intended to contain different orientations in use or operation in addition to the orientation of the device described in the drawings. For example, if the device in the drawings is inverted, the device described to be "above other devices or constructions" or "over other devices or constructions" will be positioned "below other devices or constructions" or "under other devices or constructions". Thus, the exemplary term "above" may include both orientations including "above" and "below". The device may also be positioned in other different manners (rotated 90 degrees or at other orientations), and the relative descriptions of the space used here are interpreted accordingly.

[0021] Exemplary embodiments according to the present application will now be described in more detail with reference to the accompanying drawings. However, these exemplary embodiments may be embodied in multiple different forms and should not be construed as being limited to only the embodiments set forth here. It is to be understood that these embodiments are provided so that the disclosure of the present application will be thorough and complete, and the concept of these exemplary embodiments will be fully conveyed to those skilled in the art. In the accompanying drawings, for the sake of clarity, it is possible to enlarge the thickness of layers and areas and use the same reference sign to present the same component, so that the description thereof will be omitted.

[0022] In conjunction with Figs. 1 to 9, according to an embodiment of the present invention, an air conditioner is provided.

[0023] Specifically, as shown in Fig. 1, the air conditioner includes a housing 10. The housing 101 has an upper air outlet 11 and a lower air outlet 12, wherein the upper air outlet 11 has an air outlet capacity greater than an air outlet capacity of the lower air outlet 12.

[0024] In the present embodiment, the air outlet capacity of the upper air outlet is set to be greater than that of the lower air outlet, such that during the heating, the air conditioner may realize an effect in which an air stream blown from the upper air outlet suppresses an air stream blown from the lower air outlet, a floor covering area of hot air can be an effectively enlarged and a blasting comfort of the air conditioner can be enhanced.

[0025] Further, the housing 10 further has an air inlet 13 having an air inlet capacity φ , and the upper air outlet 11 has an air outlet capacity φ_1 , wherein $53\% \varphi \leq \varphi_1 \leq 70\% \varphi$. This arrangement can effectively improve the blasting comfort of the upper air outlet 11 of the air conditioner and enhance the user's operational experience.

[0026] Preferably, the lower air outlet 12 has an air outlet capacity φ_2 , wherein $30\% \varphi \leq \varphi_2 \leq 47\% \varphi$. This arrangement can effectively improve the blasting comfort of the lower air outlet 12. In the present embodiment, $\varphi_1 + \varphi_2 = \varphi$. This arrangement can effectively improve the

heating performance of the air conditioner.

[0027] As shown in Fig. 2, the air inlet 13 has a lower edge at a distance $L1$ from ground, wherein $0.3m \leq L1 \leq 0.5m$. The air inlet 13 has a width $W1$, wherein $0.1m \leq W1 \leq 0.4m$. This arrangement can effectively improve the air intake efficiency of an entirety of the air conditioner.

[0028] In order to further improve the blasting comfort of the air conditioner, the air conditioner further includes a temperature sensing means and an opening-and-closing member. The temperature sensing means is connected to the housing 10, wherein the temperature sensing means is configured to monitor an indoor temperature. The opening-and-closing member is disposed at the lower air outlet 12, and configured to close the lower air outlet 12 when the indoor temperature monitored by the temperature sensing means reaches a preset value.

[0029] As shown in Fig. 1, the upper air outlet 11 has a lower edge at a distance $L2$ from ground, wherein $1.6m \leq L2 \leq 1.9m$. The lower air outlet 12 has a lower edge at a distance $L3$ from the ground, wherein $0 < L3 \leq 0.2m$. This arrangement can effectively control an air outlet capacity of the upper air outlet 11 and the lower air outlet 12. The air blown by the air conditioner is more comfortable by changing the distance between the air inlet of the air conditioner and the ground, and/or between the air outlet of the air conditioner and the ground.

[0030] In order to further improve the blasting comfort of the air conditioner, the upper air outlet 11 and the lower air outlet 12 are sequentially arranged along a vertical axis direction of the housing 10, and the upper air outlet 11 and the lower air outlet 12 are located on the same side of the housing 10. The lower air outlet 12 is symmetrically arranged with respect to an extension line of a geometric centerline of the upper air outlet 11 extending along a vertical direction. The arrangement enables that the air stream blown from the upper air outlet 11 and the air stream blown from the lower air outlet 12 mix with each other to effectively avoid laminarity of the indoor streams, and effectively improve the comfort of the air conditioner during cooling and heating.

[0031] Further, in the present embodiment, the air conditioner has a cooling mode and a heating mode, wherein $ADPI > 83\%$ when the air conditioner is in the cooling mode or the heating mode. Specifically, as shown in Figs. 3, 8 and 9, the housing 10 may have a circular, elliptical or quadrate cross-section. The quadrate may be square or rectangular.

[0032] Specifically, the air conditioner is used to effectively solve the problem of poor heating comfort and indoor thermal stratification of the current household air conditioners and solves the problem that the current household air conditioners are difficult to take into consideration the refrigeration and the heating comfort at the same time. The air conditioner of this structure is used to significantly shorten the processing time for the indoor air to meet the comfort requirements and save the operational cost. The power consumption may be saved by

48% as compared to the conventional household air conditioners, the air conditioner can quickly achieve thermal balance.

[0033] The heights of the upper and lower air outlets relative to the ground and the distance between the air outlets are both optimally designed, so that the airflow organization within the room is reasonable and efficient. At the same time, the optimal design of air capacity ratio of the upper air outlet and lower air outlet is used, to achieve an airflow control effect by configuring different air capacity proportions of the upper air outlet and the lower air outlet. During the heating, it is possible to implement that the upper air outlet suppresses the air stream of the lower air outlet, thereby increasing the floor covering area of hot air and significantly enhancing the heating comfort. During the cooling, the upper and lower air outlets perform blasting at the same time, and after the indoor temperature reaches a preset temperature rapidly, it is allowable to change to separately blast from the upper air outlet, thereby avoiding a blasting feeling to be produced.

[0034] By optimizing the design of the size of the air inlet, the airflow organization and circulation efficiency is ensured while the windward area of the heat exchanger is satisfied.

[0035] As shown in Figs. 1 to 3, in a top view, the housing of the air conditioner has a circular cross-section with a diameter $D1$. The housing has two air outlets and one air inlet, which are an upper air outlet, a lower air outlet, and an air inlet respectively, and all symmetrical with respect to a centerline of the housing. Under the heating condition, the blasting manner of the air conditioner is as shown in Fig. 4. The upper air outlet and the lower air outlet perform blasting at the same time, and the air capacity of the upper air outlet has a proportion $\varphi1$ (that is, the percentage of the air outlet capacity of the upper air outlet relative to the air inlet capacity of the air inlet), and the air capacity of the lower air outlet has a proportion $\varphi2$, wherein $\varphi1 > \varphi2$. The lower air outlet is disposed proximate to the ground. Due to the viscosity of the air, the produced air stream is conveyed close to the ground to realize a carpet-type blasting. The air stream produced by the upper air outlet performs downward suppression to increase a movement distance of the air stream on the ground, such that there is a greater blasting area during the heating, thereby avoiding a thermal stratification phenomenon in a room, and significantly improving the heating comfort. Under the cooling condition, the blasting mode at an extremity is as shown in Figs. 5 and 6. The air capacity of the upper air outlet has a proportion $\varphi1$, and the air capacity of the lower air outlet has a proportion $\varphi2$, wherein $\varphi1 > \varphi2$. In order to rapidly reach a set temperature and avoid a blasting feeling to be produced, the upper air outlet blasts obliquely upwards, such that cold air which has a large density falls slowly from up to down, to effectuate a shower-type blasting. The lower air outlet performs blasting close to the ground, to effectuate rapid temperature reduction in a near-ground area. When the

temperature in a room is close to a set temperature, the lower air outlet is closed, such that only a shower-type blasting manner is used, to ensure the indoor comfort. In addition to the above-described blasting manner, personalized blasting may also be performed at the extremity according to the needs of human body. As shown in Fig. 7, the upper air outlet may swing longitudinally within a certain angle β , and the upper air outlet and the lower air outlet may swing right and left within a certain angle, to satisfy different blasting requirements.

[0036] By using the air conditioner of the present application, it is possible to ensure reasonable and comfortable airflow organization, and the indoor Air Diffusion Performance Indices (ADPIs) can reach more than 83% under both the cooling and heating conditions. The definition of ADPI is as follows:

[0037] ADPI is an airflow organization assessment standard recommended by AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE), in which by considering a temperature and speed of each measurement point, it is considered that when an effective draft temperature (EDT) of a certain point satisfies the range between -1.7 and 1.1 °C, a majority of people feel comfortable. The percentage occupied by such points in all the measurement points is an ADPI value. When $ADPI \geq 80\%$, the airflow organization within the air-conditioned area may be considered satisfactory. The calculation formula is as follows:

$$\Delta ET = (t_i - t_n) - 7.66(u_i - 0.15);$$

$ADPI = (-1.7 < \Delta ET < 1.1) / \text{total number of measurement points} \times 100\%$.

[0038] In the formula, ΔET is an effective blasting temperature, t_i is a temperature of a certain point in a working area with a unit of °C, t_n is a given indoor average temperature with a unit of °C, and u_i is an air flow rate at a certain point in a working area with a unit of m/s. The ADPI value comprehensively reflects an impact by an airflow organization in the air-conditioned area. The higher the ADPI value is, the more people feel satisfactory with the environment among the people who stay within the air-conditioned area. When $ADPI \geq 80\%$, it may be considered that the airflow organization blown by the air conditioner is satisfactory.

[0039] In addition to the above-described, it should also be noted that "one embodiment", "another embodiment", "an embodiment" and the like referred to in the present specification mean that specific features, structures or characteristics described in conjunction with the embodiment are included in at least one embodiment generally described in the present application. The same definition appearing in multiple places in the specification does not necessarily refer to the same embodiment. Furthermore, when a specific feature, structure, or characteristic is described in conjunction with any embodiment,

it is claimed that the implementations of such feature, structure, or characteristic in conjunction with other embodiments are also included in the scope of the present invention.

[0040] In the above-described embodiments, the focus of the descriptions of the various embodiments are different, and for the parts that are not described in detail in a certain embodiment, it is possible to refer to the related descriptions of other embodiments.

[0041] The foregoing descriptions are only preferred embodiments of the present invention, but do not serve to limit the present invention. For those skilled in the art, various modifications and changes may be made in the present invention. Any amendment, equivalent replacement, improvement, and the like made within the spirit and principles of the present invention should all be contained within the protection scope of the present invention.

Claims

1. An air conditioner, comprising: a housing (10) having an upper air outlet (11) and a lower air outlet (12), wherein the upper air outlet (11) has an air outlet capacity greater than an air outlet capacity of the lower air outlet (12).
2. The air conditioner according to claim 1, wherein the housing (10) has an air inlet (13) having an air inlet capacity ϕ , and the upper air outlet (11) has an air outlet capacity ϕ_1 , wherein $53\% \phi \leq \phi_1 \leq 70\% \phi$.
3. The air conditioner according to claim 2, wherein the lower air outlet (12) has an air outlet capacity ϕ_2 , wherein $30\% \phi \leq \phi_2 \leq 47\% \phi$.
4. The air conditioner according to claim 2, wherein the air inlet (13) has a lower edge at a distance L_1 from ground, wherein $0.3m \leq L_1 \leq 0.5m$.
5. The air conditioner according to claim 2, wherein the air inlet (13) has a width W_1 , wherein $0.1m \leq W_1 \leq 0.4m$.
6. The air conditioner according to claim 2, further comprising:
 - a temperature sensing means connected to the housing (10), and configured to monitor an indoor temperature; and
 - an opening-and-closing member disposed at the lower air outlet (12), and configured to close the lower air outlet (12) when the indoor temperature monitored by the temperature sensing means reaches a preset value.
7. The air conditioner according to claim 1, wherein the

upper air outlet (11) has a lower edge at a distance L_2 from ground, wherein $1.6\text{m} \leq L_2 \leq 1.9\text{m}$, and/or the lower air outlet (12) has a lower edge at a distance L_3 from the ground, wherein $0 < L_3 \leq 0.2\text{m}$.

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8. The air conditioner according to claim 1, wherein the upper air outlet (11) and the lower air outlet (12) are sequentially arranged along a vertical axis direction of the housing (10), and the upper air outlet (11) and the lower air outlet (12) are located on a same side of the housing (10), wherein the lower air outlet (12) is symmetrically arranged with respect to an extension line of a geometric centerline of the upper air outlet (11) extending along a vertical direction.

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9. The air conditioner according to claim 1, wherein the air conditioner having a cooling mode and a heating mode, wherein $\text{ADPI} > 83\%$ when the air conditioner is in the cooling mode or the heating mode.

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10. The air conditioner according to claim 1, wherein the housing (10) has a circular, elliptical or quadrate cross-section.

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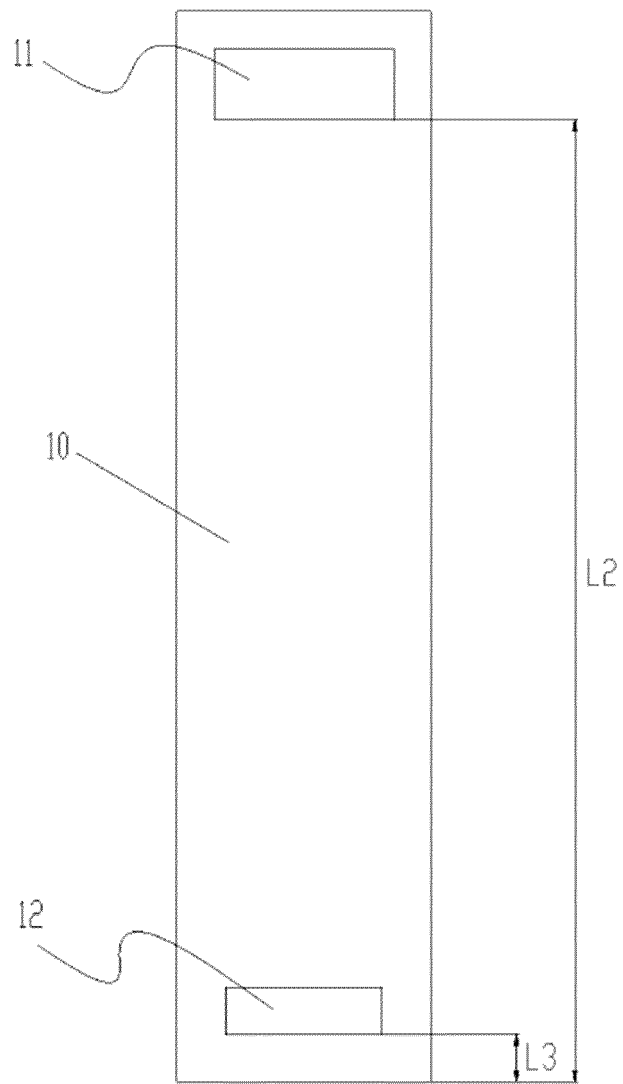


Fig. 1

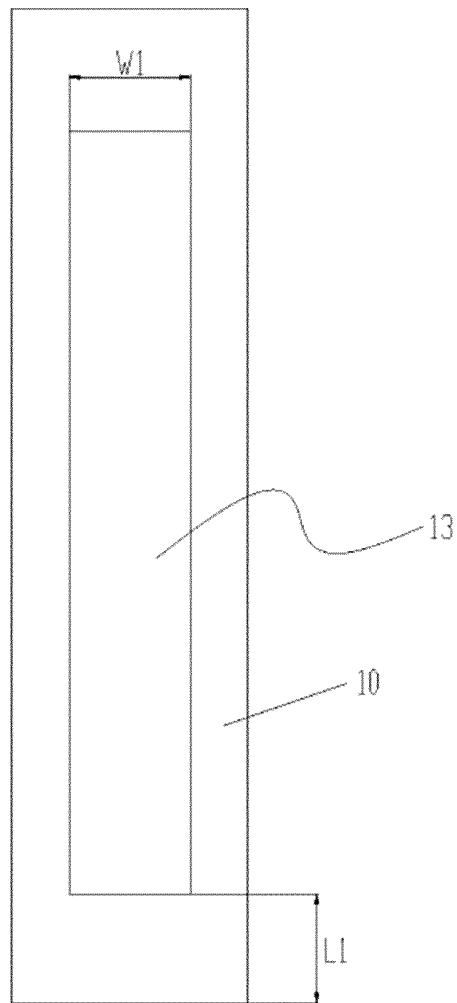


Fig. 2

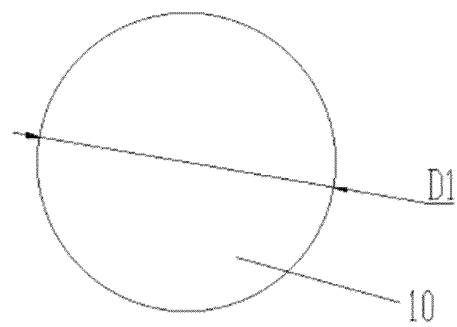


Fig. 3

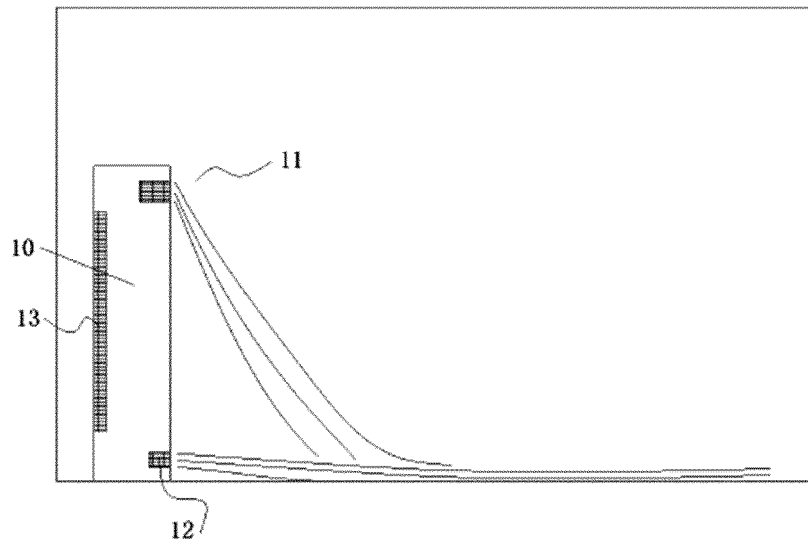


Fig. 4

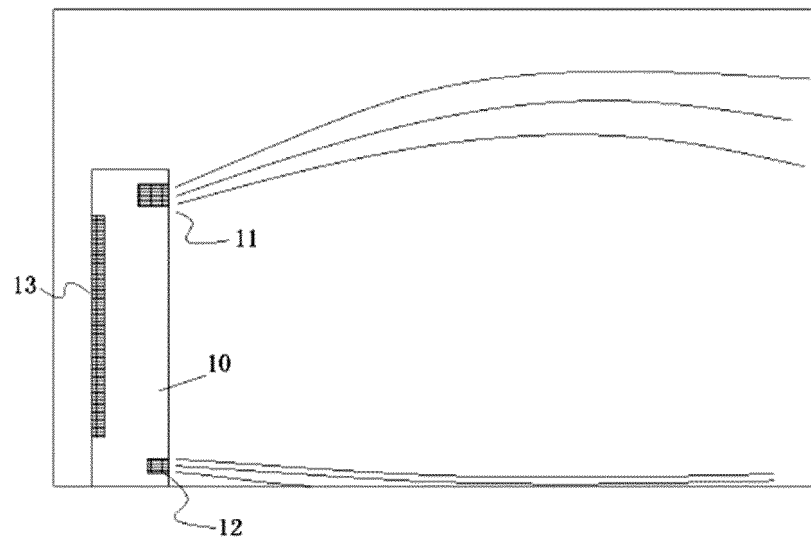


Fig. 5

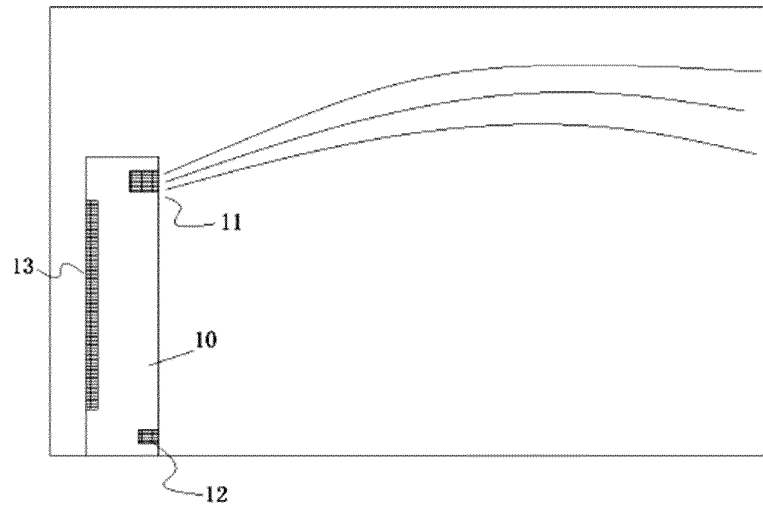


Fig. 6

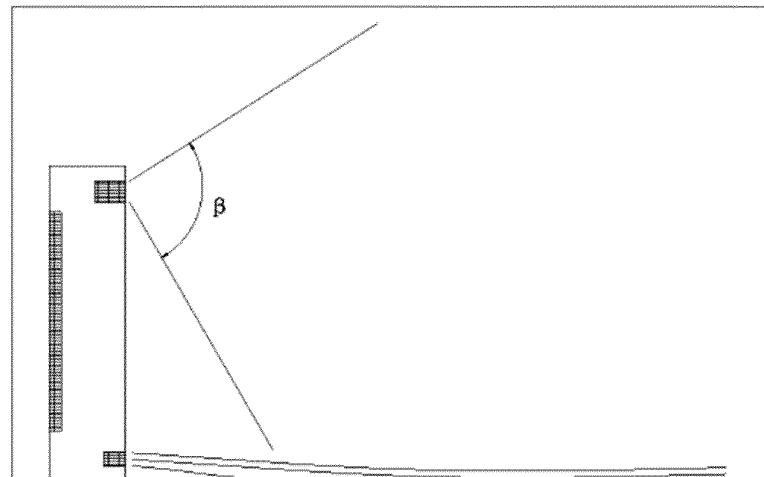


Fig. 7

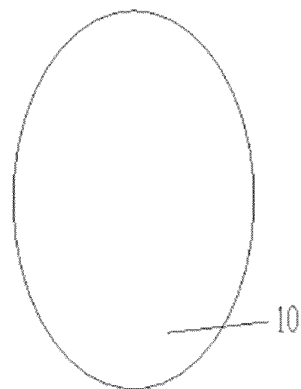


Fig. 8

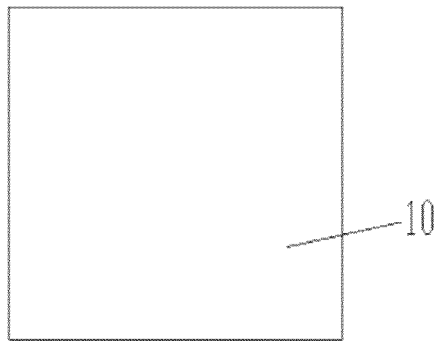


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/117909

A. CLASSIFICATION OF SUBJECT MATTER

F24F 1/00 (2011.01) i; F24F 13/06 (2006.01) i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F 1, F24F 13

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, SIPOABS, CNKI, CNTXT, VEN: 空调, 空气调节, 空气调和, 上出风口, 下出风口, 上风口, 下风口, 上送风口, 下送风口, 上出口, 下出口, 主风口, 辅助风口, 副风口, 第一风口, 第二风口, 多出风口, 多送风口, 风量, air condition+, upper air outlet+, lower air outlet+, main air outlet, first air outlet, auxiliary air outlet, supplementary air outlet, second air outlet, air quantity, air volume

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 201748598 U (UNIVERSITY OF SHANGHAI FOR SCIENCE AND TECHNOLOGY) 16 February 2011 (16.02.2011), description, paragraphs [0016]-[0020], and figures 1-4	1-10
X	CN 205316480 U (CHINA YANGZI GROUP CHUZHOU YANGZI AIR CONDITIONER CO., LTD.) 15 June 2016 (15.06.2016), description, paragraphs [0030]-[0043], and figure 5	1-10
X	CN 105465892 A (CHINA YANGZI GROUP CHUZHOU YANGZI AIR CONDITIONER CO., LTD.) 06 April 2016 (06.04.2016), description, paragraphs [0030]-[0042], and figure 5	1-10
X	CN 205261758 U (CHINA YANGZI GROUP CHUZHOU YANGZI AIR CONDITIONER CO., LTD.) 25 May 2016 (25.05.2016), description, paragraphs [0030]-[0042], and figure 5	1-10

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search 22 February 2018	Date of mailing of the international search report 27 March 2018
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer YANG, Xiuhua Telephone No. (86-10) 62084899

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/117909

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2008261555 A (MATSUSHITA DENKI SANGYO K.K.) 30 October 2008 (30.10.2008), entire document	1-10
A	JP H04273921 A (TOSHIBA CORP.) 30 September 1992 (30.09.1992), entire document	1-10
A	JP H04347426 A (SANYO ELECTRIC CO.) 02 December 1992 (02.12.1992), entire document	1-10

Form PCT/ISA /210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/117909

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 201748598 U	16 February 2011	None	
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