



(11)

EP 4 495 495 A1

(12)

EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:

22.01.2025 Bulletin 2025/04

(21) Application number: **23769939.2**

(22) Date of filing: **13.04.2023**

(51) International Patent Classification (IPC):

F24F 11/36 ^(2018.01) **F24F 1/0011** ^(2019.01)
F24F 1/0047 ^(2019.01) **F24F 11/65** ^(2018.01)
F24F 11/74 ^(2018.01) **F24F 13/06** ^(2006.01)
F24F 13/20 ^(2006.01) **F24F 13/32** ^(2006.01)
F24F 11/61 ^(2018.01) **F24F 11/79** ^(2018.01)

(52) Cooperative Patent Classification (CPC):

F24F 1/0011; F24F 1/0047; F24F 11/36;
F24F 11/61; F24F 11/79; F24F 13/06; F24F 13/32;
F24F 2110/65; F24F 2110/74; F24F 2130/20

(86) International application number:

PCT/CN2023/088105

(87) International publication number:

WO 2023/174437 (21.09.2023 Gazette 2023/38)

(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 ME MK MT NL
NO PL PT RO RS SE SI SK SM TR

Designated Extension States:

BA

Designated Validation States:

KH MA MD TN

(30) Priority: **16.03.2022 CN 202210260142**

13.04.2022 CN 202210384810

04.07.2022 CN 202210777040

04.07.2022 CN 202210777060

04.07.2022 CN 202210777067

04.07.2022 CN 202210777069

04.07.2022 CN 202210777084

04.07.2022 CN 202210777107

04.07.2022 CN 202210777108

30.08.2022 CN 202211048419

(71) Applicant: **Gree Electric Appliances, Inc. of**

Zhuhai

Zhuhai, Guangdong 519070 (CN)

(72) Inventors:

- **DONG, Mingzhu**
Zhuhai, Guangdong 519070 (CN)
- **DU, Hui**
Zhuhai, Guangdong 519070 (CN)
- **LIU, Hua**
Zhuhai, Guangdong 519070 (CN)
- **LI, Ziqi**
Zhuhai, Guangdong 519070 (CN)
- **LI, Jinqiu**
Zhuhai, Guangdong 519070 (CN)

(74) Representative: **Reddie & Grose LLP**

The White Chapel Building
10 Whitechapel High Street
London E1 8QS (GB)

Remarks:

The filing date of the international application is within two months from the date of expiration of the priority period (R. 26bis.3 PCT).

(54) **CEILING RECESSED FAN AND CONTROL METHOD AND CONTROL APPARATUS THEREOF, AND RECESSED AIR CONDITIONER**

(57) Disclosed are a ceiling recessed fan, a control method and control apparatus thereof, and a recessed air conditioner, wherein the ceiling recessed fan includes a main body frame and an air outlet assembly. An air outlet duct is disposed in the main body frame, the air outlet duct having a first end and a second end along the airflow direction of the air outlet duct; the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered. The ceiling recessed fan pro-

vided in the embodiments of the present disclosure, when in a cooling mode, limits the ratio of the height of an air outlet to the width of the first end of the air outlet duct; that is, design standards are defined for the ceiling recessed fan so as to balance the attenuation of the air supply distance and the air output volume of the ceiling recessed fan, such that the produced air output effect of the ceiling recessed fan satisfies requirements when in a cooling mode; furthermore, because an air deflector may

EP 4 495 495 A1

adjust the height of the air outlet, by limiting the ratio range of a minimum value of the air outlet to the width of the first end of the air outlet duct so as to limit the dimensions and rotational angle of the air deflector, in the end, the produced air output effect of the ceiling recessed fan reaches a preset level.

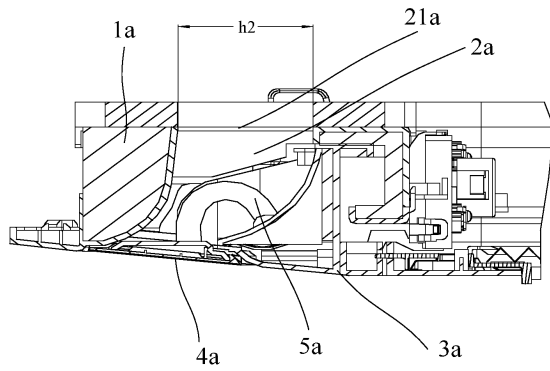


Figure 1

Description**CROSS-REFERENCE TO RELATED APPLICATIONS**

5 **[0001]** The present application is based on and claims priority to China Patent Application No. 202210384810.6 filed on April 13, 2022; China Patent Application No. 20221077060.9 filed on July 4, 2022; China Patent Application No. 20221077067.0 filed on July 4, 2022; China Patent Application No. 20221077107.1 filed on July 4, 2022; China Patent Application No. 20221077108.6 filed on July 4, 2022; China Patent Application No. 202210777069.X filed on July 4, 2022; China Patent Application No. 202211048419.5 filed on August 30, 2022; China Patent Application No. 202210260142.6
10 filed on March 16th, 2022; China Patent Application No. 20221077040.1 filed on July 4, 2022; and China Patent Application No. 20221077084.4 filed on July 4, 2022, the disclosures of which are incorporated by reference herein in its entirety.

Field of the Invention

15 **[0002]** The present disclosure relates to the technical field of an air treatment device, in particular to a control method and control apparatus of a ceiling recessed fan, a ceiling recessed fan and a recessed air conditioner.

Description of Related Art

20 **[0003]** The ceiling recessed fan which pertains to an air conditioner, is embedded mounted in the ceiling to reduce the occupied space, and exchanges air output heat through the air outlet provided on the surface of the ceiling recessed fan. With the limitation by the position of its air outlet, it is only possible to output air according to a set direction, rather than performing horizontal blow during cooling.

25 **[0004]** In the related art, in order to enable the ceiling recessed fan to perform horizontal blow in a cooling mode so that the airflow flows against the wall, the technical solution in use is to arrange the air outlet assembly to be a structure in a way so as to be able to be raised and lowered, and the main body frame is fixedly arranged on a circumferential outer side of the air outlet assembly. During operation of the ceiling recessed fan, the air outlet assembly descends to a certain height and forms a height difference with the main body frame, and the air outlet assembly and the main body frame arranged on an
30 outer side of the air outlet assembly form an air outlet, and the fan blows air from the inside of the ceiling recessed fan and outputs air through the air outlet. When the air conditioner is in a cooling mode, it is necessary to make the outlet air parallel to the horizontal plane as much as possible to increase the air supply distance, so as to realize waterfall cooling and improve the comfort of the user.

35 **[0005]** However, the descending height of the air outlet frame of the ceiling recessed fan in the related art is only the experience design of the designer, without considering a cooperation relationship with the internal structure of the ceiling recessed fan. Moreover, when the dimension of the air outlet formed between the air outlet frame and the main body frame is too large, in a cooling mode, although the air output volume attenuates less, the air supply distance is very small, which results in a poor air output effect of the ceiling recessed fan.

40 **[0006]** At present, the air outlet assembly of the ceiling recessed fan in the related art is a structure in a way so as to be able to be raised and lowered, and the main body frame is fixedly arranged on a circumferential outer side of the air outlet assembly. During operation of the ceiling recessed fan, the air outlet assembly descends by a certain height and forms a height difference with the main body frame, and the air outlet assembly and the main body frame arranged on an outer side of the air outlet assembly form an air outlet, so that the fan blows air from the inside of the ceiling recessed fan and outputs air through the air outlet, and the airflow is deflected by the air deflector at the air outlet. Especially when the air conditioner
45 is in a cooling mode, it is necessary to make the outlet air parallel to the horizontal plane as much as possible to increase the air supply distance, so as to realize waterfall cooling and improve the comfort of the user. However, the air deflector of the ceiling recessed fan in the related art when designed adjusts the air output direction of the ceiling recessed fan according to the angle of the air deflector alone, without considering the influence of the internal structure of the ceiling recessed fan on the air output direction of the ceiling recessed fan. When the upward reflex angle of the air deflector is too large, the air
50 output volume will be affected as the air output directly blows to the wall. When the downward swing angle of the air deflector is too large, the air supply distance will be reduced, which eventually results in a poor air output effect of the ceiling recessed fan.

55 **[0007]** At present, the air outlet assembly of the ceiling recessed fan in the related art is a structure in a way so as to be able to be raised and lowered, and the main body frame is fixedly arranged on a circumferential outer side of the air outlet assembly. During operation of the ceiling recessed fan, the air outlet assembly descends to a certain height and forms a height difference with the main body frame, and the air outlet assembly and the main body frame arranged on an outer side of the air outlet assembly form an air outlet, and the fan blows air from the inside of the ceiling recessed fan and outputs air through the air outlet. When the air conditioner is in a cooling mode, it is necessary to make the outlet air parallel to the

horizontal plane as much as possible to increase the air supply distance, so as to realize waterfall cooling and improve the comfort of the user. However, the dimension of the air outlet of the ceiling recessed fan in the related art which is only the experience design of the designer, is not designed reasonably, which results in a poor air output effect of the ceiling recessed fan.

[0008] In the related art, in order to enable the ceiling recessed fan to perform horizontal blow in a cooling mode so that the airflow flows against the wall, the technical solution in use is to arrange the air outlet assembly to be a structure in a way so as to be able to be raised and lowered, and the main body frame is fixedly arranged on a circumferential outer side of the air outlet assembly. During operation of the ceiling recessed fan, the air outlet assembly descends by a certain height and forms a height difference with the main body frame, and the air outlet assembly and the main body frame arranged on an outer side of the air outlet assembly form an air outlet, so that the fan blows air from the inside of the ceiling recessed fan and outputs air through the air outlet, and the airflow is deflected by the air deflector at the air outlet. Especially when the air conditioner is in a cooling mode, it is necessary to make the outlet air parallel to the horizontal plane as much as possible to increase the air supply distance, so as to realize waterfall cooling and improve the comfort of the user.

[0009] However, the air deflector of the ceiling recessed fan in the related art when designed adjusts the air output direction of the ceiling recessed fan according to the angle of the air deflector alone, without considering the influence of the air deflector and the mounting planar face of the internal structure of the ceiling recessed fan on the air output direction of the ceiling recessed fan. When the upward reflex angle of the air deflector is too large, the air output volume will be affected as the air output directly blows to the wall. When the downward swing angle of the air deflector is too large, the air supply distance will be reduced, which eventually results in a poor air output effect of the ceiling recessed fan.

[0010] In the related art, in order to enable the ceiling recessed fan to perform horizontal blow in a cooling mode so that the airflow flows against the wall, the technical solution in use is to arrange the air outlet assembly to be a structure in a way so as to be able to be raised and lowered, and the main body frame is fixedly arranged on a circumferential outer side of the air outlet assembly. During operation of the ceiling recessed fan, the air outlet assembly descends to a certain height and forms a height difference with the main body frame, and the air outlet assembly and the main body frame arranged on an outer side of the air outlet assembly form an air outlet, and the fan blows air from the inside of the ceiling recessed fan and outputs air through the air outlet. When the air conditioner is in a cooling mode, it is necessary to make the outlet air parallel to the horizontal plane as much as possible to increase the air supply distance, so as to realize waterfall cooling and improve the comfort of the user.

[0011] However, the descending height of the air outlet frame of the ceiling recessed fan in the related art is only the experience design of the designer, without considering a cooperation relationship with the internal structure of the ceiling recessed fan. Moreover, when the dimension of the air outlet formed between the air outlet frame and the main body frame is too large, in a cooling mode, although the air output volume attenuates less, the air supply distance is very small, which results in a poor air output effect of the ceiling recessed fan.

[0012] At present, the air outlet assembly of the ceiling recessed fan in the related art is a structure in a way so as to be able to be raised and lowered, and the main body frame is fixedly arranged on a circumferential outer side of the air outlet assembly. During operation of the ceiling recessed fan, the air outlet assembly descends to a certain height and forms a height difference with the main body frame, and the air outlet assembly and the main body frame arranged on an outer side of the air outlet assembly form an air outlet, and the fan blows air from the inside of the ceiling recessed fan and outputs air through the air outlet. When the air conditioner is in a cooling mode, it is necessary to make the outlet air parallel to the horizontal plane as much as possible to increase the air supply distance, so as to realize waterfall cooling and improve the comfort of the user. However, the dimension of the air outlet of the ceiling recessed fan in the related art which is only the experience design of the designer, is not designed reasonably, which results in a poor air output effect of the ceiling recessed fan.

[0013] The ceiling recessed fan, also known as a ceiling cassette air conditioner or a ceiling concealed/embedded air conditioner. The ceiling recessed fan is widely applied as it saves the space and provides an aesthetic feeling.

[0014] At present, an air outlet is formed between the air outlet assembly and the main body frame of the ceiling recessed fan in the related art, and the fan blows air from the inside of the ceiling recessed fan and horizontally outputs air through the air outlet, thus reducing the discomfort caused by direct skin blow of cold air. However, a horizontal blow method with cold air may result in that it is impossible to cool indoor rapidly, thereby affecting the user experience.

[0015] The inventors have found that, an effective solution is not provided at present to solve the problem that it is impossible to cool indoor rapidly by a horizontal blow method with cold air in the related art.

[0016] At present, the ceiling recessed fan often uses such a method that the air outlet is arranged on the side frame, and the number of air outlets is generally four, so that air is supplied from the ceiling to indoor at a certain angle, that is, air is supplied in four directions along the angles set by the four air outlets respectively. However, since an included angle is formed between the air output direction of the air outlet and the horizontal plane where the ceiling is located, and the air supply direction is limited, when the air conditioner is in a cooling mode, cold air will directly blow downward, and if someone is in the vicinity of the air conditioner, cold air will directly blow to the skin, which results in reduced comfort.

[0017] To that end, there is an existing ceiling recessed fan with an air outlet assembly arranged in a way so as to be able

to be raised and lowered. The ceiling recessed fan includes a main body frame and an air outlet assembly mounted on the ceiling, and the air outlet assembly is mounted on the main body frame through a lifting mechanism. When the ceiling recessed fan outputs air, the air outlet assembly is driven by the lifting mechanism to descend relative to the main body frame, and after the air outlet assembly descends, its outer edge and the inner edge of the main body frame form a horizontal air outlet, so that air is output by horizontal blow, and waterfall refrigeration is realized, thereby improving the comfort of the user.

[0018] However, in order to allow a smooth lifting movement between the air outlet assembly and the main body frame, a movement gap has to be retained between the lifting assembly and the main body frame. With the presence of the movement gap, the movement gap is not sealed in the structure in the related art, and the air outlet may communicate with the air return gate through the movement gap, which will lead to air output entering the air return gate through the movement gap so that it is likely to cause condensation.

[0019] Moreover, when the air outlet assembly descends to an operation position, since almost all the gravity of the air outlet assembly is borne by the lifting mechanism, and the weight of the air outlet assembly is also relatively heavy in normal circumstances, the lifting mechanism is very likely to be damaged.

[0020] The embedded air conditioner is also known as a ceiling cassette air conditioner or a ceiling concealed air conditioner. The embedded air conditioner is widely applied as it saves the space and provides an aesthetic feeling.

[0021] At present, the embedded air conditioner often uses such a method that the air outlet is arranged on the side frame, and the number of air outlets is generally four, so that air is supplied from the ceiling to indoor at a certain angle, that is, air is supplied in four directions along the angles set by the four air outlets respectively. However, since an included angle is formed between the air output direction of the air outlet and the horizontal plane where the ceiling is located, and the air supply direction is limited, when the air conditioner is in a cooling mode, cold air will directly blow downward, and if someone is in the vicinity of the air conditioner, cold air will directly blow to the skin, which results in reduced comfort.

[0022] There is an embedded air conditioner with an air outlet assembly arranged in a way so as to be able to be raised and lowered. The embedded air conditioner includes a main body frame and an air outlet assembly mounted on the ceiling, and the air outlet assembly is mounted on the main body frame through a lifting mechanism. When the embedded air conditioner outputs air, the air outlet assembly is driven by the lifting mechanism to descend relative to the main body frame, and after the air outlet assembly descends, its outer edge and the inner edge of the main body frame form a horizontal air outlet, so that air is output by horizontal blow, and waterfall refrigeration is realized, thereby improving the comfort of the user.

[0023] However, the inventors have found that, there may be present with a vibration phenomenon during the lifting process of the air outlet assembly, which will lead to noise and affect the service life of the embedded air conditioner. Therefore, how to solve the vibration of the air outlet assembly during the lifting process is an urgent problem to be solved.

[0024] The ceiling recessed fan which pertains to an air conditioner, is recessedly installed in the ceiling to reduce the occupied space, and performs air output heat exchange through the air outlet provided on the surface of the ceiling recessed fan. With the limitation by the position of its air outlet, it is only possible to perform air output according to a set direction, rather than performing horizontal blow during cooling. Especially for business occasions, skin blow by cold air during downdraft airflow cooling will make people uncomfortable, and skin blow by cold air for a long time is likely to lead to colds and other diseases.

SUMMARY OF THE INVENTION

[0025] In some embodiments of the disclosure, a ceiling recessed fan, a control method and control apparatus thereof, and a recessed air conditioner are provided.

[0026] In some embodiments of the present disclosure, a ceiling recessed fan is provided to improve the air output effect of the ceiling recessed fan.

[0027] According to a first aspect of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: a main body frame internally provided with an air outlet duct, wherein the air outlet duct has a first end and a second end along an airflow direction; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, there is a height difference between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame, and the air outlet communicates with a second end of the air outlet duct; the ratio of the height h_1 of the air outlet to the width h_2 of a first end of the air outlet duct is in the range of $1/3 \leq h_1/h_2 \leq 3/5$.

[0028] In some embodiments, the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form a height difference. When the air outlet assembly is in an operation position, the ratio range of the height h_1 of the air outlet to the width h_2 of the first end of the air outlet duct is $1/3 \leq h_1/h_2 \leq 3/5$.

[0029] In some embodiments, the air outlet assembly includes an air deflector and an air outlet frame, wherein the air outlet frame is arranged in the main body frame; the air deflector is rotatably arranged on the air outlet frame; and when the

air outlet assembly is in an operation position, the air deflector may adjust the height of the air outlet.

[0030] In some embodiments, the air deflector has a first position to allow the height h_1 of the air outlet to reach a minimum value, and the ratio of the minimum height h_1 of the air outlet to the width of a first end of the air outlet duct is in the range of $1/3 \leq h_1/h_2 \leq 3/5$.

[0031] In some embodiments, when the ceiling recessed fan is in a cooling mode, the angle range of the included angle a between the plane where the air deflector is located and the horizontal plane is $-10^\circ \leq a \leq 10^\circ$, and when $a=0^\circ$, the plane where the air deflector is located is parallel to the horizontal plane.

[0032] In some embodiments, when the ceiling recessed fan is in a cooling mode, the included angle a in the angle range of $10^\circ \geq a > 0^\circ$, and when $a > 0^\circ$, the air deflector tilts upwards relative to the horizontal plane.

[0033] In some embodiments, the air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.

[0034] In some embodiments, when the air outlet assembly is in the closed position, the air outlet frame and the air deflector jointly cooperate with the main body frame to form a seal.

[0035] In some embodiments, the second edge is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure. When the air outlet assembly is in the closed position, the first step structure is sealingly fit with the second step structure.

[0036] In some embodiments, the first step structure is provided with a seal, and when the air outlet assembly is in the closed position, the seal is arranged between the first step structure and the second step structure.

[0037] In some embodiments, the ceiling recessed fan also includes a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.

[0038] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0039] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0040] The ceiling recessed fan with a cooling mode provided in the present disclosure, when in a cooling mode, limits the ratio of the height of an air outlet to the width of the first end of the air outlet duct; that is, design standards are provided for the ceiling recessed fan so as to balance the attenuation of the air supply distance and the air output volume of the ceiling recessed fan, such that the produced air output effect of the ceiling recessed fan satisfies requirements when in a cooling mode; furthermore, because an air deflector can adjust the height of the air outlet, by limiting the ratio range of a minimum value of the height of the air outlet to the width of the first end of the air outlet duct so as to limit the rotational angle of the air deflector, in the end, the produced air output effect of the ceiling recessed fan reaches a preset level.

[0041] According to a second aspect of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: a main body frame internally provided with an air outlet duct, wherein the air outlet duct has a first end and a second end along an airflow direction; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a heating mode, there is a height difference between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame, and the air outlet communicates with a second end of the air outlet duct; the ratio of the height h_1 of the air outlet to the width h_2 of a first end of the air outlet duct is in the range of $2/3 \leq h_1/h_2 \leq 4/5$.

[0042] In some embodiments, the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form a height difference. When the air outlet assembly is in an operation position, the ratio range of the height h_1 of the air outlet to the width h_2 of the first end of the air outlet duct is $2/3 \leq h_1/h_2 \leq 4/5$.

[0043] In some embodiments, the air outlet assembly includes an air deflector and an air outlet frame, wherein the air outlet frame is arranged in the main body frame; the air deflector is rotatably arranged on the air outlet frame; and when the air outlet assembly is in an operation position, the air deflector may adjust the height of the air outlet.

[0044] In some embodiments, the air deflector has a first position to allow the height h_1 of the air outlet to reach a minimum value, and the ratio of the minimum height h_1 of the air outlet to the width of a first end of the air outlet duct is in the range of $2/3 \leq h_1/h_2 \leq 4/5$.

[0045] In some embodiments, when the ceiling recessed fan is in a heating mode, the included angle a between the air deflector $4a$ and the horizontal plane is in the angle range of 45° to 75° .

[0046] In some embodiments, the air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.

[0047] In some embodiments, when the air outlet assembly is in the closed position, the air outlet frame and the air

deflector jointly cooperate with the main body frame to form a seal.

[0048] In some embodiments, the second edge is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure. When the air outlet assembly is in the closed position, the first step structure is sealingly fit with the second step structure.

[0049] In some embodiments, the first step structure is provided with a seal, and when the air outlet assembly is in the closed position, the seal is arranged between the first step structure and the second step structure.

[0050] In some embodiments, the ceiling recessed fan also includes a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.

[0051] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0052] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0053] The ceiling recessed fan with a heating mode provided in the present disclosure, when in a heating mode, limits the ratio of the height of the air outlet to the width of the first end of the air outlet duct to provide design standards for the ceiling recessed fan, such that the produced air output effect of the ceiling recessed fan satisfies requirements in a heating code to improve the heat exchange efficiency of the ceiling recessed fan in a heating mode; furthermore, because an air deflector can adjust the height of the air outlet, by limiting the ratio range of a minimum value of the air outlet to the width of the first end of the air outlet duct so as to limit the dimensions and rotational angle of the air deflector, in the end, the produced air output effect of the ceiling recessed fan reaches a preset level.

[0054] According to a third aspect of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: a main body frame; and an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered. Moreover, the air outlet assembly has an operation position descending to a set height and forming an air outlet with the main body frame. When the height h_1 of the air outlet is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$, the air output volume of the ceiling recessed fan is greater than or equal to 75% of a rated air output volume of the ceiling recessed fan.

[0055] In some embodiments, the height h_1 of the air outlet is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$.

[0056] In some embodiments, the air outlet assembly includes a rotatable air deflector, and the air deflector and the main body frame form an air outlet.

[0057] In some embodiments, when the ceiling recessed fan is in a cooling mode, the angle range of the included angle a between the plane where the air deflector is located and the horizontal plane is $-10^\circ \leq a \leq 10^\circ$, and when $a=0^\circ$, the plane where the air deflector is located is parallel to the horizontal plane.

[0058] In some embodiments, the ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly, and the air deflector is arranged on the rotating mechanism.

[0059] In some embodiments, the rotating mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly, and the other end of which is arranged on the air deflector.

[0060] In some embodiments, the rotating mechanism also includes a driving member arranged on the air outlet assembly and drivingly connected with the rotary arm.

[0061] In some embodiments, the air outlet assembly includes an air outlet frame, the air deflector is rotatably arranged on the air outlet frame, and a step sealing structure is provided between an edge of the air deflector and the air outlet frame.

[0062] In some embodiments, the edge of the air deflector is provided with a first step structure, and the air outlet frame is provided with a second step structure, so that the first step structure and the second step structure are fit to form the step sealing structure.

[0063] In some embodiments, a sealing member is provided between the first step structure and the second step structure.

[0064] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0065] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0066] The ceiling recessed fan provided in the present disclosure limits the relationship between the height of the air outlet and the target air output volume to provide design standards for the ceiling recessed fan so as to balance the attenuation of the air supply distance and the air output volume of the ceiling recessed fan, such that the produced air output effect of the ceiling recessed fan satisfies requirements; furthermore because the relationship between the height of the air outlet and the target air velocity of the air output is limited, selection standards of the fan are provided for the ceiling recessed fan, so as to reduce the design difficulties without wasting the air volume due to the selection of a fan that is too large, which effectively reduces the energy consumption of the ceiling recessed fan. Because the air deflector can adjust the height of the air outlet, by limiting the relationship between the angle a and the height of the air outlet so as to limit the rotational angle of the air deflector, in the end, the produced air output effect of the ceiling recessed fan reaches a preset

level.

[0067] According to a fourth aspect of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: a main body frame, wherein the main body frame is formed with an air outlet duct, and the main body frame includes a side frame with a first edge forming the lowermost point of the air outlet duct; an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, wherein the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame; the relationship between the width D of the outer edge of the air outlet assembly beyond the first edge and the height h1 of the air outlet is $2/5 \leq D/h1 \leq 9/5$.

[0068] In some embodiments, when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, a gap which is formed between the air outlet assembly and the main body frame, forms an air supply duct. One end of the air supply duct communicates with the air outlet duct, and the other end of the air supply duct forms a first air outlet.

[0069] In some embodiments, when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, an air supply duct is formed between the air outlet assembly and the side frame. The projection of the air outlet assembly at least partially coincides with the projection of the side frame on the mounting planar face of the main body frame.

[0070] In some embodiments, the air outlet assembly is provided with a second air outlet, and the second air outlet is provided with an air deflector which is rotatably arranged at the second air outlet and capable of closing or opening the second air outlet.

[0071] In some embodiments, a step sealing structure is provided between the edge of the air deflector and the edge of the second air outlet.

[0072] In some embodiments, the edge of the air deflector is provided with a first step structure, and the edge of the second air outlet is provided with a second step structure, so that the first step structure and the second step structure are fit to form a step sealing structure.

[0073] In some embodiments, the ceiling recessed fan also includes a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.

[0074] In some embodiments, the air outlet assembly includes an air outlet frame, wherein a first air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0075] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein a first air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0076] In the ceiling recessed fan provided by the present disclosure, the part of the projection of the air deflector on the main body frame is located on the side frame. Also that is, the tilting downward air output of the ceiling recessed fan is deflected to horizontal flow as much as possible by increasing the dimensions of the air deflector, so that the air output of the ceiling recessed fan flows along a horizontal direction to a maximum extent, which effectively enhances the air deflection effect of the air deflector over the air output of the ceiling recessed fan. Moreover, according to a ratio relationship between the dimension of the air deflector and the height of the air outlet, the dimensions of the air deflector can be directly determined, thereby improving the air deflection effect of the air deflector over the air output of the ceiling recessed fan.

[0077] According to a fifth aspect of the present disclosure, a ceiling recessed fan is provided, which includes: a main body frame; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame; and a first air deflector arranged on a swinging mechanism, and swingably arranged at the air outlet. The angle c between the plane of the first air deflector and the mounting planar face of the main body frame is in the range of $-10^\circ \leq c \leq 10^\circ$, and when the angle c is 0° , the plane of the first air deflector is parallel to the mounting planar face. The air outlet assembly has a first descending height h, and the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$ when the ceiling recessed fan is in a cooling mode.

[0078] In some embodiments, when the angle c is in the range of $-10^\circ \leq c < 0^\circ$, the plane of the first air deflector tilts upward relative to the mounting planar face, and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$. Alternatively, when the angle c is in the range of $0^\circ \leq c < 10^\circ$, the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$.

[0079] In some embodiments, the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form a height difference.

[0080] In some embodiments, the mounting planar face of the main body frame is parallel to the horizontal plane.

[0081] In some embodiments, the first air deflector is provided with an extension plate projecting out of the first air deflector when the air outlet assembly is in the operation position.

[0082] In some embodiments, the ceiling recessed fan also includes an air deflection structure arranged in the main body frame, and capable of deflecting the air output of the air outlet when the ceiling recessed fan is in a cooling mode.

[0083] In some embodiments, the main body frame includes a side frame, at least part of the air output of the air outlet passes through the side frame, and the air deflecting structure includes a second air deflector swingably arranged on the

side frame; or the main body frame includes a side frame, at least part of the air output of the air outlet passes through the side frame, and the side frame is formed with an air deflecting channel which constitutes the air deflecting structure.

[0084] According to a sixth aspect of the present disclosure, a ceiling recessed fan is provided, which includes: a main body frame; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame; and a first air deflector arranged on a swinging mechanism, and swingably arranged at the air outlet. The plane of the first air deflector tilts upward relative to the mounting planar face of the main body frame, and the angle c between the plane of the first air deflector and the mounting planar face is in the range of $-10^{\circ} \leq c \leq 0^{\circ}$.

[0085] In some embodiments, the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form a height difference.

[0086] In some embodiments, the air outlet assembly has a first descending height h , and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$ when the ceiling recessed fan is in a cooling mode.

[0087] In the ceiling recessed fan provided by the present disclosure, the air output of the ceiling recessed fan is deflected by the first air deflector, and by limiting the angle relationship between the plane where the first air deflector is located and the mounting planar face of the main body frame, the first air deflector tilts towards the mounting planar face of the main body frame, so as to allow that the air output of the ceiling recessed fan faces towards the mounting planar face of the main body frame as much as possible, thereby improving the air output effect of the ceiling recessed fan. At the same time, according to the relationship between the air output volume of the ceiling recessed fan and the angle c or the relationship between the height of the air outlet assembly and the angle c , the air output effect of the ceiling recessed fan is further improved according to actual requirements of the ceiling recessed fan.

[0088] According to a seventh aspect of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: a main body frame; an air outlet assembly disposed on the main body frame in a way so as to be able to be raised and lowered, and having an operation position that descends to a predetermined height and forms an air outlet with the main body frame; an air deflection structure arranged in the main body frame, and capable of deflecting the air output of the air outlet when the ceiling recessed fan is in a cooling mode.

[0089] In some embodiments, the main body frame includes a side frame, at least part of the air output of the air outlet passes through the side frame, and the air deflection structure includes a first air deflector swingably arranged on the side frame.

[0090] In some embodiments, the plane where the first air deflector is located tilts upward relative to the horizontal plane to form a tilting angle d , and the angle range of the tilting angle d is $0^{\circ} < d \leq 10^{\circ}$; and/or, the plane where the first air deflector is located is parallel to the horizontal plane.

[0091] In some embodiments, the air outlet assembly also includes a second air deflector swingably arranged at the air outlet. The included angle e between the plane of the first air deflector and the plane of the second air deflector is in the angle range of $-10^{\circ} \leq e \leq 10^{\circ}$, and when $e=0^{\circ}$, the plane of the first air deflector is parallel to the plane of the second air deflector.

[0092] In some embodiments, the main body frame includes a side frame, at least part of the air output of the air outlet passes through the side frame, and an air deflection channel formed on the side frame constitutes an air deflection structure.

[0093] In some embodiments, the width of the air deflection channel gradually increases along the air output direction; and/or, the depth of the air deflection channel is gradually increased.

[0094] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0095] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0096] In the ceiling recessed fan provided by the present disclosure, the airflow passing through the side frame is deflected by providing an air deflecting structure, thereby solving a phenomenon that the airflow cannot favorably flow against the ceiling because the main body frame projects out of the ceiling. At the same time, the first air deflector can adjust the flow direction of the upper layer airflow at the air outlet, and effectively increase the air supply distance of the air outlet by joint cooperation with the second air deflector. The air deflection channel can utilize the change of the width or the depth so that the upper layer airflow at the air outlet flows towards the ceiling direction or the corner of the ceiling recessed fan, thereby effectively increasing the air supply distance and the air supply angle of the ceiling recessed fan and increasing the air output effect of the ceiling recessed fan.

[0097] According to an eighth embodiment of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: internally provided with an air outlet duct having a first end and a second end provided along the airflow direction; an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered,

and the air outlet assembly has an operation position that descends to a predetermined height, wherein an air outlet is formed between the air outlet assembly and the main body frame, and the air outlet communicates with the second end of the air outlet duct; a second air deflector swingably arranged in the air outlet duct and capable of changing an air output direction of the air outlet duct; and a first air deflector swingably arranged on the air outlet assembly and capable of adjusting a height of the air outlet when the air outlet assembly is in an operation position. When the air outlet assembly is in an operation position, an included angle c is formed between the plane where the first air deflector is located and the plane where the second air deflector is located.

[0098] In some embodiments, the ceiling recessed fan has a cooling mode. When the ceiling recessed fan is in a cooling mode, the included angle c is in the range of 90° to 110° .

[0099] In some embodiments, the ceiling recessed fan has a heating mode. When the ceiling recessed fan is in a heating mode, the included angle c is in the range of 145° to 165° .

[0100] In some embodiments, the air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the first air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet assembly.

[0101] In some embodiments, the first air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding edge of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet assembly.

[0102] In some embodiments, the second edge is provided with a first step structure, and the air outlet assembly is provided with a second step structure fit with the step structure. When the air outlet assembly is in the closed position, the first step structure is sealingly fit with the second step structure.

[0103] In some embodiments, the first step structure is provided with a seal, and when the air outlet assembly is in the closed position, the seal is arranged between the first step structure and the second step structure.

[0104] In some embodiments, the ceiling recessed fan also includes a swinging mechanism arranged on the air outlet assembly, and the first air deflector is arranged on the swinging mechanism.

[0105] In some embodiments, the swinging mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly, and the other end of which is arranged on the air deflector.

[0106] In some embodiments, the swinging mechanism also includes a driving member arranged on the air outlet assembly and directly or indirectly driving the rotary arm to rotate.

[0107] In some embodiments, the second air deflector divides the air outlet duct into a first air outlet duct and a second air outlet duct.

[0108] In some embodiments, along the airflow direction of the air outlet duct, the width of the first air outlet duct gradually decreases; and/or along the airflow direction of the air outlet duct, the width of the second air outlet duct gradually decreases.

[0109] In some embodiments, the ceiling recessed fan has a cooling mode, and when the ceiling recessed fan is in a cooling mode, the ratio of the average width $D1$ of the first air outlet duct to the average width $D2$ of the second air outlet duct is in the range of $1.0 \leq D1/D2 \leq 1.1$; and/or, the ceiling recessed fan has a heating mode, and when the ceiling recessed fan is in a heating mode, the ratio of the average width $D1$ of the first air outlet duct to the average width $D2$ of the second air outlet duct is in the range of $1.2 \leq D1/D2 \leq 1.25$.

[0110] In some embodiments, the ceiling recessed fan has a cooling mode, and when the ceiling recessed fan is in a cooling mode, the included angle between the second air deflector and the vertical surface is in the range of 0° to 20° ; and the ceiling recessed fan has a heating mode, and when the ceiling recessed fan is in a heating mode, the included angle between the second air deflector and the vertical surface is in the range of -10° to 10° .

[0111] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0112] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0113] In the ceiling recessed fan with a second air deflector provided by the present disclosure, a second air deflector is provided to deflect the airflow direction in the air outlet duct, so as to adjust the airflow direction entering the air outlet, which effectively reduces the obstruction effect produced by the internal structure of the ceiling recessed fan over the air output of the ceiling recessed fan, and allows a more smooth internal airflow of the ceiling recessed fan. At the same time, the second air deflector cooperates with the first air deflector to jointly increase the adjustment of the air output of the ceiling recessed fan and improve the air output effect of the ceiling recessed fan. Also, standards are provided for designers by limiting the angle b , so as to facilitate determining the parameters of the second air deflector, which allows that the air output effect of the ceiling recessed fan product achieves preset requirements.

[0114] According to a ninth embodiment of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: a main body frame 1a internally provided with an air outlet duct having a first end and a second end;

and an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, wherein the air outlet assembly descends so that an air outlet is formed between the air outlet assembly and the main body frame, and the air outlet communicates with the second end of the air outlet duct. The ratio of the circulation area S_1 of the air outlet 10a to the minimum circulation area S_2 of the air outlet duct 2a is in the range of $0.7 \leq S_1/S_2 \leq 1.27$.

[0115] In some embodiments, the air outlet duct has a second end communicating with the air outlet and a first end remote from the air outlet, and a minimum circulation area of the air outlet duct is formed at the first end of the air outlet duct.

[0116] In some embodiments, the air outlet assembly includes a rotatable air deflector, and the air deflector and the main body frame form an air outlet.

[0117] In some embodiments, the ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly, and the air deflector is arranged on the rotating mechanism.

[0118] In some embodiments, the rotating mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly, and the other end of which is arranged on the air deflector.

[0119] In some embodiments, the rotating mechanism also includes a driving member arranged on the air outlet assembly and drivingly connected with the rotary arm.

[0120] In some embodiments, the air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet assembly.

[0121] In some embodiments, a sealing structure is provided between the second edge and the air outlet assembly.

[0122] In some embodiments, the ceiling recessed fan also includes a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.

[0123] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0124] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0125] The ceiling recessed fan with an air outlet provided in the present disclosure limits the relationship between the height of the air outlet and the minimum circulation area of the air outlet duct to provide design standards for the ceiling recessed fan so as to balance the attenuation of the air supply distance and the air output volume of the ceiling recessed fan and improve the produced air output effect of the ceiling recessed fan, thereby reducing the design difficulties.

[0126] According to a tenth aspect of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: a main body frame internally provided with an air outlet duct having a first end and a second end provided along the airflow direction; an air outlet assembly disposed on the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position that descends to a predetermined height, wherein an air outlet is formed between the air outlet assembly and the main body frame, and the air outlet communicates with the second end of the air outlet duct. When the air outlet assembly is in an operation position, the angle b between the air outlet and the air outlet duct is in the angle range of $130^\circ \leq b \leq 150^\circ$.

[0127] In some embodiments, the air outlet assembly includes an air deflector and an air outlet frame, wherein the air outlet frame is arranged in the main body frame; the air deflector is swingably arranged on the air outlet frame; and when the air outlet assembly is in an operation position, the air deflector may adjust the height of the air outlet.

[0128] In some embodiments, the ceiling recessed fan has a cooling mode, and when the ceiling recessed fan is in a cooling mode, the angle c between the plane where the air deflector is located and the air output direction of the air outlet duct is in the angle range of $120^\circ \leq c \leq 140^\circ$.

[0129] In some embodiments, the ceiling recessed fan has a heating mode, and when the ceiling recessed fan is in a heating mode, the angle c between the plane where the air deflector is located and the air output direction of the air outlet duct is in the angle range of $180^\circ \leq c \leq 190^\circ$.

[0130] In some embodiments, the air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.

[0131] In some embodiments, the air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding edge of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.

[0132] In some embodiments, the second edge is provided with a first step structure, and the air outlet assembly is provided with a second step structure fit with the step structure, so that the first step structure can be sealingly fit with the second step structure.

[0133] In some embodiments, the first step structure is provided with a seal, and when the first step structure is sealingly fit with the second step structure, the seal is arranged between the first step structure and the second step structure.

[0134] In some embodiments, the ceiling recessed fan also includes a swinging mechanism arranged on the air outlet assembly, and the air deflector is arranged on the swinging mechanism.

[0135] In some embodiments, the swinging mechanism includes a rotary arm, one end of which is hinged to the air outlet frame, and the other end of which is arranged on the air deflector.

[0136] In some embodiments, the swinging mechanism also includes a driving member arranged on the air outlet frame and directly or indirectly driving the rotary arm to rotate.

[0137] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0138] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0139] The ceiling recessed fan provided by the present disclosure provides design standards for the specific parameters of the air outlet assembly and the air deflector (the dimensions, the swingable angle of the air deflector, etc.) based on the angle between the air output direction of the air outlet and the air output direction of the air outlet duct and the angle between the plane where the air deflector is located and the air outlet duct, which can optimize the deflecting effect of the airflow at the air outlet, thereby enhancing the air outlet effect of the ceiling recessed fan and overcoming the problem of a poor air output effect of the ceiling recessed fan due to the design of the air outlet assembly and the air deflector by the appearance structure of the ceiling recessed fan in the related art that has been found by the inventors, and allows that the air output effect of the finished ceiling recessed fan achieves preset requirements. Wherein, the included angle is required in a cooling mode and a heating mode respectively to further optimize the parameters of the air deflector and further optimize the air output effect of the ceiling recessed fan.

[0140] In order to solve the problem of a poor air output effect of the ceiling recessed fan that has been found by the inventors, a ceiling recessed fan defining a matching relationship between the air deflector and the air outlet duct to improve the air output effect is provided.

[0141] A ceiling recessed fan, includes: a main body frame internally provided with an air outlet duct, wherein the air outlet duct has a first end and a second end along an airflow direction; an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, and having an operation position which descends to a predetermined height and forms an air outlet with the main body frame, wherein the air outlet communicates with a second end of the air outlet duct; when the air outlet assembly is in the operation position, the angle b between the air output direction of the air outlet and the air output direction of the air outlet duct is in the angle value of $130^{\circ} \leq b \leq 150^{\circ}$.

[0142] The air outlet assembly includes an air deflector and an air outlet frame, wherein the air outlet frame is arranged in the main body frame; the air deflector is swingably arranged on the air outlet frame; and when the air outlet assembly is in an operation position, the air deflector may adjust the height of the air outlet.

[0143] The ceiling recessed fan has a cooling mode, and when the ceiling recessed fan is in a cooling mode, the angle c between the plane where the air deflector is located and the air output direction of the air outlet duct is in the angle range of $120^{\circ} \leq c \leq 140^{\circ}$.

[0144] The ceiling recessed fan has a heating mode, and when the ceiling recessed fan is in a heating mode, the angle c between the plane where the air deflector is located and the air output direction of the air outlet duct is in the angle range of $180^{\circ} \leq c \leq 190^{\circ}$.

[0145] The air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.

[0146] The air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding edge of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.

[0147] The second edge is provided with a first step structure, and the air outlet assembly is provided with a second step structure fit with the step structure, so that the first step structure can be sealingly fit with the second step structure.

[0148] The first step structure is provided with a seal, and when the first step structure is sealingly fit with the second step structure, the seal is arranged between the first step structure and the second step structure.

[0149] The ceiling recessed fan also includes a swinging mechanism arranged on the air outlet assembly, and the air deflector is arranged on the swinging mechanism.

[0150] The swinging mechanism includes a rotary arm, one end of which is hinged to the air outlet frame, and the other end of which is arranged on the air deflector.

[0151] The swinging mechanism also includes a driving member arranged on the air outlet frame and directly or indirectly driving the rotary arm to rotate.

[0152] The air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0153] The air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0154] The air outlet assembly is provided with at least one second air outlet communicating with the air outlet duct.

[0155] The ceiling recessed fan further includes an air deflector which is rotatably arranged at the second air outlet and capable of closing or opening the second air outlet.

[0156] The ceiling recessed fan provided by the present disclosure provides design standards for the specific parameters of the air outlet assembly and the air deflector (the dimensions, the swingable angle of the air deflector, etc.) based on the angle between the air output direction of the air outlet and the air output direction of the air outlet duct and the angle between the plane where the air deflector is located and the air outlet duct, which can optimize the deflecting effect of the airflow at the air outlet, thereby enhancing the air outlet effect of the ceiling recessed fan and overcoming the problem of a poor air output effect of the ceiling recessed fan due to the design of the air outlet assembly and the air deflector by the appearance structure of the ceiling recessed fan in the related art that has been found by the inventors, and allows that the air output effect of the finished ceiling recessed fan achieves preset requirements. Wherein, the included angle is required in a cooling mode and a heating mode respectively to further optimize the parameters of the air deflector and further optimize the air output effect of the ceiling recessed fan.

[0157] In order to improve the air output effect of the ceiling recessed fan, a ceiling recessed fan defining a relationship between the dimensions of the air outlet of the ceiling recessed fan and the air output volume of the ceiling recessed fan to improve the air output volume is provided.

[0158] Therefore, the present disclosure provides a ceiling recessed fan. The ceiling recessed fan includes: a main body frame; and an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered. Moreover, the air outlet assembly has an operation position descending to a set height and forming an air outlet with the main body frame. The height h_1 of the air outlet is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$.

[0159] When the height h_1 of the air outlet is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$, the air output volume of the ceiling recessed fan is greater than or equal to 75% of a rated air output volume of the ceiling recessed fan.

[0160] The air outlet assembly includes a rotatable air deflector, and the air deflector and the main body frame form an air outlet.

[0161] When the ceiling recessed fan is in a cooling mode, the angle range of the included angle a between the plane where the air deflector is located and the horizontal plane is $-10^\circ \leq a \leq 10^\circ$, and when $a=0^\circ$, the plane where the air deflector is located is parallel to the horizontal plane.

[0162] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly, and the air deflector is arranged on the rotating mechanism.

[0163] The rotating mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly, and the other end of which is arranged on the air deflector.

[0164] The rotating mechanism also includes a driving member arranged on the air outlet assembly and drivingly connected with the rotary arm.

[0165] The air outlet assembly includes an air outlet frame, the air deflector is rotatably arranged on the air outlet frame, and a step sealing structure is provided between an edge of the air deflector and the air outlet frame.

[0166] The edge of the air deflector is provided with a first step structure, and the air outlet frame is provided with a second step structure, so that the first step structure and the second step structure are fit to form the step sealing structure.

[0167] A sealing member is provided between the first step structure and the second step structure.

[0168] The air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0169] The air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0170] The ceiling recessed fan provided in the present disclosure limits the relationship between the height of the air outlet and the target air output volume to provide design standards for the ceiling recessed fan so as to balance the attenuation of the air supply distance and the air output volume of the ceiling recessed fan and improve the produced air output effect of the ceiling recessed fan; furthermore because the relationship between the height of the air outlet and the target air velocity of the air output is limited, selection standards of the fan are provided for the ceiling recessed fan, so as to reduce the design difficulties without wasting the air volume due to the selection of a fan that is too large, which effectively reduces the energy consumption of the ceiling recessed fan. Because the air deflector can adjust the height of the air outlet, by limiting the relationship between the angle a and the height of the air outlet so as to limit the rotational angle of the air deflector, in the end, the produced air output effect of the ceiling recessed fan reaches a preset level.

[0171] In order to improve the air output effect of the ceiling recessed fan, a ceiling recessed fan defining a cooperation relationship between the air deflector and the mounting planar face of the ceiling recessed fan to improve the air output volume is provided.

[0172] A ceiling recessed fan, includes: a main body frame; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame; a first air deflector arranged at a swinging mechanism, and swingably arranged at the air outlet; the angle c between the plane where the first air deflector is located and a mounting planar face of the main body frame is in the range of $-10^{\circ} \leq c \leq 10^{\circ}$, and when the angle c is 0° , the plane where the first air deflector is located is parallel to the mounting planar face; the air outlet assembly has a first descending height h , and the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$ when the ceiling recessed fan is in a cooling mode.

[0173] When the angle c is in the range of $-10^{\circ} \leq c < 0^{\circ}$, the plane of the first air deflector tilts upward relative to the mounting planar face, and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$. Alternatively, when the angle c is in the range of $0^{\circ} \leq c < 10^{\circ}$, the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$.

[0174] The air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form a height difference.

[0175] The mounting planar face of the main body frame is parallel to the horizontal plane.

[0176] The first air deflector is provided with an extension plate projecting out of the first air deflector when the air outlet assembly is in the operation position.

[0177] The ceiling recessed fan also includes an air deflection structure arranged in the main body frame, and capable of deflecting the air output of the air outlet when the ceiling recessed fan is in a cooling mode.

[0178] The main body frame includes a side frame, at least part of the air output of the air outlet passes through the side frame, and the air deflecting structure includes a second air deflector swingably arranged on the side frame; or the main body frame includes a side frame, at least part of the air output of the air outlet passes through the side frame, and the side frame is formed with an air deflecting channel which constitutes the air deflecting structure.

[0179] In another aspect of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes: a main body frame; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame; a first air deflector arranged at a swinging mechanism, and swingably arranged at the air outlet; the plane where the first air deflector is located tilts upward relative to a mounting planar face of the main body frame, and the angle c between the plane where the first air deflector is located and the mounting planar face is in the range of $-10^{\circ} \leq c \leq 0^{\circ}$.

[0180] The air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form a height difference.

[0181] The air outlet assembly has a first descending height h , and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$ when the ceiling recessed fan is in a cooling mode.

[0182] In the ceiling recessed fan provided by the present disclosure, the air output of the ceiling recessed fan is deflected by the first air deflector, and by limiting the angle relationship between the plane where the first air deflector is located and the mounting planar face of the main body frame, the first air deflector tilts towards the mounting planar face of the main body frame, so as to allow that the air output of the ceiling recessed fan faces towards the mounting planar face of the main body frame as much as possible, thereby improving the air output effect of the ceiling recessed fan. At the same time, according to the relationship between the air output volume of the ceiling recessed fan and the angle c or the relationship between the height of the air outlet assembly and the angle c , the air output effect of the ceiling recessed fan is further improved according to actual requirements of the ceiling recessed fan.

[0183] In order to improve the air output effect of the ceiling recessed fan, a ceiling recessed fan with a cooling mode defining a relationship between a descending height of the air outlet frame and the air outlet duct in a cooling mode to improve the air output volume is provided.

[0184] A ceiling recessed fan with a cooling mode, includes: a main body frame internally provided with an air outlet duct, wherein the air outlet duct has a first end and a second end along an airflow direction; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, there is a height difference between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame, and the air outlet communicates with a second end of the air outlet duct; the ratio of the height h_1 of the air outlet to the width h_2 of a first end of the air outlet duct is in the range of $1/3 \leq h_1/h_2 \leq 3/5$.

[0185] The air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form a height difference. When the air outlet assembly is in an operation position, the ratio range of the height h_1 of the air outlet to the width h_2 of the first end of the air outlet duct is $1/3 \leq h_1/h_2 \leq 3/5$.

[0186] The air outlet assembly includes an air deflector and an air outlet frame, wherein the air outlet frame is arranged in the main body frame; the air deflector is rotatably arranged on the air outlet frame; and when the air outlet assembly is in an operation position, the air deflector may adjust the height of the air outlet.

[0187] The air deflector has a first position to allow the height h_1 of the air outlet to reach a minimum value, and the ratio of

the minimum height h_1 of the air outlet to the width of a first end of the air outlet duct is in the range of $1/3 \leq h_1/h_2 \leq 3/5$.

[0188] When the ceiling recessed fan is in a cooling mode, the angle range of the included angle α between the plane where the air deflector is located and the horizontal plane is $-10^\circ \leq \alpha \leq 10^\circ$, and when $\alpha = 0^\circ$, the plane where the air deflector is located is parallel to the horizontal plane.

[0189] When the ceiling recessed fan is in a cooling mode, the included angle α in the angle range of $10^\circ \geq \alpha > 0^\circ$, and when $\alpha > 0^\circ$, the air deflector tilts upwards relative to the horizontal plane.

[0190] The air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.

[0191] When the air outlet assembly is in the closed position, the air outlet frame and the air deflector jointly cooperate with the main body frame to form a seal.

[0192] The second edge is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure. When the air outlet assembly is in the closed position, the first step structure is sealingly fit with the second step structure.

[0193] The first step structure is provided with a seal, and when the air outlet assembly is in the closed position, the seal is arranged between the first step structure and the second step structure.

[0194] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.

[0195] The air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0196] The air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0197] The air outlet assembly is provided with at least one second air outlet communicating with a second end of the air outlet duct.

[0198] The ceiling recessed fan further includes an air deflector which is rotatably arranged at the second air outlet and capable of closing or opening the second air outlet.

[0199] The ceiling recessed fan with a cooling mode provided in the present disclosure, when in a cooling mode, limits the ratio of the height of an air outlet to the width of the first end of the air outlet duct; that is, design standards are provided for the ceiling recessed fan so as to balance the attenuation of the air supply distance and the air output volume of the ceiling recessed fan, such that the produced air output effect of the ceiling recessed fan satisfies requirements when in a cooling mode; furthermore, because an air deflector can adjust the height of the air outlet, by limiting the ratio range of a minimum value of the height of the air outlet to the width of the first end of the air outlet duct so as to limit the rotational angle of the air deflector, in the end, the produced air output effect of the ceiling recessed fan reaches a preset level.

[0200] In order to improve the air output effect of the ceiling recessed fan, a ceiling recessed fan with an air outlet defining the dimensions of the air outlet of the ceiling recessed fan to improve the air output volume is provided.

[0201] Therefore, the present disclosure provides a ceiling recessed fan, including: a main body frame internally provided with an air outlet duct, wherein the air outlet duct has a first end and a second end; an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, and descending to form an air outlet with the main body frame, wherein the air outlet communicates with a second end of the air outlet duct; the ratio of the circulation area S_1 of the air outlet to the minimum circulation area S_2 of the air outlet duct is in the range of $0.7 \leq S_1/S_2 \leq 1.27$.

[0202] The air outlet duct has a second end communicating with the air outlet and a first end remote from the air outlet, and a minimum circulation area of the air outlet duct is formed at the first end of the air outlet duct.

[0203] The air outlet assembly includes a rotatable air deflector, and the air deflector and the main body frame form an air outlet.

[0204] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly, and the air deflector is arranged on the rotating mechanism.

[0205] The rotating mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly, and the other end of which is arranged on the air deflector.

[0206] The rotating mechanism also includes a driving member arranged on the air outlet assembly and drivingly connected with the rotary arm.

[0207] The air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge. When the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet assembly.

[0208] A sealing structure is provided between the second edge and the air outlet assembly.

[0209] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame, and the air outlet

assembly is arranged on the lifting mechanism.

[0210] The air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0211] The air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0212] The air outlet assembly is provided with at least one second air outlet communicating with a second end of the air outlet duct.

[0213] The ceiling recessed fan further includes an air deflector which is rotatably arranged at the second air outlet and capable of closing or opening the second air outlet.

[0214] The ceiling recessed fan with an air outlet provided in the present disclosure limits the relationship between the height of the air outlet and the minimum circulation area of the air outlet duct to provide design standards for the ceiling recessed fan so as to balance the attenuation of the air supply distance and the air output volume of the ceiling recessed fan and improve the produced air output effect of the ceiling recessed fan, thereby reducing the design difficulties.

[0215] The embodiment of the present disclosure provides a control method and control apparatus of a ceiling recessed fan and a ceiling recessed fan to solve the problem in the art that when the ceiling recessed fan is just turned on, since cold air cannot be directly blown to the skin, it is impossible to rapidly relieve the discomfort in hot air that has been found by the inventors.

[0216] Therefore, the present disclosure provides a control method of a ceiling recessed fan, wherein the ceiling recessed fan includes a main body frame and an air outlet assembly, the air outlet assembly is mounted on the main body frame, and a height difference is formed between the air outlet assembly and the main body frame to form a first air outlet; the air outlet assembly is also provided with a second air outlet, the control method including the steps of: judging whether a fast cooling condition is met; and controlling the first air outlet and the second air outlet to be opened at the same time when the judgment result is YES.

[0217] In some embodiments, the ceiling recessed fan further includes: a lifting mechanism through which the air outlet assembly is mounted on the main body frame; the step of controlling the opening of the first air outlet includes: controlling the lifting mechanism to drive the air outlet assembly to descend so as to open the first air outlet.

[0218] In some embodiments, a first air deflecting portion is provided between the air outlet assembly and the main body frame; the air outlet assembly is provided with a second air deflecting portion, the opening of the first air outlet is controlled by controlling the opening of the first air deflecting portion; the opening of the second air outlet is controlled by controlling the opening of the second air deflecting portion.

[0219] In some embodiments, the step of judging whether a fast cooling condition is met includes: judging whether a fast cooling instruction is received or whether an indoor temperature is higher than a first preset temperature; judging that a fast cooling condition is satisfied if YES.

[0220] In some embodiments, after the step of controlling the first air outlet and the second air outlet to be opened at the same time, the control method further includes: judging whether a fast cooling exit condition is met; controlling the second air outlet to be closed when the first air outlet remains opened if YES.

[0221] In some embodiments, the step of judging whether a fast cooling exit condition is met includes: judging whether a fast cooling exit instruction is received, or judging whether an opening duration of the second air outlet reaches a first preset duration, or judging whether an indoor temperature is lower than a second preset temperature; judging that a fast cooling exit condition is met if YES.

[0222] In some embodiments, after the step of judging that a fast cooling exit condition is met and before controlling the second air outlet to be closed, the control method further includes: controlling the second air outlet to be intermittently opened; controlling the second air outlet to be closed after a second preset duration.

[0223] The present disclosure further provides a control apparatus of a ceiling recessed fan, for realizing the above-described control method, wherein the control apparatus includes: a first judging module configured to judge whether a fast cooling condition is met; a first control module configured to control a first air outlet and a second air outlet to be opened at the same time when the judgment result is YES.

[0224] The present disclosure also provides a ceiling recessed fan, including a main body frame and an air outlet assembly, wherein the air outlet assembly is mounted on the main body frame, and a height difference is formed between the air outlet assembly and the main body frame to form a first air outlet which outputs air horizontally; the air outlet assembly is also provided with a second air outlet which outputs air downwards, and the ceiling recessed fan further includes the above-described control apparatus.

[0225] The present embodiment also provides a computer readable storage medium having a computer program stored thereon that, when executed by a processor implements the above-described control method.

[0226] By applying the technical solution of the present disclosure, when a fast cooling condition is met, the first air outlet is opened to perform horizontal air output, and the second air outlet is opened to perform downward air output, so that cold air is directly blown to the user, which can reduce the skin-felt temperature of the user as soon as possible and relieve the

discomfort of the user in hot air as soon as possible, thereby improving the user experience.

[0227] The embodiment of the present disclosure provides a ceiling recessed fan to solve the problem in the art that the lifting mechanism of the ceiling recessed fan is likely to be damaged that has been found by the inventors.

[0228] According to a first aspect of the present disclosure, a ceiling recessed fan is provided. The ceiling recessed fan includes a main body frame, an air outlet assembly and a lifting mechanism, wherein the air outlet assembly is connected to the main body frame through the lifting mechanism, the main body frame is provided with a load-bearing member, and the air outlet assembly is provided with a lapped joint member movable relative to the load-bearing member. During the ascending process of the air outlet assembly, the load-bearing member is separated from a lapped joint member. When the air outlet assembly descends to an operation position, the lapped joint member is in lapped joint with the load-bearing member, and the load-bearing member bears at least part of the gravity of the air outlet assembly.

[0229] In some embodiments, a movement stroke A of the lapped joint member is equal to a maximum descending height of the air outlet assembly.

[0230] In some embodiments, the maximum lifting distance of the lifting mechanism is greater than the movement stroke of the lapped joint member.

[0231] In some embodiments, the lifting mechanism includes: a driving device arranged in the main body frame; a gear mounted on an output shaft of the driving device; a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack; a meshing length of the rack is equal to a maximum lifting distance of the lifting mechanism.

[0232] In some embodiments, the lifting mechanism is mounted on the load-bearing member.

[0233] In some embodiments, the load-bearing member includes a load-bearing plate and a load-bearing step, wherein the load-bearing plate is connected with the main body frame, and the load-bearing step is connected with the load-bearing plate; the lapped joint member includes a lapped joint plate and a lapped joint step, wherein the lapped joint plate is connected with the air outlet assembly, and the lapped joint step is connected with the lapped joint plate; during the ascending process of the air outlet assembly, the lap jointed step ascends away from the load-bearing step; when the air outlet assembly descends to an operation position, the lap jointed step descends and is in lapped joint with the load-bearing step.

[0234] In some embodiments, the bearing plate has a first side surface and a second side surface that are oppositely arranged; the load-bearing step is formed on the first side surface, and the lifting mechanism is mounted on the second side surface.

[0235] In some embodiments, the cross-sectional shape of the load-bearing member is C-shaped, and the cross-sectional shape of the lapped joint member is L-shaped or T-shaped.

[0236] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0237] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0238] In some embodiments, the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame.

[0239] In some embodiments, the air outlet assembly descends to form an air supply duct with the main body frame, so that one end of the air supply duct forms a first air outlet, and the other end of the air supply duct communicates with an air outlet duct of the ceiling recessed fan.

[0240] In some embodiments, the air outlet assembly is also provided with a second air outlet communicating with the air outlet duct of the ceiling recessed fan.

[0241] In some embodiments, the air outlet assembly is provided with an air deflector located at the position of the first air outlet and/or the second air outlet.

[0242] In some embodiments, the main body frame further includes a side frame, and when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, an air supply duct is formed between the air outlet assembly and the side frame. The projection of the air outlet assembly at least partially coincides with the projection of the side frame on the mounting planar face of the main body frame.

[0243] In some embodiments, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

When the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed;

When the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open;

When the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

[0244] In some embodiments, when the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode; and when the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0245] The ceiling recessed fan with a load-bearing member in the present disclosure is provided with the load-bearing member and the lapped joint member, which cooperate to transfer the gravity of the air outlet assembly to the main body frame when the air outlet assembly descends to an operation position, and at least part of the gravity of the air outlet assembly is directly transferred to the main body frame through the load-bearing member and the lapped joint member, instead of being totally borne by the lifting mechanism. This greatly reduces the pressure borne by the lifting mechanism during the operation process and reduces the deformation and stress concentration of the lifting mechanism under the effect of pressure, which solves the problem that the lifting mechanism is likely to be damaged during use for a long time that has been found by the inventors.

[0246] According to a second embodiment of the present disclosure, a ceiling recessed fan is provided to solve the problem that the air output of the ceiling recessed fan enters the air return gate through the movement gap between the air outlet assembly and the main body frame so that it is likely to cause condensation that has been found by the inventors.

[0247] The present disclosure provides a ceiling recessed fan, including a main body frame, an air outlet assembly and a lifting mechanism. The main body frame is internally formed with an air outlet duct, and the air outlet assembly is connected to the main body frame through a lifting mechanism. The air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame. The ceiling recessed fan further includes: a flexible windshield located between the air outlet duct and the air return gate, so that a first end of the flexible windshield is connected with the air outlet assembly; and a second end of the flexible windshield is connected with the main body frame. When the air outlet assembly descends to an operation position, the flexible windshield is unfolded to block the air return gate and the first air outlet of the ceiling recessed fan.

[0248] In some embodiments, the main body frame has a first thermal insulation portion located between the air outlet duct and the air return gate, and the first end of the flexible windshield is connected to the first thermal insulation portion.

[0249] In some embodiments, the first thermal insulation portion has a first side surface and a second side surface that are oppositely arranged, wherein the first side surface faces towards the first air outlet and the second side surface faces towards the return air outlet. The first side surface is laid with a thermal insulation material, and the second side surface is mounted with a lifting mechanism.

[0250] In some embodiments, the air outlet assembly has a second thermal insulation portion located between the air outlet duct and the air return gate, and the second end of the flexible windshield is connected to the second thermal insulation portion.

[0251] In some embodiments, when the air outlet assembly descends to an operation position, the first thermal insulation portion and the second thermal insulation portion cooperate to form a thermal insulation layer for performing thermal insulation on the airflow between the air return gate and the first air outlet.

[0252] In some embodiments, the material of the flexible windshield includes one or more of the following: corrugated board, waterproof cloth and windproof fabric.

[0253] In some embodiments, when the air outlet assembly descends to an operation position, the windward surface of the flexible windshield forms an air deflecting surface for guiding the air output to the first air outlet.

[0254] In some embodiments, the ceiling recessed fan further includes an elastic reel arranged in the main body frame, so that one end of the flexible windshield is connected with the elastic reel. The elastic reel is configured to wind up the flexible windshield when the air outlet assembly ascends.

[0255] In some embodiments, the air outlet assembly includes an air outlet frame, wherein a first air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0256] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein a first air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0257] In some embodiments, the air outlet assembly is provided with at least one second air outlet communicating with the air outlet duct; when the air outlet assembly descends to an operation position, the flexible windshield is unfolded to block the flow of the airflow between the air return gate and the first air outlet and between the air return gate and the second air outlet.

[0258] In some embodiments, when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, a gap which is formed between the air outlet assembly and the main body frame, forms an air supply duct. One end of the air supply duct communicates with the air outlet duct, and the other end of the air supply duct forms a first air outlet.

[0259] In some embodiments, the main body frame further includes a side frame, and when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, an air supply duct is formed between the air outlet assembly and the side frame. The projection of the air outlet assembly at least partially coincides with the projection of the side frame on the mounting planar face of the main body frame.

[0260] In some embodiments, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode: when the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed; when the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open; when the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

[0261] In some embodiments, when the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode; and when the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0262] In the ceiling recessed fan provided by some embodiments of the present disclosure, both ends of the flexible windshield are connected to the main body frame and the air outlet assembly respectively, and when the air outlet assembly first descends to an operation position, the flexible windshield is unfolded to block the air return gate and the first air outlet of the ceiling recessed fan so as to partition the airflow between the air outlet and the first air outlet, thereby preventing the air output from entering the air outlet from the movement gap and reducing the generation of condensation.

[0263] According to a third embodiment of the present disclosure, a ceiling recessed fan is provided to solve the problem in the art that there are many irregular structures inside the air duct of the ceiling recessed fan so that it is likely to cause energy loss of the air output that has been found by the inventors.

[0264] The present disclosure provides a ceiling recessed fan, which includes a main body frame, an air outlet assembly and a lifting mechanism, wherein the main body frame is internally formed with an air outlet duct. The air outlet assembly is connected to the main body frame through a lifting mechanism, and the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame. The main body frame has a first windshield located between the air outlet duct and the air return gate, and the air outlet assembly has a second windshield located between the air outlet duct and the air return gate. When the air outlet assembly descends to an operation position, the first windshield cooperates with the second windshield to block the air return gate and the first air outlet. The ceiling recessed fan further includes: an air deflector located in the air outlet duct. The first end of the air deflector is swingably arranged in the main body frame. When the air outlet assembly descends to an operation position, the second end of the air deflector is in lapped joint with the second windshield. The air deflector covers at least part of the surface structure of the first windshield and at least part of the surface structure of the second windshield, and the air deflector is configured to deflect the air output to the first air outlet.

[0265] In some embodiments, the air outlet assembly ascends and descends to swing the air deflector. During the descending process of the air outlet assembly, and the second end of the air deflector descends by gravity and is in lapped joint with the air outlet assembly. During the ascending process of the air outlet assembly, the air outlet assembly pushes the air deflector to ascend.

[0266] In some embodiments, the second windshield is provided with a first air deflecting surface arranged on one side of the second windshield facing towards the first air outlet, and the second end of the air deflecting plate may be in lapped joint with the first air deflecting surface.

[0267] In some embodiments, the windward surface of the air deflector forms a second air deflecting surface. When the air outlet assembly descends to an operation position, the second air deflecting surface is connected with the first air deflecting surface to form an air deflecting structure.

[0268] In some embodiments, when the air outlet assembly ascends to a retracted position, the air deflector is located in an avoidance position, and the air deflector swings upward to avoid the retracted air outlet assembly.

[0269] In some embodiments, the first windshield and/or the second windshield are/is provided with a thermal insulation layer.

[0270] In some embodiments, the air outlet assembly includes an air outlet frame, wherein a first air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0271] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein a first air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0272] In some embodiments, the air outlet assembly is provided with at least one second air outlet communicating with the air outlet duct; when the air outlet assembly descends to an operation position, the first windshield cooperates with the second windshield to block the flow of the airflow between the air return gate and the first air outlet and between the air return gate and the second air outlet; when the air outlet assembly descends to an operation position, the air deflector is configured to deflect the air output to the first air outlet and/or the second air output.

[0273] In some embodiments, when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, a gap which is formed between the air outlet assembly and the main body frame, forms an air supply duct. One end of the air supply duct communicates with the air outlet duct, and the other end of the air supply duct forms a first air outlet.

[0274] In some embodiments, the main body frame further includes a side frame, and when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, an air supply duct is

formed between the air outlet assembly and the side frame. The projection of the air outlet assembly at least partially coincides with the projection of the side frame on the mounting planar face of the main body frame.

[0275] In some embodiments, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode: when the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed; when the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open; when the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

[0276] In some embodiments, when the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode;

when the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0277] In the ceiling recessed fan provided by some embodiments of the present disclosure, one end of the air deflector is swingably arranged in the main body frame. When the air outlet assembly first descends to an operation position, the air deflector swings so that the other end of the air deflector is in lapped joint with the second windshield by swinging, and covers at least part of the surface structure of the first windshield and at least part of the surface structure of the second windshield. That is, the irregular structure inside the air duct is blocked by the air deflector, which not only prevents the outlet air from flowing through the irregular structure to reduce the generation of turbulence, but also deflects the air output in the air duct to the air outlet through the air deflector, thereby allowing a higher air output efficiency and reducing the air volume loss.

[0278] According to a fourth embodiment of the present disclosure, a ceiling recessed fan is provided to solve the problem that the air output of the ceiling recessed fan enters the air return gate through the movement gap between the air outlet assembly and the main body frame so that it is likely to cause condensation that has been found by the inventors.

[0279] The present disclosure discloses a ceiling recessed fan, including a main body frame, an air outlet assembly and a lifting mechanism. The main body frame is internally formed with an air outlet duct, and the air outlet assembly is connected to the main body frame through a lifting mechanism. The air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame. The ceiling recessed fan further includes: a first windshield arranged in the main body frame and located between the air outlet duct and the air return gate, wherein the first windshield has an accommodating groove; a second windshield arranged on the air outlet assembly and located between the air outlet duct and the air return gate. The first end of the second windshield is connected with the air outlet assembly, the second end of the second windshield is movably arranged in the accommodating groove. When the air outlet assembly descends to an operation position, the first windshield cooperates with the second windshield to block the flow of the airflow between the air return gate and the first air outlet.

[0280] In some embodiments, the notch of the accommodating groove is arranged towards the descending direction of the air outlet assembly, and the second windshield passes through the notch.

[0281] In some embodiments, a sealing structure is provided between the notch and the second windshield.

[0282] In some embodiments, the sealing structure is a sealing brush.

[0283] In some embodiments, the first windshield cooperates with the second windshield to form a maze sealing structure.

[0284] In some embodiments, the second end of the second windshield has a step structure, so that the step structure, the notch and the inner wall of the accommodating groove together form a maze sealing structure.

[0285] In some embodiments, the groove wall of the accommodating groove is provided with a sealing protrusion. When the air outlet assembly descends to an operation position, the sealing protrusion abuts against or is lapped joint with the step structure to form cooperation, so as to block the air return gate and the first air outlet.

[0286] In some embodiments, the ceiling recessed fan has an air outlet duct, and the first windshield has a first side surface located in the air outlet duct, wherein the first side surface is an air deflecting surface for deflecting the air output to the first air outlet.

[0287] In some embodiments, the ceiling recessed fan also has an air return duct, the first windshield also has a second side surface located in the air return duct, and the lifting mechanism is mounted on the second side surface.

[0288] In some embodiments, the first windshield has an annular structure arranged along an outer circumference of the air return gate, and the accommodating groove is an annular groove.

[0289] In some embodiments, the ceiling recessed fan also includes a thermal insulation layer arranged on the inner wall of the accommodating groove and/or the second windshield.

[0290] In some embodiments, the air outlet assembly includes an air outlet frame, wherein a first air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0291] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein a first air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0292] In some embodiments, the air outlet assembly is provided with at least one second air outlet communicating with

the air outlet duct.

[0293] When the air outlet assembly descends to an operation position, the first windshield and the second windshield form cooperation to block the flow of the airflow between the air return gate and the first air outlet and between the air return gate and the second air outlet.

[0294] In some embodiments, when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, a gap which is formed between the air outlet assembly and the main body frame, forms an air supply duct. One end of the air supply duct communicates with the air outlet duct, and the other end of the air supply duct forms a first air outlet.

[0295] In some embodiments, the main body frame further includes a side frame, and when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, an air supply duct is formed between the air outlet assembly and the side frame. The projection of the air outlet assembly at least partially coincides with the projection of the side frame on the mounting planar face of the main body frame.

[0296] In some embodiments, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode: when the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed; when the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open; when the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

[0297] In some embodiments, when the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode; and when the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0298] The ceiling recessed fan provided by some embodiments of the present disclosure is provided with a first windshield and a second windshield. The first windshield is provided with an accommodating groove, and the second end of the second windshield is movably arranged in the accommodating groove. When the air outlet assembly descends to an operation position, the first windshield cooperates with the second windshield so as to block the flow of the airflow between the air return gate and the air outlet, thereby preventing the air output from entering the air return gate through the movement gap and reducing the generation of condensation.

[0299] According to a fifth embodiment of the present disclosure, a ceiling recessed fan is provided to solve the problem that the structure of the air outlet assembly is unreasonably provided so that it is likely to generate vortex so as to cause the air volume that has been found by the inventors.

[0300] The present disclosure provides a ceiling recessed fan, including a main body frame, an air outlet assembly and a lifting mechanism. The main body frame is internally formed with an air outlet duct, and the air outlet assembly is connected to the main body frame through a lifting mechanism. The air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame. The ceiling recessed fan further includes: a vent cover plate arranged on the air outlet assembly and located between the air outlet duct and the air return gate. The vent cover plate has an arc-shaped air deflecting surface for deflecting the airflow to the first air outlet.

[0301] In some embodiments, the vent cover plate is an arc-shaped plate, and covers at least part of the structure of the air outlet assembly.

[0302] In some embodiments, there is a movement gap between the main body frame and the air outlet assembly, and the movement gap communicates with the air return gate of the ceiling recessed fan. The main body frame is provided with a first windshield located at the position of the movement gap. When the air outlet assembly descends to an operation position, the first windshield and the vent cover plate form cooperation to block the movement gap.

[0303] In some embodiments, when the air outlet assembly descends to an operation position, the vent cover plate is in lapped joint with the first windshield so as to block the movement gap.

[0304] In some embodiments, the main body frame is provided with a second windshield located above the first windshield. When the air outlet assembly ascends to a retracted position, the vent cover plate and the second windshield form cooperation so as to block the movement gap.

[0305] In some embodiments, the first windshield and/or the second windshield are/is a reinforcement rib on the main body frame.

[0306] In some embodiments, the distance between the first windshield and the second windshield is a descending height of the air outlet assembly.

[0307] In some embodiments, the air outlet assembly is provided with an air deflector arranged at the position of the first air outlet, and the air deflector has an air deflecting surface in smooth transition with the air deflecting surface.

[0308] In some embodiments, the air outlet assembly is provided with an air deflector, and the air deflector has a lapped joint portion. The lapped joint portion is in lapped joint with the vent cover plate, and the air deflecting surface of the air deflector is connected with the air deflecting surface through the lapped joint portion.

[0309] In some embodiments, the air outlet assembly includes an air outlet frame, wherein a first air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0310] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein a first

air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0311] In some embodiments, the air outlet assembly is provided with at least one second air outlet communicating with the air outlet duct, and the air deflecting surface is configured to deflect the airflow to the first air outlet and/or the second air output.

[0312] In some embodiments, when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, a gap which is formed between the air outlet assembly and the main body frame, forms an air supply duct. One end of the air supply duct communicates with the air outlet duct, and the other end of the air supply duct forms a first air outlet.

[0313] In some embodiments, the main body frame further includes a side frame, and when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, an air supply duct is formed between the air outlet assembly and the side frame. The projection of the air outlet assembly at least partially coincides with the projection of the side frame on the mounting planar face of the main body frame.

[0314] In some embodiments, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode: when the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed; when the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open; when the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

[0315] In some embodiments, when the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode.

When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0316] The ceiling recessed fan provided by some embodiments of the present disclosure is provided with the vent cover plate, and the vent cover plate is provided with the air deflecting surface. When the ceiling recessed fan outputs air, and the airflow inside the ceiling recessed fan passes through the air deflecting surface, the airflow is deflected to the air outlet through the air deflecting surface, which reduces the generation of vortex and allows a more smooth air output, thereby reducing the air volume loss and improving the air output efficiency of the air conditioner.

[0317] According to a sixth embodiment of the present disclosure, in order to solve the technical problem in the art that the ceiling recessed fan involves a manufacturing difficulty and a poor air output effect that has been found by the inventors, a ceiling recessed fan that bears part of the weight of the air outlet assembly by a support assembly to reduce the weight required to be borne by the lifting mechanism so as to reduce the manufacturing difficulty and improve the air output effect is provided.

[0318] The present disclosure provides a ceiling recessed fan, including: a main body frame; a lifting mechanism arranged in the main body frame; an air outlet assembly arranged on the lifting mechanism capable of driving the air outlet assembly to ascend and descend; a support assembly arranged in the main body frame, and capable of providing a support force for the air outlet assembly, wherein the direction of the support force is opposite to the direction of the gravity.

[0319] The air outlet assembly has an operation position that descends to a predetermined height and forms a first air outlet with the main body frame. The air outlet assembly has a first windshield at the position of the first air outlet, and the main body frame has a second windshield at the position of the first air outlet. When the air outlet assembly descends to an operation position, the first windshield cooperates with the second windshield to block the air return gate and the first air outlet. The support assembly is arranged between the first windshield and the second windshield.

[0320] The upper edge of the first windshield is bent towards the second windshield to form a first bent portion, and the upper edge of the second windshield is bent towards the first windshield to form a second bent portion, and the support assembly is arranged between the first bent portion and the second bent portion. Alternatively, the upper edge of the first windshield is bent towards the second windshield to form a first bent portion, and the lower edge of the second windshield is bent towards the first windshield to form a third bent portion, and the support assembly is arranged between the first bent portion and the third bent portion.

[0321] The air outlet assembly is provided with a first boss, the main body frame includes a first mounting structure above the first boss, the first end of the support assembly is arranged on the first mounting structure, and the second end of the support assembly is arranged on the first boss.

[0322] The air outlet assembly is provided with a first boss, the main body frame includes a second mounting structure below the first boss, the first end of the support assembly is arranged on the second mounting structure, and the second end of the support assembly is arranged on the first boss.

[0323] The main body frame is provided with a connector, the upper end of which is arranged in the main body frame, and the lower end of which is bent in a direction away from the center of the main body frame to form the second mounting structure.

[0324] The air outlet assembly has an operation position that descends to a predetermined height and forms a first air outlet with the main body frame. The air outlet assembly has a first windshield at the position of the first air outlet, and the

main body frame has a second windshield at the position of the first air outlet. When the air outlet assembly descends to an operation position, the first windshield cooperates with the second windshield to block the air return gate and the first air outlet. The second windshield forms a connector.

[0325] In the vertical direction, the support assembly has a first end and a second end opposite to each other, wherein the first end is arranged in the main body frame, and the second end is arranged on the air outlet assembly, and the second end can be remote from or proximate to the first end.

[0326] The support assembly includes a deformation member, which is deformed during the lifting process of the air outlet assembly.

[0327] The deformation member includes a spring, which is compressed or stretched during the lifting process of the air outlet assembly; and/or, the deformation member includes a balloon, which is compressed or stretched in the vertical direction when the air outlet assembly descends.

[0328] The air outlet assembly includes an air outlet frame, wherein a first air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0329] The air outlet assembly includes an air outlet frame and an air return panel, wherein a first air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0330] The main body frame is internally formed with an air outlet duct.

The air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and descending to form a first air outlet with the main body frame.

The air outlet assembly is provided with at least one second air outlet communicating with the air outlet duct.

[0331] When the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, a gap which is formed between the air outlet assembly and the main body frame, forms an air supply duct. One end of the air supply duct communicates with the air outlet duct, and the other end of the air supply duct forms a first air outlet.

[0332] The main body frame further includes a side frame, and when the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, an air supply duct is formed between the air outlet assembly and the side frame. The projection of the air outlet assembly at least partially coincides with the projection of the side frame on the mounting planar face of the main body frame.

[0333] The ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

When the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed.

When the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open.

When the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

[0334] When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode.

[0335] When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0336] In the ceiling recessed fan provided by the present disclosure, a support assembly is provided so that part of the gravity of the air outlet assembly is borne by the main body frame, which effectively reduces the lifting force required to be provided by the lifting mechanism. In the case where the air outlet assembly with the same mass in the related art is lifted, the support assembly can apparently reduce the structural requirements of the lifting mechanism, thereby reducing the manufacturing difficulty of the lifting mechanism and reducing the overall structural dimensions of the ceiling recessed fan.

[0337] According to a seventh aspect of the present disclosure, in order to solve the technical problem in the related art that downdraft airflow cooling of the ceiling recessed fan makes people uncomfortable that has been found by the inventors, a ceiling recessed fan with an air supply duct which includes an air outlet assembly arranged in a way so as to be able to be raised and lowered and forms an air supply duct is provided.

[0338] The present disclosure provides a ceiling recessed fan with an air supply duct, including: a main body frame internally formed with an air outlet duct; an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, and descending to form a first air outlet with the main body frame; the air outlet assembly is provided with at least one second air outlet communicating with the air outlet duct.

[0339] When the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, a gap which is formed between the air outlet assembly and the main body frame, forms an air supply duct. One end of the air supply duct communicates with the air outlet duct, and the other end of the air supply duct forms a first air outlet.

[0340] The projection of the air outlet assembly at least partially coincides with the projection of the main body frame on the mounting planar face of the main body frame.

[0341] The ceiling recessed fan further includes an air deflector which is rotatably arranged at the second air outlet and capable of closing or opening the second air outlet.

[0342] The air deflector is provided with a plurality of partition plates. All the partition plates are arranged in parallel along the length direction of the air deflector, and a flow channel is formed between two adjacent partition plates.

[0343] A step sealing structure is provided between the edge of the air deflector and the edge of the second air outlet.

[0344] The edge of the air deflector is provided with a first step structure, and the edge of the second air outlet is provided with a second step structure, so that the first step structure and the second step structure are fit to form a step sealing structure.

[0345] The first step structure includes an elastic sealing material; and/or, the second step structure includes an elastic sealing material.

[0346] The ceiling recessed fan also includes at least two partition plates, all the partition plates are arranged in the air outlet duct, and a flow channel is formed between the two adjacent partition plates.

[0347] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.

[0348] The lifting mechanism is connected to one side of the air outlet assembly away from the air return gate of the ceiling recessed fan.

[0349] The lifting mechanism is connected to the corner of the air outlet assembly.

[0350] The lifting mechanism includes: a driving device; a transmission mechanism connected with the air outlet assembly and drivingly connected with the driving device, wherein the drive device drives the air outlet assembly to ascend and descend through the transmission mechanism; the transmission mechanism includes a guiding portion; and a guiding mechanism, wherein the guiding mechanism and the guiding portion are movable relative to each other in a lifting direction of the air outlet assembly, and at the same time, the guiding mechanism is in limiting fit with the guiding portion in a horizontal direction.

[0351] The guiding mechanism includes a guiding unit, and the guiding unit has two guiding members arranged oppositely. A guiding channel is formed between the two guiding members, and the guiding portion is located in the guiding channel.

[0352] There are a plurality of guiding units arranged at intervals along the lifting direction of the air outlet assembly.

[0353] The transmission mechanism includes: a gear mounted on an output shaft of the driving device; a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack; and the guiding portion is located on the rack. The guiding portion is a guiding column on the rack, and the two opposite guiding members are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members through the guiding grooves.

[0354] The first side of the rack is provided with a meshing tooth, the second side is provided with a guiding portion, and the rack is provided with a mounting groove located between the meshing tooth and the guiding portion.

[0355] The two guiding members of the guiding unit are located on both sides of the guiding portion respectively, and one of the guiding members of the guiding unit is located in the mounting groove. The extension direction of the mounting groove is the lifting direction of the air outlet assembly, and the mounting groove has a first end wall located above and a second end wall located below along a lifting direction of the air outlet assembly, and the maximum distance between the first end wall and the guiding unit is equal to a maximum descending height of the air outlet assembly.

[0356] The guiding member includes a slider in sliding fit with the guiding portion and/or a roller in rolling fit with the guiding portion.

[0357] The lifting mechanism also includes a mounting box arranged in the main body frame, and the transmission mechanism and the guiding mechanism are mounted in the mounting box.

[0358] The driving device is arranged outside the mounting box, and the output shaft of the electric motor passes through the inside of the mounting box.

[0359] The air outlet assembly is provided with a first windshield, and the main body frame is provided with a second windshield. The first windshield cooperates with the second windshield to block the air return gate and the air outlet duct, and the first windshield can move relative to the second windshield.

[0360] A sealing member is provided between the contact surfaces of the first windshield and the second windshield.

[0361] The included angle β between the air output direction of the first air outlet and the horizontal plane is in the angle range of $-20^\circ \leq \beta \leq 45^\circ$; and when $\beta = 0^\circ$, the air output direction of the first air outlet is parallel to the horizontal direction; and when $\beta > 0^\circ$, the air output direction of the first air outlet tilts upwards relative to the horizontal direction.

[0362] The included angle β between the air output direction of the first air outlet and the horizontal plane is in the angle range of $0^\circ \leq \beta \leq 30^\circ$, and when $\beta > 0^\circ$, the air output direction of the first air outlet tilts upward relative to the horizontal plane.

[0363] The air outlet assembly has a first descending height L_1 , and the value of the predetermined height L_1 is in the

range of $15\text{mm} \leq L_1 \leq 60\text{mm}$.

[0364] The air outlet assembly has a first descending height L_1 , and the value of the predetermined height L_1 is in the range of $20\text{mm} \leq L_1 \leq 50\text{mm}$.

[0365] The ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

When the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed;

When the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open;

When the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

[0366] When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode.

[0367] When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0368] The main body frame includes a side frame; and when the air outlet assembly descends to form a first air outlet with the main body frame, the air supply duct is formed between the air outlet assembly and the side frame, the part of the side frame for forming the air supply duct is arranged obliquely relative to a horizontal plane; and/or, the part of the air outlet assembly for forming the air supply duct is arranged obliquely relative to a horizontal plane.

[0369] The tilting angle α formed between the part of the side frame for forming the air supply duct and a horizontal plane is in the angle range of $-20^\circ \leq \alpha \leq 45^\circ$, and when $\alpha = 0^\circ$, the part of the side frame for forming the air supply duct is parallel to a horizontal direction, and when $\alpha > 0^\circ$, the part of the side frame for forming the air supply duct tilts upward relative to the horizontal plane; and/or, the tilting angle β formed between the part of the air outlet assembly for forming the air supply duct and a horizontal plane is in the angle range of $-20^\circ \leq \beta \leq 45^\circ$, and when $\beta = 0^\circ$, the part of the air outlet assembly for forming the air supply duct is parallel to a horizontal direction, and when $\beta > 0^\circ$, the part of the air outlet assembly for forming the air supply duct tilts upward relative to a horizontal plane.

[0370] The air outlet assembly includes an air outlet frame, which is lifted independently.

[0371] The air outlet assembly includes an air outlet frame and an air return panel, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0372] In the ceiling recessed fan with an air supply duct provided by the present disclosure, the air outlet assembly descends and the first air outlet is formed between the air outlet assembly and the main body frame, so that the ceiling recessed fan outputs air distally, thereby effectively overcoming the problem that it is only possible to generate a downdraft airflow blow in the related art that have been found by the inventors. The first air outlet may output air horizontally or even obliquely upwards by tilting of the air outlet assembly, tilting of the side frame and/or a method of at least partially coinciding a projection of the air outlet assembly with the side frame, so as to realize a "waterfall" refrigeration. At the same time, in order to improve the air output effect, a second air outlet for downward air output is also provided, so that the ceiling recessed fan can simultaneously meet the requirements of downward air output in the related art at the same time, and an air output method of the ceiling recessed fan is increased by opening and closing the first air outlet and the second air outlet, thereby further improving the air output effect of the ceiling recessed fan.

[0373] According to an eighth embodiment of the present disclosure, the present disclosure discloses a ceiling recessed fan to solve the problem of vibration of the air outlet assembly during the lifting process that has been found by the inventors.

[0374] The present disclosure discloses a ceiling recessed fan, which includes a main body frame, an air outlet assembly and a lifting mechanism, wherein the air outlet assembly is connected to the main body frame through the lifting mechanism. The lifting mechanism includes a driving device, a transmission mechanism and a guiding mechanism, wherein the transmission mechanism is connected with the air outlet assembly and the transmission mechanism is drivingly connected with the driving device which drives the air outlet assembly to ascend and descend through the transmission mechanism. The transmission mechanism has a guiding portion. The guiding mechanism and the guiding portion may move relative to each other in the lifting direction of the air outlet assembly. At the same time, the guiding mechanism is in limiting fit with the guiding portion in the horizontal direction.

[0375] In some embodiments, the guiding mechanism includes a guiding unit, and the guiding unit has two guiding members arranged oppositely. A guiding channel is formed between the two guiding members, and the guiding portion is located in the guiding channel.

[0376] In some embodiments, there are a plurality of guiding units arranged at intervals along the lifting direction of the air outlet assembly.

[0377] In some embodiments, the transmission mechanism includes: a gear mounted on an output shaft of the driving device; a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives

the air outlet assembly to ascend and descend by cooperation between the gear and the rack; and the guiding portion is located on the rack.

[0378] In some embodiments, the guiding portion is a guiding column on the rack, and the two opposite guiding members are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members through the guiding grooves.

[0379] In some embodiments, the first side of the rack is provided with a meshing tooth, and the second side is provided with a guiding portion. The rack is provided with a mounting groove located between the meshing tooth and the guiding portion. Two guiding members of the guiding unit are located on both sides of the guiding portion respectively, and one of the guiding members of the guiding unit is located in the mounting groove.

[0380] In some embodiments, the extension direction of the mounting groove is the lifting direction of the air outlet assembly, and the mounting groove has a first end wall located above and a second end wall located below along a lifting direction of the air outlet assembly, and the maximum distance between the first end wall and the guiding unit is equal to a maximum descending height of the air outlet assembly.

[0381] In some embodiments, the guiding member includes a slider in sliding fit with the guiding portion and/or a roller in rolling fit with the guiding portion.

[0382] In some embodiments, the guiding mechanism includes two guiding units arranged at intervals along the lifting direction of the air outlet assembly, and the guiding unit and the guiding portion are in sliding fit in the lifting direction of the air outlet assembly. At the same time, the guiding mechanism and the guiding portion are in limiting fit in the horizontal direction. For the maximum descending height B of the air outlet assembly and the spacing distance C between the two guiding units, the ratio of B/C is in the range of 2:1 to 4:1.

[0383] In some embodiments, the transmission mechanism includes: a gear mounted on an output shaft of the driving device; a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack; and the guiding portion is located on the rack; for a length A of the rack along a lifting direction of the air outlet assembly, the ratio of A/C is in the range of 3:1 to 5:1.

[0384] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0385] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0386] In some embodiments, the lifting mechanism also includes a mounting box arranged in the main body frame, and the transmission mechanism and the guiding mechanism are mounted in the mounting box.

[0387] In some embodiments, the mounting box includes: a box body fixedly connected with the main body frame; and a box cover detachably arranged on the box body.

[0388] In some embodiments, the driving device is arranged outside the mounting box, and the output shaft of the electric motor passes through the inside of the mounting box.

[0389] In the ceiling recessed fan provided by some embodiments of the present disclosure, the transmission mechanism is provided with the guiding portion, so that the transmission mechanism cooperates with the guiding mechanism through the guiding portion, and the guiding mechanism restricts the movement direction of the transmission mechanism, so that the transmission mechanism moves in the lifting direction of the air outlet assembly without shaking in the horizontal direction, which allows that the transmission mechanism and the driving mechanism cooperate with each other more closely and stably, thereby lessening the vibration of the transmission mechanism during the driving process and reducing the generation of noise.

[0390] The present disclosure discloses a recessed air conditioner with a transmission mechanism to solve the problem of vibration of the air outlet assembly during the lifting process that has been found by the inventors.

[0391] The present disclosure discloses a recessed air conditioner with a transmission mechanism, which includes a main body frame, an air outlet assembly and a lifting mechanism, wherein the air outlet assembly is connected to the main body frame through the lifting mechanism. The lifting mechanism includes a driving device, a transmission mechanism and a guiding mechanism, wherein the transmission mechanism is connected with the air outlet assembly and the transmission mechanism is drivingly connected with the driving device which drives the air outlet assembly to ascend and descend through the transmission mechanism. The transmission mechanism has a guiding portion. The guiding mechanism and the guiding portion may move relative to each other in the lifting direction of the air outlet assembly. At the same time, the guiding mechanism is in limiting fit with the guiding portion in the horizontal direction.

[0392] In some embodiments, the guiding mechanism includes a guiding unit, and the guiding unit has two guiding members arranged oppositely. A guiding channel is formed between the two guiding members, and the guiding portion is located in the guiding channel.

[0393] In some embodiments, there are a plurality of guiding units arranged at intervals along the lifting direction of the air outlet assembly.

[0394] In some embodiments, the transmission mechanism includes: a gear mounted on an output shaft of the driving device; a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack; and the guiding portion is located on the rack.

[0395] In some embodiments, the guiding portion is a guiding column on the rack, and the two opposite guiding members are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members through the guiding grooves.

[0396] In some embodiments, the first side of the rack is provided with a meshing tooth, and the second side is provided with a guiding portion. The rack is provided with a mounting groove located between the meshing tooth and the guiding portion. Two guiding members of the guiding unit are located on both sides of the guiding portion respectively, and one of the guiding members of the guiding unit is located in the mounting groove.

[0397] In some embodiments, the extension direction of the mounting groove is the lifting direction of the air outlet assembly, and the mounting groove has a first end wall located above and a second end wall located below along a lifting direction of the air outlet assembly, and the maximum distance between the first end wall and the guiding unit is equal to a maximum descending height of the air outlet assembly.

[0398] In some embodiments, the guiding member includes a slider in sliding fit with the guiding portion and/or a roller in rolling fit with the guiding portion.

[0399] In some embodiments, the guiding mechanism includes two guiding units arranged at intervals along the lifting direction of the air outlet assembly, and the guiding unit and the guiding portion are in sliding fit in the lifting direction of the air outlet assembly. At the same time, the guiding mechanism and the guiding portion are in limiting fit in the horizontal direction. For the maximum descending height B of the air outlet assembly and the spacing distance C between the two guiding units, the ratio of B/C is in the range of 1:1 to 4:1.

[0400] In some embodiments, the transmission mechanism includes: a gear mounted on an output shaft of the driving device; a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack; and the guiding portion is located on the rack; for a length A of the rack along a lifting direction of the air outlet assembly, the ratio of A/C is in the range of 2:1 to 5:1.

[0401] In some embodiments, the air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

[0402] In some embodiments, the air outlet assembly includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0403] In some embodiments, the lifting mechanism also includes a mounting box arranged in the main body frame, and the transmission mechanism and the guiding mechanism are mounted in the mounting box.

[0404] In some embodiments, the mounting box includes: a box body fixedly connected with the main body frame; and a box cover detachably arranged on the box body.

[0405] In some embodiments, the driving device is arranged outside the mounting box, and the output shaft of the electric motor passes through the inside of the mounting box.

[0406] In some embodiments, the air outlet assembly descends to form an air supply duct with the main body frame, so that one end of the air supply duct forms a first air outlet, and the other end of the air supply duct communicates with an air outlet duct of the recessed air conditioner.

[0407] In some embodiments, the air outlet assembly is also provided with a second air outlet communicating with the air outlet duct of the recessed air conditioner.

[0408] In some embodiments, the air outlet assembly is provided with an air deflector located at the position of the first air outlet and/or the second air outlet.

[0409] In some embodiments, the projection of the air outlet assembly on the ground coincides with the projection of the main body frame on the ground.

[0410] In the recessed air conditioner provided by some embodiments of the present disclosure, the transmission mechanism is provided with the guiding portion, so that the transmission mechanism cooperates with the guiding mechanism through the guiding portion, and the guiding mechanism restricts the movement direction of the transmission mechanism, so that the transmission mechanism moves in the lifting direction of the air outlet assembly without shaking in the horizontal direction, which allows that the transmission mechanism and the driving mechanism cooperate with each other more closely and stably, thereby lessening the vibration of the transmission mechanism during the driving process and reducing the generation of noise.

[0411] In order to solve the technical problem in the related art that downdraft airflow cooling of the ceiling recessed fan makes people uncomfortable that has been found by the inventors, a ceiling recessed fan with an air supply duct which includes an air outlet assembly arranged in a way so as to be able to raised and lowered and forms an air supply duct is provided.

[0412] Therefore, the present disclosure provides a ceiling recessed fan with an air supply duct, including: a main body frame internally formed with an air outlet duct; an air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and descending to form a first air outlet with the main body frame; the air outlet assembly is provided with at least one second air outlet communicating with the air outlet duct.

[0413] When the air outlet assembly descends so that a first air outlet is formed between the air outlet assembly and the main body frame, a gap which is formed between the air outlet assembly and the main body frame, forms an air supply duct. One end of the air supply duct communicates with the air outlet duct, and the other end of the air supply duct forms a first air outlet.

[0414] The projection of the air outlet assembly at least partially coincides with the projection of the main body frame on the mounting planar face of the main body frame.

[0415] The ceiling recessed fan further includes an air deflector which is rotatably arranged at the second air outlet and capable of closing or opening the second air outlet.

[0416] The air deflector is provided with a plurality of partition plates. All the partition plates are arranged in parallel along the length direction of the air deflector, and a flow channel is formed between two adjacent partition plates.

[0417] A step sealing structure is provided between the edge of the air deflector and the edge of the second air outlet.

[0418] The edge of the air deflector is provided with a first step structure, and the edge of the second air outlet is provided with a second step structure, so that the first step structure and the second step structure are fit to form a step sealing structure.

[0419] The first step structure includes an elastic sealing material; and/or, the second step structure includes an elastic sealing material.

[0420] The ceiling recessed fan also includes at least two partition plates, all the partition plates are arranged in the air outlet duct, and a flow channel is formed between the two adjacent partition plates.

[0421] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.

[0422] The lifting mechanism is connected to one side of the air outlet assembly away from the air return gate of the ceiling recessed fan.

[0423] The lifting mechanism is connected to the corner of the air outlet assembly.

[0424] The lifting mechanism includes: a driving device; a transmission mechanism connected with the air outlet assembly and drivingly connected with the driving device, wherein the drive device drives the air outlet assembly to ascend and descend through the transmission mechanism; the transmission mechanism includes a guiding portion; and a guiding mechanism, wherein the guiding mechanism and the guiding portion are movable relative to each other in a lifting direction of the air outlet assembly, and at the same time, the guiding mechanism is in limiting fit with the guiding portion in a horizontal direction.

[0425] The guiding mechanism includes a guiding unit, and the guiding unit has two guiding members arranged oppositely. A guiding channel is formed between the two guiding members, and the guiding portion is located in the guiding channel.

[0426] There are a plurality of guiding units arranged at intervals along the lifting direction of the air outlet assembly.

[0427] The transmission mechanism includes: a gear mounted on an output shaft of the driving device; a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack; and the guiding portion is located on the rack.

[0428] The guiding portion is a guiding column on the rack, and the two opposite guiding members are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members through the guiding grooves.

[0429] The first side of the rack is provided with a meshing tooth, the second side is provided with a guiding portion, and the rack is provided with a mounting groove located between the meshing tooth and the guiding portion; The two guiding members of the guiding unit are located on both sides of the guiding portion respectively, and one of the guiding members of the guiding unit is located in the mounting groove.

[0430] The extension direction of the mounting groove is the lifting direction of the air outlet assembly, and the mounting groove has a first end wall located above and a second end wall located below along a lifting direction of the air outlet assembly, and the maximum distance between the first end wall and the guiding unit is equal to a maximum descending height of the air outlet assembly.

[0431] The guiding member includes a slider in sliding fit with the guiding portion and/or a roller in rolling fit with the guiding portion.

[0432] The lifting mechanism also includes a mounting box arranged in the main body frame, and the transmission mechanism and the guiding mechanism are mounted in the mounting box.

[0433] The driving device is arranged outside the mounting box, and the output shaft of the electric motor passes through the inside of the mounting box.

[0434] The air outlet assembly is provided with a first windshield, and the main body frame is provided with a second

windshield. The first windshield cooperates with the second windshield to block the air return gate and the air outlet duct, and the first windshield can move relative to the second windshield.

[0435] A sealing member is provided between the contact surfaces of the first windshield and the second windshield.

[0436] The included angle β between the air output direction of the first air outlet and the horizontal plane is in the angle range of $-20^\circ \leq \beta \leq 45^\circ$; and when $\beta = 0^\circ$, the air output direction of the first air outlet is parallel to the horizontal direction; and when $\beta > 0^\circ$, the air output direction of the first air outlet tilts upwards relative to the horizontal direction.

[0437] The included angle β between the air output direction of the first air outlet and the horizontal plane is in the angle range of $0^\circ \leq \beta \leq 30^\circ$, and when $\beta > 0^\circ$, the air output direction of the first air outlet tilts upward relative to the horizontal plane.

[0438] The air outlet assembly has a first descending height L1, and the value of the predetermined height L1 is in the range of $15\text{mm} \leq L1 \leq 60\text{mm}$.

[0439] The air outlet assembly has a first descending height L1, and the value of the predetermined height L1 is in the range of $20\text{mm} \leq L1 \leq 50\text{mm}$.

[0440] The ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

When the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed;

When the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open.

When the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

[0441] When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode.

When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0442] The main body frame includes a side frame; and when the air outlet assembly descends to form a first air outlet with the main body frame, the air supply duct is formed between the air outlet assembly and the side frame, the part of the side frame for forming the air supply duct is arranged obliquely relative to a horizontal plane; and/or, the part of the air outlet assembly for forming the air supply duct is arranged obliquely relative to a horizontal plane.

[0443] The tilting angle a formed between the part of the side frame for forming the air supply duct and a horizontal plane is in the angle range of $-20^\circ \leq a \leq 45^\circ$, and when $a = 0^\circ$, the part of the side frame for forming the air supply duct is parallel to a horizontal direction, and when $a > 0^\circ$, the part of the side frame for forming the air supply duct tilts upward relative to the horizontal plane; and/or, the tilting angle b formed between the part of the air outlet assembly for forming the air supply duct and a horizontal plane is in the angle range of $-20^\circ \leq b \leq 45^\circ$, and when $b = 0^\circ$, the part of the air outlet assembly for forming the air supply duct is parallel to a horizontal direction, and when $b > 0^\circ$, the part of the air outlet assembly for forming the air supply duct tilts upward relative to a horizontal plane.

[0444] The air outlet duct has a first end and a second end along an airflow direction, the first air outlet and the second air outlet both communicate with the second end, and the ratio of the width D1 of the first end to the width D2 of the second air outlet is in the range of $0.75 \leq D2/D1 \leq 0.85$.

[0445] The air outlet assembly includes an air outlet frame, which is lifted independently.

[0446] The air outlet assembly includes an air outlet frame and an air return panel, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0447] In the ceiling recessed fan with an air supply duct provided by the present disclosure, the air outlet assembly descends and the first air outlet is formed between the air outlet assembly and the main body frame, so that the ceiling recessed fan performs air output distally, thereby effectively overcoming the problem that it is only possible to generate a downdraft airflow so as to cause skin blow in the related art that have been found by the inventors. The first air outlet may output air horizontally or even obliquely upwards by tilting of the air outlet assembly, tilting of the side frame and/or a method of at least partially coinciding a projection of the air outlet assembly with the side frame, so as to realize a "waterfall" refrigeration. At the same time, in order to improve the air output effect, a second air outlet for downward air output is also provided, so that the ceiling recessed fan can simultaneously meet the requirements of downward air output in the related art at the same time, and an air output method of the ceiling recessed fan is increased by opening and closing the first air outlet and the second air outlet, thereby further improving the air output effect of the ceiling recessed fan.

BRIEF DESCRIPTION OF THE DRAWINGS

[0448]

Figure 1 is a schematic structural view of a ceiling recessed fan according to a first embodiment of the present

disclosure.

Figure 2 is another schematic structural view of a ceiling recessed fan according to a first embodiment of the present disclosure.

Figure 3 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.47 according to a first embodiment of the present disclosure.

Figure 4 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.6 according to a first embodiment of the present disclosure.

Figure 5 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.75 according to a first embodiment of the present disclosure.

Figure 6 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.33 according to a first embodiment of the present disclosure.

Figure 7 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.25 according to a first embodiment of the present disclosure.

Figure 8 is a schematic structural view of a ceiling recessed fan according to a second embodiment of the present disclosure.

Figure 9 is another schematic structural view of a ceiling recessed fan according to a second embodiment of the present disclosure.

Figure 10 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.75 according to a second embodiment of the present disclosure.

Figure 11 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.8 according to a second embodiment of the present disclosure.

Figure 12 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.9 according to a second embodiment of the present disclosure.

Figure 13 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.67 according to a second embodiment of the present disclosure.

Figure 14 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.6 according to a second embodiment of the present disclosure.

Figure 15 is a wind field simulation diagram of a ceiling recessed fan having an air deflector and when h_1/h_2 is about 0.75 according to a second embodiment of the present disclosure.

Figure 16 is a wind field simulation diagram of a ceiling recessed fan having an air deflector and when h_1/h_2 is about 0.8 according to a second embodiment of the present disclosure.

Figure 17 is a wind field simulation diagram of a ceiling recessed fan having an air deflector and when h_1/h_2 is about 0.9 according to a second embodiment of the present disclosure.

Figure 18 is a wind field simulation diagram of a ceiling recessed fan having an air deflector and when h_1/h_2 is about 0.67 according to a second embodiment of the present disclosure.

Figure 19 is a wind field simulation diagram of a ceiling recessed fan having an air deflector and when h_1/h_2 is about 0.6 according to a second embodiment of the present disclosure.

Figure 20 is a schematic structural view of a ceiling recessed fan according to a third embodiment of the present disclosure.

Figure 21 is a cross-sectional view of a ceiling recessed fan according to a fourth embodiment of the present disclosure.

Figure 22 is a bottom view of a ceiling recessed fan according to a fourth embodiment of the present disclosure.

Figure 23 is a simulation view of a ceiling recessed fan when a ratio of D/h_1 is 0.33 according to a fourth embodiment of the present disclosure.

Figure 24 is a simulation view of a ceiling recessed fan when a ratio of D/h_1 is 0.4 according to a fourth embodiment of the present disclosure.

Figure 25 is a cross-sectional view of a ceiling recessed fan according to a fifth embodiment and a sixth embodiment of the present disclosure.

Figure 26 is a wind field simulation view of a ceiling recessed fan when the angle c is -10° according to a fifth embodiment and a sixth embodiment of the present disclosure.

Figure 27 is a wind field simulation view of a ceiling recessed fan when the angle c is 0° according to a fifth embodiment and a sixth embodiment of the present disclosure.

Figure 28 is a wind field simulation view of a ceiling recessed fan when the angle c is 10° according to a fifth embodiment and a sixth embodiment of the present disclosure.

Figure 29 is a wind field simulation view of a ceiling recessed fan when the angle c is 15° according to a fifth embodiment and a sixth embodiment of the present disclosure.

Figure 30 is a wind field simulation view of a ceiling recessed fan when the angle c is -15° according to a fifth embodiment and a sixth embodiment of the present disclosure.

Figure 31 is a cross-sectional view of a ceiling recessed fan according to a seventh embodiment of the present disclosure.

Figure 32 is a bottom view of a ceiling recessed fan according to a seventh embodiment of the present disclosure.

Figure 33 is another bottom view of a ceiling recessed fan according to a seventh embodiment of the present disclosure.

Figure 34 is a schematic structural view of a ceiling recessed fan according to an eighth embodiment of the present disclosure.

Figure 35 is another schematic structural view of a ceiling recessed fan according to an eighth embodiment of the present disclosure.

Figure 36 is a schematic structural view of a ceiling recessed fan according to a ninth embodiment of the present disclosure.

Figure 37 is a schematic structural view of a ceiling recessed fan according to a tenth embodiment of the present disclosure.

Figure 38 is a schematic structural view of a ceiling recessed fan according to some embodiments provided by the present disclosure.

Figure 39 is another schematic structural view of a ceiling recessed fan provided by some embodiments of the present disclosure.

Figure 40 is a cross-sectional view of a ceiling recessed fan provided by some embodiments of the present disclosure.

Figure 41 is a schematic structural view of a ceiling recessed fan provided by some embodiments of the present disclosure.

Figure 42 is a cross-sectional view of a ceiling recessed fan according to some embodiments provided by the present disclosure.

Figure 43 is a wind field simulation view when the angle c is -10° according to some embodiments provided by the present disclosure.

Figure 44 is a wind field simulation view when the angle c is 0° according to some embodiments provided by the present disclosure.

Figure 45 is a wind field simulation view when the angle c is 10° according to some embodiments provided by the present disclosure.

Figure 46 is a wind field simulation view when the angle c is 15° according to some embodiments provided by the present disclosure.

Figure 47 is a wind field simulation view when the angle c is -15° according to some embodiments provided by the present disclosure.

Figure 48 is a schematic structural view of a ceiling recessed fan according to some embodiments provided by the present disclosure.

Figure 49 is another schematic structural view of a ceiling recessed fan according to some embodiments provided by the present disclosure.

Figure 50 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.47 according to some embodiments provided by the present disclosure.

Figure 51 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.6 according to some embodiments provided by the present disclosure.

Figure 52 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.75 according to some embodiments provided by the present disclosure.

Figure 53 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.33 according to some embodiments provided by the present disclosure.

Figure 54 is a wind field simulation diagram of a ceiling recessed fan when h_1/h_2 is about 0.25 according to some embodiments provided by the present disclosure.

] Figure 55 is another schematic structural view of a ceiling recessed fan provided by some embodiments of the present disclosure.

Figure 56 is a cross-sectional view of a ceiling recessed fan provided by some embodiments of the present disclosure.

Figure 57 is a schematic structural view of a ceiling recessed fan provided by some embodiments of the present disclosure.

Figure 58 is another schematic structural view of a ceiling recessed fan provided by some embodiments of the present disclosure.

Figure 59 is a cross-sectional view of a ceiling recessed fan provided by some embodiments of the present disclosure.

Figure 60 is a structural view of a ceiling recessed fan provided by some embodiments applying the present disclosure.

Figure 61 is a structural view of another ceiling recessed fan applying the present disclosure.

Figure 62 is a structural view of an air outlet and an air deflecting member according to another embodiment of the

present disclosure.

Figure 63 is a flowchart of a control method of a ceiling recessed fan according to an embodiment of the present disclosure.

Figure 64 is a flowchart of a control method of a ceiling recessed fan according to another embodiment of the present disclosure.

Figure 65 is a flowchart of a control method of a ceiling recessed fan according to a further embodiment of the present disclosure.

Figure 66 is a structural block view of a control apparatus according to an embodiment of the present disclosure.

Figure 67 is a structural block view of a control apparatus according to another embodiment of the present disclosure.

Figure 68 is a schematic structural view of a ceiling recessed fan when the air outlet assembly descends to an operation position according to a first embodiment of the present disclosure.

Figure 69 is a schematic view of an internal structure of a ceiling recessed fan according to a first embodiment of the present disclosure.

Figure 70 is a schematic structural view of a lifting mechanism of a ceiling recessed fan according to a first embodiment of the present disclosure.

Figure 71 is a schematic structural view of a ceiling recessed fan when in a first air output mode according to a second embodiment of the present disclosure.

Figure 72 is a schematic structural view of a ceiling recessed fan when in a second air output mode according to a second embodiment of the present disclosure.

Figure 73 is a schematic structural view of an air outlet assembly of a ceiling recessed fan in an operation position according to a third embodiment of the present disclosure.

Figure 74 is a schematic structural view of a ceiling recessed fan according to a third embodiment of the present disclosure.

Figure 75 is a schematic structural view of a ceiling recessed fan when in a first air output mode according to a fourth embodiment of the present disclosure.

Figure 76 is a schematic structural view of a ceiling recessed fan when in a second air output mode according to a fourth embodiment of the present disclosure.

Figure 77 is a schematic structural view of a ceiling recessed fan in an operation state according to a fifth embodiment of the present disclosure.

Figure 78 is a schematic structural view of a ceiling recessed fan in a power-off state according to a fifth embodiment of the present disclosure.

Figure 79 is a schematic structural view of a ceiling recessed fan when in a first air output mode according to a sixth embodiment of the present disclosure.

Figure 80 is a schematic structural view of a ceiling recessed fan when in a second air output mode according to a sixth embodiment of the present disclosure.

Figure 81 is a schematic structural view of a ceiling recessed fan according to a seventh embodiment of the present disclosure.

Figure 82 is a schematic structural view of an air outlet assembly of a ceiling recessed fan descending to an operation position according to a seventh embodiment of the present disclosure.

Figure 83 is a schematic structural view of a ceiling recessed fan when in a first air output mode according to an eighth embodiment of the present disclosure.

Figure 84 is a schematic structural view of a ceiling recessed fan when in a second air output mode according to an eighth embodiment of the present disclosure.

Figure 85 is a schematic structural view of a ceiling recessed fan in an operation position according to a ninth embodiment of the present disclosure.

Figure 86 is a schematic structural view of a ceiling recessed fan in a retracted position according to a ninth embodiment of the present disclosure.

Figure 87 is a schematic structural view of a ceiling recessed fan when in a first air output mode according to a tenth embodiment of the present disclosure.

Figure 88 is a schematic structural view of a ceiling recessed fan when in a second air output mode according to a tenth embodiment of the present disclosure.

Figure 89 is a schematic structural view of a ceiling recessed fan according to an eleventh embodiment of the present disclosure.

Figure 90 is another schematic structural view of a ceiling recessed fan according to an eleventh embodiment of the present disclosure.

Figure 91 is a schematic structural view of a ceiling recessed fan having a first boss according to a twelfth embodiment of the present disclosure.

Figure 92 is a schematic structural view of a ceiling recessed fan having a first boss according to a thirteenth

embodiment of the present disclosure.

Figure 93 is a schematic structural view of a ceiling recessed fan according to a fourteenth embodiment of the present disclosure.

Figure 94 is a schematic structural view of another ceiling recessed fan according to a fourteenth embodiment of the present disclosure.

Figure 95 is a schematic structural view of a ceiling recessed fan having a first boss according to a fifteenth embodiment of the present disclosure.

Figure 96 is a schematic structural view of a ceiling recessed fan having a first boss according to a sixteenth embodiment of the present disclosure.

Figure 97 is a schematic structural view of a ceiling recessed fan according to a seventeenth embodiment of the present disclosure.

Figure 98 is a schematic structural view of a ceiling recessed fan with the second air outlet opened according to a seventeenth embodiment of the present disclosure.

Figure 99 is a schematic structural view of a ceiling recessed fan with the first air outlet opened according to a seventeenth embodiment of the present disclosure.

Figure 100 is a schematic structural view of a ceiling recessed fan with the first air outlet and the second air outlet both opened according to a seventeenth embodiment of the present disclosure.

Figure 101 is a schematic structural view of an air outlet assembly and an air deflector according to a seventeenth embodiment of the present disclosure.

Figure 102 is a schematic structural view of a lifting mechanism according to a seventeenth embodiment of the present disclosure.

Figure 103 is a schematic structural view of a lifting mechanism after descending according to a seventeenth embodiment of the present disclosure.

Figure 104 is a cross-sectional view of the second air outlet opened according to a seventeenth embodiment of the present disclosure.

Figure 105 is a cross-sectional view of the first air outlet opened according to a seventeenth embodiment of the present disclosure.

Figure 106 is another cross-sectional view of the first air outlet opened according to a seventeenth embodiment of the present disclosure.

Figure 107 is a cross-sectional view of the first air outlet and the second air outlet both opened according to a seventeenth embodiment of the present disclosure. Figure 108 is a schematic structural view of a lifting mechanism of an embedded air conditioner according to a first embodiment of the present disclosure.

Figure 109 is a schematic structural view of a lifting mechanism of an embedded air conditioner in a descending state according to a first embodiment of the present disclosure.

Figure 110 is a schematic structural view of an embedded air conditioner according to a first embodiment of the present disclosure.

Figure 111 is a schematic structural view of an embedded air conditioner in a first air output mode according to a second embodiment of the present disclosure.

Figure 112 is a schematic structural view of an embedded air conditioner in a second air output mode according to a second embodiment of the present disclosure.

Figure 113 is a schematic structural view of a ceiling recessed fan provided by an embodiment of the present disclosure.

Figure 114 is a schematic structural view of a ceiling recessed fan with the second air outlet opened provided by an embodiment of the present disclosure. Figure 115 is a schematic structural view of a ceiling recessed fan with the first air outlet opened provided by an embodiment of the present disclosure.

Figure 116 is a schematic structural view of a ceiling recessed fan with the first air outlet and the second air outlet both opened provided by an embodiment of the present disclosure.

Figure 117 is a schematic structural view of an air outlet assembly and an air deflector provided by an embodiment of the present disclosure.

Figure 118 is a schematic structural view of a lifting mechanism provided by an embodiment of the present disclosure.

Figure 119 is a schematic structural view of a lifting mechanism after descending provided by an embodiment of the present disclosure.

Figure 120 is a cross-sectional view of the second air outlet opened provided by an embodiment of the present disclosure.

Figure 121 is a cross-sectional view of the first air outlet opened provided by an embodiment of the present disclosure.

Figure 122 is another cross-sectional view of the first air outlet opened provided by an embodiment of the present disclosure.

Figure 123 is a cross-sectional view of the first air outlet and the second air outlet both opened provided by an

embodiment of the present disclosure.

Figure 124 is another schematic structural view of a ceiling recessed fan provided by an embodiment of the present disclosure.

DESCRIPTION OF THE INVENTION

[0449] The implementation of the present disclosure will be introduced in detail in conjunction with Figs. 1 to 124.

[0450] Referring to Figs. 1 to 7, according to a first embodiment of the present disclosure, the following relationship is present between the air supply distance and the air output volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air output volume thereof is attenuated more, and when the air supply distance is short, the air output volume is attenuated less. In view of the problem that the air output volume is attenuated more when the air supply distance is long present in the ceiling recessed fan that has been found by the inventors, in the related art, it is generally to simply increase the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air output volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the parameters concerning the dimension of the air outlet and the dimension of the air duct inside the ceiling recessed fan, which are neglected and ignored in the art, are aspects to be improved that effectively enhance a matching degree between the air supply distance and the air volume of the ceiling recessed fan in turn.

[0451] Therefore, in order to allow the air supply distance and the air output volume of the ceiling recessed fan in a cooling mode to reach a better level as much as possible, the present disclosure provides the ceiling recessed fan with a cooling mode as shown in Figs. 1 and 2, which includes a main body frame 1a internally provided with an air outlet duct 2a having a first end 21a and a second end 22a provided along the airflow direction; an air outlet assembly 3a arranged in the main body frame 1a, wherein there is a height difference between the air outlet assembly 3a and the main body frame 1a when the ceiling recessed fan is in a cooling mode, and an air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a, and the air outlet 10a communicates with the second end 22a of the air outlet duct 2a. The ratio range of the height h1 of the air outlet 10a to the width h2 of the first end 21a of the air outlet duct 2a is $1/3 \leq h1/h2 \leq 3/5$.

[0452] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a. The height h1 of the air outlet 10a refers to the height between the edge of the main body frame forming the lowermost point of the air outlet duct and the outermost edge of the air outlet assembly in the direction of a height difference between the air outlet assembly and the main body frame.

[0453] During the operation of the ceiling recessed fan, the air flows from the first end 21a to the second end 22a of the air outlet duct, and is finally expelled from the ceiling recessed fan through the air outlet 10a. When the ceiling recessed fan is designed, in order to achieve the balance between the air supply distance and the air output volume of the ceiling recessed fan, the designer determines the specific parameters of the ceiling recessed fan according to the ratio range of the height h1 of the air outlet to the width of the first end 21a of the air outlet duct 2a, so that the air output effect of the produced ceiling recessed fan achieves preset requirements.

[0454] Taking the experiment data of a 3 horse power air conditioner as an example, in this solution, h2 is 60mm, and the value of h1 is adjusted for simulation. The simulation results are as follows:

h1	h1/h2	Air volume (m ³ /h)	Air supply distance
15	0.25	667	3.3m
20	0.33	834	3.5m
28	0.47	1005	3.5m
36	0.6	1112	2m
45	0.75	1112	1.2m

[0455] From the experiment results, when h1/h2 is 0.47, the air volume is attenuated less and the air supply distance is also far enough, which is the most desirable (Figure 3). When h1/h2 is increased to 0.6, the air volume reaches a maximum value, but the air supply distance is apparently shortened (Figure 4). When h1/h2 continues to increase to 0.75, the air supply distance is severely shortened, which cannot be accepted (Figure 5). When h1/h2 is reduced to 0.33, the air volume is about 75% of a maximum value (Figure 6). When h1/h2 continues to decrease to 0.25, the air volume is severely

attenuated, which cannot be accepted (Figure 7).

[0456] The air outlet assembly 3a is arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position descending to a set height to form a height difference. When the air outlet assembly 3a is in an operation position, the ratio range of the height h1 of the air outlet 10a to the width h2 of the first end 21a of the air outlet duct 2a is $1/3 \leq h1/h2 \leq 3/5$. At this time, the height h1 of the air outlet 10a is the height between the edge of the main body frame forming the lowermost point of the air outlet duct and the outermost edge of the air outlet assembly in the lifting direction of the air outlet assembly 3a.

[0457] The air outlet assembly 3a includes an air deflector 4a and an air outlet frame, wherein the air outlet frame is arranged in the main body frame 1a; the air deflector 4a is rotatably arranged on the air outlet frame; and when the air outlet assembly 3a is in an operation position, the air deflector 4a may adjust the height of the air outlet 10a. At this time, the height of the air outlet is the height between the edge of the main body frame forming the lowermost point of the air outlet duct and the outermost edge of the air deflector in the lifting direction of the air outlet assembly.

[0458] The air deflector 4a has a first position to allow the height h1 of the air outlet 10a to reach a minimum value, and the ratio range of the minimum height h1 of the air outlet 10a to the width of the first end 21a of the air outlet duct 2a is $1/3 \leq h1/h2 \leq 3/5$, so that the rotation range of the air deflector is determined by the ratio range to improve the air output effect of the ceiling recessed fan.

[0459] The air deflector 4a may deflect the air output at the air outlet 10a. When the ceiling recessed fan is in a cooling mode, in order to achieve the waterfall refrigeration effect, the angle range of the included angle a between the plane where the air deflector 4a is located and the horizontal plane is $-10^\circ \leq a \leq 10^\circ$, and when $a=0^\circ$, the plane where the air deflector 4a is located is parallel to the horizontal plane. At this time, the air output at the air outlet 10a may flow against the wall (against the ceiling) as much as possible under the definition of the air deflector 4a, and then a waterfall refrigeration effect is formed by the downward flow characteristic of cold air.

[0460] In some embodiments, when the ceiling recessed fan is in a cooling mode, the angle range of the included angle a is $10^\circ \geq a > 0$, and when $a > 0^\circ$, the air deflector 4a tilts upward relative to the horizontal plane, also that is, the air deflector 4a is always in a state of tilting upwards relative to the horizontal plane, thereby increasing the attachment effect of the air output of the air outlet 10a against the wall and increasing the air supply distance and the refrigeration effect of the ceiling recessed fan.

[0461] The air outlet assembly has a closed position to close the air outlet 10a in cooperation with the main body frame 1a, and the air deflector 4a has a first edge 41a and a second edge 42a. When the air outlet assembly 3a is in the closed position, the first edge 41a is sealed with a corresponding position of the main body frame 1a, and the second edge 42a is sealed with a corresponding edge of the air outlet frame. By way of a corresponding seal between the first edge 41a and the main body frame 1a and a corresponding seal between the second edge 42a and the air outlet frame, when the air outlet assembly is in the closed position, the air deflector 4a can enclose a corresponding position of the air outlet 10a, thereby reducing impurities such as dust entering the interior of the ceiling recessed fan from the position of the air outlet 10a to affect the performance of the ceiling recessed fan.

[0462] When the air outlet assembly 3a is in the closed position, the air outlet frame and the air deflector 4a jointly cooperate with the main body frame 1a to form a seal. At this time, the air outlet assembly is attached to the main body frame, and the opening on the main body frame is completely covered by the air outlet assembly, so that the ceiling recessed fan has a favorable aesthetic effect.

[0463] The second edge 42a is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure. When the air outlet assembly 3a is in the closed position, the first step structure is sealingly fit with the second step structure. The first step structure and the second step structure not only make the sealing between the air deflector 4a and the air outlet frame reliable, but also allow that the structure of the air outlet assembly 3a is not be affected by a structural interference between the air deflector 4a and the air outlet assembly 3a during the rotation process of the air deflector 4a.

[0464] The first step structure is provided with a seal, and when the air outlet assembly 3a is in the closed position, the seal is arranged between the first step structure and the second step structure. Also that is, the seal moves together with the air deflector, and when the air deflector is sealed relative to the air outlet frame, the seal can enclose a slit between the air deflector and the air outlet frame, thereby enhancing the sealing effect between the air deflector and the air outlet frame.

[0465] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet frame, and the air deflector 4a is arranged on the rotating mechanism.

[0466] The rotating mechanism includes a rotary arm 5a, one end of which is hinged to the air outlet frame, and the other end of which is arranged on the air deflector 4a. In some embodiments, both ends of the air deflector 4a in the length direction are provided with a rotary arm 5a, thereby improving the synchronization of the overall movement of the air deflector 4a.

[0467] The rotating mechanism also includes a driving member arranged on the air outlet frame and directly or indirectly driving the rotary arm 5a to rotate. Wherein, one end of the rotary arm 5a is arranged on the driving member, and the air deflector 4a is arranged on the other end of the rotary arm 5a. When the rotary arm 5a rotates with the end arranged on the

driving member, the air deflector 4a may move together with the end of the rotary arm 5a, so as to realize the rotation of the air deflector 4a, wherein the driving member is a stepper motor.

[0468] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1a, and the air outlet assembly 3a is arranged on the lifting mechanism. The air outlet assembly 3a may project from or retract into the main body frame 1a by means of the lifting mechanism, so that the air outlet assembly 3a may move freely between the operation position and the closed position.

[0469] The air outlet assembly 3a includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0470] The ceiling recessed fan is an air treatment device installed on the ceiling for indoor heat exchange. During its heat exchange process, heat exchange is prioritized in a high part of the room. During cooling, since cold air is heavy, it may flow from the high part of the room to the ground of the room to realize fast cooling in the room. However, during heating, since hot air is light, it may float high in the room to only improve the temperature in a high part of the room, which results in that the ceiling recessed fan mistakenly judges that the temperature in the room has reached a set temperature so as to affect the overall heating effect in the room. In the related art, it is generally to simply increase the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air output volume, and utilize a greater air output volume or a greater air output velocity to blow hot air to the ground of the room as much as possible, so that such solution may result in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the parameters concerning the dimension of the air outlet and the dimension of the air duct inside the ceiling recessed fan, which are neglected and ignored in the art, are aspects to be improved that may effectively enhance a heating efficiency of the ceiling recessed fan in turn.

[0471] Therefore, in order to achieve a better heating comfort, hot air is first blown to the ground nearby, and then diffused outward along the ground, thereby improving the heat exchange efficiency of the ceiling recessed fan in a heating mode.

[0472] Referring to Figs. 8 to 19, according to a second embodiment of the present disclosure, a ceiling recessed fan with a heating mode is provided, which includes a main body frame 1a internally provided with an air outlet duct 2a having a first end 21a and a second end 22a provided along the airflow direction; an air outlet assembly 3a arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position that descends to a predetermined height, wherein an air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a, and the air outlet 10a communicates with the second end 22a of the air outlet duct 2a. The ceiling recessed fan has a heating mode. When the ceiling recessed fan is in a heating mode and the air outlet assembly 3a is in an operation position, the ratio range of the height h1 of the air outlet 10a to the width h2 of the first end 21a of the air outlet duct 2a is $2/3 \leq h1/h2 \leq 4/5$.

[0473] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a. The height h1 of the air outlet 10a refers to the height between the edge of the main body frame forming the lowermost point of the air outlet duct and the outermost edge of the air outlet assembly in the direction of a height difference between the air outlet assembly and the main body frame.

[0474] During the operation of the ceiling recessed fan, the air flows from the first end 21a to the second end 22a of the air outlet duct, and is finally expelled from the ceiling recessed fan through the air outlet 10a. When the ceiling recessed fan is designed, in order to achieve the balance between the air supply distance and the air outlet volume of the ceiling recessed fan, the designer determines the specific parameters of the ceiling recessed fan according to the ratio range of the height h1 of the air outlet to the width of the first end 21a of the air outlet duct 2a, so that the air output effect of the produced ceiling recessed fan achieves preset requirements.

[0475] Taking the experiment data of a 3 horse power air conditioner as an example, in this solution, h2 is a fixed value of 60mm, and the value of h1 is adjusted for simulation. The simulation results are as follows:

h1	h1/h2	Air volume (m ³ /h)	Air supply distance
35	0.6	953	2.5m
40	0.67	1005	2m
45	0.75	1112	1.8m
48	0.8	1112	1.1m

(continued)

h1	h1/h2	Air volume (m ³ /h)	Air supply distance
54	0.9	1112	0.3m

[0476] From the results, when $h1/h2$ is about 0.8, the air volume and hot air landing are both favorable, which is a desirable state (Figure 10). When $h1/h2$ continues to increase and exceeds 0.9, the airflow can only flow downward rather than diffusing outwards, which is a poor effect (Figure 12). When $h1/h2$ decreases to 0.75, the air volume does not change. However, as can be seen from the drawing, hot air begins to present an upward float tendency, so that it is impossible to land well (Figure 11). When $h1/h2$ decreases to 0.67, the air volume begins to decrease, and although the air supply distance increases, hot air cannot reach the ground, so that the heating effect becomes worse (Figure 13). When the ratio of $h1/h2$ is less than 0.6, hot air can be sent far away rather than blowing to the vicinity of the ground, which is a poor heating effect (Figure 14).

[0477] The air outlet assembly 3a is arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position descending to a set height to form a height difference. When the air outlet assembly 3a is in an operation position, the ratio range of the height $h1$ of the air outlet 10a to the width $h2$ of the first end 21a of the air outlet duct 2a is $2/3 \leq h1/h2 \leq 4/5$. At this time, the height $h1$ of the air outlet 10a is the height between the edge of the main body frame forming the lowermost point of the air outlet duct and the outermost edge of the air outlet assembly in the lifting direction of the air outlet assembly 3a.

[0478] The air outlet assembly 3a includes an air deflector 4a and an air outlet frame, wherein the air outlet frame is arranged in the main body frame 1a; the air deflector 4a is rotatably arranged on the air outlet frame; and when the air outlet assembly 3a is in an operation position, the air deflector 4a may adjust the height of the air outlet 10a. At this time, the height of the air outlet is the height between the edge of the main body frame forming the lowermost point of the air outlet duct and the outermost edge of the air deflector in the lifting direction of the air outlet assembly.

[0479] The air deflector 4a has a first position to allow the height $h1$ of the air outlet 10a to reach a minimum value, and the ratio range of the minimum height $h1$ of the air outlet 10a to the width of the first end 21a of the air outlet duct 2a is $2/3 \leq h1/h2 \leq 4/5$, so that the dimensions and rotation range of the air deflector is determined by the ratio range to improve the air output effect of the ceiling recessed fan.

[0480] Taking the experiment data of a 3 horse power air conditioner as an example, in this solution, $h2$ is a fixed value of 60. In the case where there is present with the air deflector 4a, the value of $h1$ is directly adjusted by the opening angle of the air deflector without descending the air outlet assembly. During simulation, the simulation results are as follows:

h1	h1/h2	Air volume (m ³ /h)	Air supply distance
35	0.6	948	3m
40	0.67	1055	2.5m
45	0.75	1112	1.8m
48	0.8	1112	0.7m
54	0.9	1112	0.3m

[0481] From the experiment results, when $h1/h2$ is about 0.8, the air volume and the air supply distance are both favorable, which is a desirable state (Figure 15). When $h1/h2$ continues to increase and exceeds 0.9, the airflow can only flow downward rather than diffusing outwards, which is a poor effect (Figure 17). When $h1/h2$ decreases to 0.75, the air supply distance increases, but hot air begins to present an upward float tendency, so that it is impossible to land well (Figure 16). When $h1/h2$ decreases to 0.67, the air volume is further reduced, and although the air supply distance increases, hot air cannot reach the ground, so that the heating effect becomes worse (Figure 18). When the ratio of $h1/h2$ is less than 0.6, hot air can be sent far away rather than blowing to the vicinity of the ground, which is a poor heating effect (Figure 19).

[0482] When there is not present with the air deflector 4a and the air outlet is formed by descending the air outlet assembly 3a to perform heating, the airflow direction of the air outlet of the ceiling recessed fan cannot be adjusted. In order to enable hot air to reach the ground smoothly, the descending dimension of the air outlet assembly 3a is required to be far more than 54mm so as to ensure the air output effect of the ceiling recessed fan. The air outlet needs to descend more, which results in that the dimension of the lifting mechanism is increased, far more than an acceptable descending dimension of the air outlet assembly. Therefore, simulation is performed only with the presence of the structure of the air deflector 4a.

[0483] The air deflector 4a may deflect the air output at the air outlet 10a. When the ceiling recessed fan is in a heating

mode, in order to achieve a rapid heating effect, the angle range of the included angle α between the air deflector 4a and the horizontal plane is 45° to 75° . At this time, the air output at the air outlet 10a may be blown out in the vertical direction under the definition of the air deflector 4a, so as to achieve a rapid heating effect.

[0484] The air outlet assembly has a closed position to close the air outlet 10a in cooperation with the main body frame 1a, and the air deflector 4a has a first edge 41a and a second edge 42a. When the air outlet assembly 3a is in the closed position, the first edge 41a is sealed with a corresponding position of the main body frame 1a, and the second edge 42a is sealed with a corresponding edge of the air outlet frame. By way of a corresponding seal between the first edge 41a and the main body frame 1a and a corresponding seal between the second edge 42a and the air outlet assembly, when the air outlet assembly is in the closed position, the air deflector 4a can enclose a corresponding position of the air outlet 10a, thereby avoiding impurities such as dust entering the interior of the ceiling recessed fan from the position of the air outlet 10a to affect the performance of the ceiling recessed fan.

[0485] When the air outlet assembly 3a is in the closed position, the air outlet frame and the air deflector 4a jointly cooperate with the main body frame 1a to form a seal. At this time, the air outlet assembly 3a is attached to the main body frame 1a, and the opening on the main body frame 1a is completely covered by the air outlet assembly 3a, so that the ceiling recessed fan has a favorable aesthetic effect.

[0486] The second edge 42a is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure. When the air outlet assembly 3a is in the closed position, the first step structure is sealingly fit with the second step structure. The first step structure and the second step structure not only make the sealing between the air deflector 4a and the air outlet frame reliable, but also allow that the structure of the air outlet assembly 3a is not be affected by a structural interference between the air deflector 4a and the air outlet assembly 3a during the rotation process of the air deflector 4a.

[0487] The first step structure is provided with a seal, and when the air outlet assembly 3a is in the closed position, the seal is arranged between the first step structure and the second step structure. Also that is, the seal moves together with the air deflector, and when the air deflector is sealed relative to the air outlet frame, the seal can enclose a slit between the air deflector and the air outlet frame, thereby enhancing the sealing effect between the air deflector and the air outlet frame.

[0488] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly 3a, and the air deflector 4a is arranged on the rotating mechanism.

[0489] The rotating mechanism includes a rotary arm 5a, one end of which is hinged to the air outlet assembly 3a, and the other end of which is arranged on the air deflector 4a. In some embodiments, both ends of the air deflector 4a in the length direction are provided with a rotary arm 5a, thereby ensuring the synchronization of the overall movement of the air deflector 4a.

[0490] The rotating mechanism also includes a driving member arranged on the air outlet assembly 3a and directly or indirectly driving the rotary arm 5a to rotate. Wherein, one end of the rotary arm 5a is arranged on the driving member, and the air deflector 4a is arranged on the other end of the rotary arm 5a. When the rotary arm 5a rotates with the end arranged on the driving member, the air deflector 4a may move together with the end of the rotary arm 5a, so as to realize the rotation of the air deflector 4a, wherein the driving member is a stepper motor.

[0491] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1a, and the air outlet assembly 3a is arranged on the lifting mechanism. The air outlet assembly 3a may project from or retract into the main body frame 1a by means of the lifting mechanism, so that the air outlet assembly 3a may move freely between the operation position and the closed position.

[0492] The air outlet assembly 3a includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0493] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. In view of the problem that the air outlet volume is attenuated more when the air supply distance is long present in the ceiling recessed fan that has been found by the inventors, in the related art, it is generally to simply increase the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air outlet volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the relationship concerning the height of the air outlet and the target air output volume, which is neglected and ignored in the art, is an aspect to be improved that can effectively enhance a matching degree between the air supply distance and the air volume of the ceiling recessed fan in turn.

[0494] Therefore, in order to ensure that the air supply distance and the air output volume of the ceiling recessed fan

reach a better level as much as possible, as shown in a third embodiment of the present disclosure in Figure 20, a ceiling recessed fan is provided, which includes a main body frame 1a and an air outlet assembly 3a. The air outlet assembly 3a is arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position descending to a set height, wherein an air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a. When the height h_1 of the air outlet 10a is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$, the air output volume of the ceiling recessed fan is greater than or equal to 75% of a rated air output volume of the ceiling recessed fan.

[0495] In some embodiments, the height h_1 of the air outlet 10a is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$.

[0496] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a. The height h_1 of the air outlet 10a refers to the height between the edge of the main body frame 1a forming the lowermost point of the air outlet duct and the outermost edge of the air outlet module 3a in the lifting direction of the air outlet assembly 3a. When the structure of the air outlet assembly 3a for forming the air outlet 10a with the main body frame 1a is a horizontal structure, the height h_1 of the air outlet 10a is also expressed as the descending height of the air outlet assembly 3a. The rated air output volume of the ceiling recessed fan refers to the air volume of the highest stage in an air supply mode under set conditions (set environments such as dry bulb temperature and wet bulb temperature).

[0497] Taking the experiment data of a 3 horse power air conditioner as an example, the value of h_1 is adjusted for simulation. The simulation results are as follows:

h_1	Air volume (m^3/h)	Air supply distance
15	667	3.3m
20	834	3.5m
28	1005	3.5m
36	1112	2m
45	1112	1.2m

[0498] From the simulation results, when h_1 is 28mm, although the air volume does not reach a maximum value, the air supply distance reaches a maximum value. When h_1 increases to 36mm, the air supply distance begins to decrease. When h_1 continues to increase to 45mm, the air volume remains at the maximum value, but the air supply distance is apparently shortened. When h_1 is reduced to 20mm, the air supply distance remains at the maximum value, but the air volume begins to decrease. When h_1 continues to decrease to 15mm, the air volume continues to decrease, and at the same time, the air supply distance also begins to decrease. Also that is, when h_1 is too large, although the air volume can be maintained, the air supply distance may be seriously reduced, which results in a poor air output effect of the ceiling recessed fan. When h_1 is too small, the air outlet at this time cannot meet the requirements of the air output volume of the ceiling recessed fan. When h_1 is in the range of 20mm to 36mm, the ceiling recessed fan reasonably matches the air volume and the air supply distance, which finally improves the air output effect of the ceiling recessed fan. When the ceiling recessed fan is designed, the target air volume of the ceiling recessed fan is set, and then the height of the air outlet 10a is designed according to the target air volume, so as to select a better height of the air outlet 10a. In this way, it is possible to set a descending stroke of the air outlet assembly 3a and a driving mechanism for driving the air outlet assembly 3a to ascend and descend, thereby effectively improving the design efficiency and solving the design and manufacturing cost.

[0499] Taking the experiment data of a 3 horse power air conditioner as an example, the value of h_1 is adjusted for simulation. The simulation results are as follows:

h_1	Air velocity (m/s)
15	16.1
20	12.0
28	8.6
36	6.7
45	5.4

[0500] From the simulation results, when h_1 is 28mm, the air velocity reaches a comfortable value of 8.6m/s. When h_1 increases to 36mm, the air velocity begins to decrease, which will reduce the indoor heat exchange effect. When h_1

continues to increase to 45mm, the air velocity continues to decrease, so that the air velocity at the air outlet cannot meet the preset requirements. When h1 decreases to 20mm, the air velocity begins to increase, which might lead to a poor experience of air output skin blow at the air outlet. When h1 continues to decrease to 15mm, the air velocity continues to increase and exceeds a maximum limit, which leads to direct blow. Also that is, when h1 is too large, the air velocity cannot make the airflow blow into indoor effectively. When h1 is too small, the air velocity is so large as to cause skin blow. Only when h1 is in the range of 20mm to 36mm, the ceiling recessed fan reasonably matches the air velocity and the air supply distance, which finally improves the air output effect of the ceiling recessed fan.

[0501] The ceiling recessed fan also includes a fan, and there is a relationship between the rotation speed of the fan and the height h1 of the air outlet 10a. Also that is, at this time, the fan is a variable frequency fan, and the rotation speed of the fan can be adjusted as necessary. In order to ensure that the ceiling recessed fan reaches the target air output volume, the height h1 of the air outlet 10a is mated with the rotation speed of the fan, which effectively reduces the energy consumption and structural complexity of the ceiling recessed fan.

[0502] The air outlet assembly 3a includes a rotatable air deflector 4a, and the air deflector 4a and the main body frame 1a form an air outlet 10a. The height h1 of the air outlet 10a can be adjusted during the rotation process of the air deflector 4a. At this time, the height h1 of the air outlet 10a refers to the height between the edge of the main body frame 1a forming the lowermost point of the air outlet duct and the outermost edge of the air deflector 4a in the lifting direction of the air outlet assembly 3a.

[0503] When the ceiling recessed fan is in a cooling mode, the angle range of the included angle a between the plane where the air deflector 4a is located and the horizontal plane is $-10^{\circ} \leq a \leq 10^{\circ}$, and when $a=0^{\circ}$, the plane where the air deflector 4a is located is parallel to the horizontal plane.

[0504] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by changing the value of a. With the upward tilting of the plane where the air deflector 4a is located relative to the mounting planar face of the main body frame 1a (upward reflex of the air deflector) as a negative angle, and the downward tilting of the plane where the air deflector 4a is located relative to the mounting planar face of the main body frame 1a (downward swing of the air deflector) as a positive angle, the simulation results are as follows:

Angle a	Air volume (m ³ /h)	Air supply distance
-15°	838	3.1m
-10°	995	3.7m
0°	1005	3.5m
10°	1112	2.2m
15°	1112	1.4m

[0505] From the simulation results, when a is 0°, although the air volume does not reach a maximum value, the air supply distance substantially reaches a maximum value. When a is increased to 0°, the air volume reaches a maximum value, but the air supply distance begins to decrease. When h1 continues to increase to 45mm, the air volume remains at the maximum value, but the air supply distance is apparently reduced, which cannot meet the waterfall refrigeration effect by horizontal air supply. When h1 decreases to 20, although the air supply distance does not change, the air volume begins to decrease. When h1 continues to decrease to 15mm, the air volume continues to decrease, and the air supply distance also begins to decrease at the same time. Also that is, when h1 is between 20mm and 36mm, the air supply distance and the air volume of the ceiling recessed fan can be reliably balanced. When h1 is too large, the air volume will not increase, but the air supply distance may be seriously attenuated, which affects the air output effect of the ceiling recessed fan. When h1 is too small, the air outlet 10a may cover the air outlet of the ceiling recessed fan to a certain extent, and the air supply distance may also be relatively reduced at the same time.

[0506] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly 3a, and the air deflector 4a is arranged on the rotating mechanism.

[0507] The rotating mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly 3a, and the other end of which is arranged on the air deflector 4a. In some embodiments, both ends of the air deflector 4a in the length direction are provided with a rotary arm, thereby ensuring the synchronization of the overall movement of the air deflector 4a.

[0508] The rotating mechanism also includes a driving member arranged on the air outlet assembly 3a and drivingly connected with the rotary arm. Wherein, one end of the rotary arm is arranged on the driving member, and the air deflector 4a is arranged on the other end of the rotary arm. When the rotary arm rotates with the end arranged on the driving member, the air deflector 4a may move together with the end of the rotary arm, so as to realize the rotation of the air deflector 4a, wherein the driving member is a stepper motor.

[0509] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1a, and the air outlet assembly 3a is arranged on the lifting mechanism. The air outlet assembly 3a may project from or retract into the main body frame 1a by means of the lifting mechanism, so that the air outlet assembly 3a may move freely between the operation position and the closed position.

[0510] The air outlet assembly 3a includes an air outlet frame, wherein an air outlet 10a is formed between the air outlet frame and the main body frame 1a, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein an air outlet 10a is formed between the air outlet frame and the main body frame 1a, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0511] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. In view of the problem that the air outlet volume is attenuated more when the air supply distance is long present in the ceiling recessed fan that has been found by the inventors, in the related art, it is generally to simply increase the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air outlet volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the parameters concerning the dimension of the air deflector, which are neglected and ignored in the art, are aspects to be improved that can effectively enhance a matching degree between the air supply distance and the air volume of the ceiling recessed fan in turn.

[0512] Therefore, according to a fourth embodiment shown in Figs. 21 to 24, a ceiling recessed fan is disclosed, which includes: a main body frame 1a and an air outlet assembly 3a. The main body frame 1a is formed with an air outlet duct, and the main body frame 1a includes a side frame 11a with a first edge 111 forming the lowermost point of the air outlet duct. The air outlet assembly 3a is arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a descends so that a first air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a. The relationship between the width D of the outer edge of the air outlet assembly 3a beyond the first edge 41a and the height h1 of the air outlet is $2/5 \leq D/h1 \leq 9/5$. If the value D is too small, it is impossible to deflect the airflow required to be expelled from the first air outlet 10a. Whereas, if the value D is too large, it is possible to affect the aesthetic feeling of the ceiling recessed fan, and since the dimension of the air outlet assembly 3a is too large, it is likely to deform the air outlet assembly and cause damage to the ceiling recessed fan.

[0513] Taking the experiment data of a 3 horse power air conditioner as an example, in this solution, h1 is 30mm, and the value of D is adjusted for simulation. The simulation results are as follows:

D	D/h1	Air volume (m ³ /h)	Air supply distance
10	0.33	1110	2.1m
12	0.4	1109	2.8m
15	0.5	1109	2.8m
20	0.67	1109	2.9m
25	0.83	1108	2.9m
30	1	1108	3.1m
35	1.17	1107	3.1m
40	1.33	1107	3.2m
45	1.5	1107	3.2m
50	1.67	1106	3.3m
55	1.83	1100	3.3m
60	2	1074	3.3m

[0514] From the data, when the ratio of D/h1 is 0.33, the air supply distance is short, which does not produce an air deflecting effect and cannot achieve the comfort during cooling (as shown in Figure 3). When D/h1 is in the range of 0.4 to 1.8, the air supply distance is apparently increased with an obvious effect, and the air volume is substantially not attenuated (as shown in Figure 4, at the same time, D/h1 is 0.4). During the process of gradually increasing the ratio, it can be seen that

the air supply distance continues to increase slowly. However, when the D/h_1 exceeds 1.8, the air volume will be attenuated due to the lengthening of the air duct, which will also affect the refrigeration effect at this time.

[0515] In the related art, the air output range of the ceiling recessed fan includes a horizontal flow portion and a tiltingly downward flow portion. The horizontal flow portion can determine the air supply distance of the ceiling recessed fan, while the tiltingly downward flow portion can rapidly allow the airflow to flow into indoor. When the air supply distance of the ceiling recessed fan needs to be increased, it is necessary to reduce the air volume of the tiltingly downward flow portion so as to increase the air volume of the horizontal flow portion. When the air volume of the horizontal flow portion increases, there is a farther air supply distance that can be achieved during air output. Therefore, In order to increase the air volume of the horizontal flow portion, the tiltingly downward component of the air outlet is adjusted to be a horizontal direction by increasing the dimension of the air outlet assembly 3a, thereby increasing the air volume flowing in the horizontal direction and finally increasing the air supply distance.

[0516] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a. The side frame 11a refers to a lapped joint portion between the main body frame 1a and the ceiling when the ceiling recessed fan is installed on the ceiling and other structures. The height h_1 of the air outlet 10a refers to the height between the edge of the main body frame 1a forming the lowermost point of the air outlet duct and the outermost edge of the air outlet assembly 3a in the direction of a height difference between the air outlet assembly 3a and the main body frame 1a. When the air deflector 4a forms a projection on the main body frame 1a, the included angle between the air deflector 4a and the horizontal plane is in the range of -10° to 10° .

[0517] When the air outlet assembly 3a descends so that a first air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a, a gap which is formed between the air outlet assembly 3a and the main body frame 1a, forms an air supply duct 14a. One end of the air supply duct 14a communicates with the air outlet duct to allow that the other end of the air supply duct 14a forms a first air outlet 10a. The airflow in the air outlet duct is blown out by the first air outlet 10a after air deflecting by the air supply duct 14a, and the vertically downward airflow in the air outlet duct is deflected by the air supply duct 14a to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0518] When the air outlet assembly 3a descends so that a first air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a, an air supply duct 14a is formed between the air outlet assembly 3a and the side frame 11a. The projection of the air outlet assembly 3a at least partially coincides with the projection of the side frame 11a on the mounting planar face of the main body frame 1a. When the projection of the air outlet assembly 3a coincides with the projection of the side frame 11a, the air outlet assembly is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet 12, the air outlet assembly 3a gradually goes away from the main body frame 1a to form an air supply duct 14a. At this time, a corresponding portion of the air outlet assembly 3a forms a lower side surface of the air supply duct 14a. When the airflow flows through the air supply duct 14a, under the air deflecting effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0519] As another embodiment, the projection of the air outlet assembly 3a completely coincides with the projection of the side frame 11a. In this case, compared with the case where the projection of the air outlet assembly 3a partially coincides with the projection of the side frame 11a, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 3a is attached to the main body frame 1a, and a corresponding portion of the air outlet assembly 3a is attached to the side frame 11a, so that a person can only see the air outlet assembly 3a instead of the main body frame 1a when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0520] As another embodiment, the projection of the air outlet assembly 3a exceeds the projection of the side frame 11a. In this case, compared with the case where the projection of the air outlet assembly 3a completely coincides with the projection of the side frame 11a, the air outlet assembly can be further extended, thereby further increasing a horizontal blow effect and an air supply distance of the ceiling recessed fan.

[0521] In some embodiments, the projection of the air outlet assembly 3a exceeds the projection of the main body frame 1a, so that the air outlet assembly 3a effectively increases the air deflecting dimension relative to the related art, so as to increase the air supply distance of the ceiling recessed fan.

[0522] The air outlet assembly 3a is provided with a second air outlet 20a, and the second air outlet 20a is provided with an air deflector 4a which is rotatably arranged at the second air outlet 20a and capable of closing or opening the second air outlet 20a. When the second air outlet 20a needs to be opened, the air deflector 4a rotates gradually, so that the second air outlet 20a communicates with the air outlet duct to allow that the airflow in the air outlet duct is blown out by the second air

outlet 20a, and the air deflector 4a adjusts its tilting angle according to actual needs to adjust the air output direction and/or the air output volume of the second air outlet 20a. When the second air outlet 20a needs to be closed, the air deflector 4a returns to the state of sealing fit with the air outlet assembly 3a so as to close the second air outlet 20a. At this time, the airflow in the air outlet duct can only be blown out from the first air outlet 10a under the joint deflection effect of the air outlet assembly 3a and the air deflector 4a.

[0523] The edge of the air deflector 4a is provided with a first step structure, and the edge of the second air outlet 20a is provided with a second step structure, so that the first step structure and the second step structure are fit to form a step sealing structure. With a sealing structure, when the second air outlet 20a is closed, it is ensured that the airflow will not flow out through a slit between the air deflector 4a and the second air outlet 20a (in order to prevent locking due to a manufacturing tolerance, it is necessary to design an avoidance gap between the air deflector 4a and the second air outlet 20a) so as to reduce the air output effect. Wherein, the air deflector 4a has a plurality of edges connected sequentially, the edge of the second air outlet 20a is an annular edge matched with the air deflector 4a, and a step sealing structure is provided between each edge of the air deflector 4a and a portion of a corresponding annular edge to ensure the sealing effect of the air deflector 4a on the second air outlet 20a.

[0524] The ceiling recessed fan also includes a lifting mechanism. The lifting mechanism is arranged in the main body frame 1a, and the air outlet assembly 3a is arranged on the lifting mechanism. The air outlet assembly 3a may project from or retract into the main body frame 1a by means of the lifting mechanism, so that the air outlet assembly 3a may move freely between the operation position and the closed position.

[0525] The air outlet assembly 3a includes an air outlet frame. A first air outlet 10a is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein a first air outlet 10a is formed between the air outlet frame and the main body frame 1a, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0526] Wall attachment effect (also referred to as Coanda effect) refers to a flow change tendency of fluid (water flow or air flow) from an initial flow direction to flowing along with a protruding object surface. When there is surface friction between the fluid and the object surface through which the fluid flows (or fluid viscosity, as long as the curvature is not large), the fluid will flow along the object surface. Moreover, when the ceiling recessed fan is in a cooling mode, the air deflector at the air outlet is generally set horizontally to increase the air output distance of the ceiling recessed fan, but in fact, the air output of the ceiling recessed fan will flow along a direction where the air deflector goes away from the ceiling under the wall attachment effect, which finally causes that the actual air output effect of the ceiling recessed fan becomes worse. However, in the related art, in order to ensure the air supply distance of the ceiling recessed fan, it is generally to simply use a method of increasing the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air output volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the parameters concerning the tilting angle of the air deflector, which are neglected and ignored in the art, are aspects to be improved that can effectively enhance an air supply distance of the ceiling recessed fan in turn.

[0527] Therefore, according to a fifth embodiment of the present disclosure, a ceiling recessed fan as shown in Figs. 25 to 30 is provided, which includes: a main body frame 1a, an air outlet assembly 3a and a first air deflector 4a. The air outlet assembly 3a is arranged in the main body frame 1a. When the ceiling recessed fan is in a cooling mode, a height difference between the air outlet assembly 3a and the main body frame 1a is formed, and an air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a. The first air deflector 4a is arranged at a swinging mechanism, and the first air deflector is swingably arranged at the air outlet. The angle c between the plane of the first air deflector 4a and the mounting planar face of the main body frame 1a is in the range of $-10^{\circ} \leq c \leq 10^{\circ}$, and when the angle c is 0° , the plane of the first air deflector 4a is parallel to the mounting planar face. The air outlet assembly 3a has a first descending height h , and the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$ when the ceiling recessed fan is in a cooling mode. Even if the first air deflector 4a tilts upward at a certain angle to ensure that the air output of the ceiling recessed fan flows against the ceiling as much as possible, the horizontal air supply distance of the ceiling recessed fan in a cooling mode is ensured, and the waterfall refrigeration effect is realized at a maximum efficiency. Wherein, the descending stroke of the air outlet assembly 3a is greater than 36 mm.

[0528] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by adjusting the value of the angle c . Wherein, with the upward tilting of the plane where the first air deflector 4a is located relative to the mounting planar face of the main body frame 1a (upward reflex of the first air deflector) as a negative angle, and the downward tilting of the plane where the first air deflector 4a is located relative to the mounting planar face of the main body frame 1a (downward swing of the first air deflector) as a positive angle, the simulation results are as follows:

Angle c	Air volume (m ³ /h)	Air supply distance
-15° (Figure 30)	838	3.1m
-10° (Figure 26)	995	3.7m
0° (Figure 27)	1005	3.5m
10° (Figure 28)	1112	2.2m
15° (Figure 29)	1112	1.4m

[0529] From the experiment results, when the angle c is -10°, although the air volume does not reach a maximum value, there is a small difference from the maximum air volume, and its air supply distance reaches a maximum value. When the angle c is reduced to -15°, the air volume and the air supply distance both begin to decrease, and at this time, the air volume is attenuated to the extent where the air output requirements of the ceiling recessed fan cannot be satisfied. When the angle c increases to 0°, the attenuation of the air volume begins to decrease, but its air supply distance also begins to decrease. When the angle c continues to increase to 10°, the air volume reaches a maximum value, but the air supply distance is seriously attenuated, so that the limit where the air output requirements of the ceiling recessed fan cannot be satisfied is almost reached. When the angle c continues to increase to 15°, the air volume reaches a maximum value, but the air supply distance has been attenuated from 3.7m to 1.4m, and the horizontal air output of the ceiling recessed fan cannot be realized at this time. Also that is, when the ceiling recessed fan needs a large air output volume, the angle c with a large value (for example, when the angle C is 0° to 10°) is used, and it is also possible to raise the air output volume without being affected by the first air deflector 4a on the premise of ensuring that the first air deflector realizes all the air output distances of the ceiling recessed fan. When the ceiling recessed fan needs a small air output volume, the angle c with a small value (for example, when the angle C is -10° to 0°) is used, and at this time, the first air deflector 4a is upwardly tilted as much as possible to deflect the air output of the ceiling recessed fan to the ceiling to a maximum extent, so that the air output of the ceiling recessed fan flows against the ceiling as much as possible, thereby ensuring the waterfall refrigeration effect of the horizontal air output of the ceiling recessed fan.

[0530] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a.

[0531] The ceiling recessed fan also includes a fan, wherein the rotation speed of the fan is adjustable. According to the rotation speed of the fan, the air output volume of the ceiling recessed fan is determined. When the rotation speed of the fan is large, it is indicated that the air output volume of the ceiling recessed fan is large at this time. On the contrary, when the rotation speed of the fan is small, it is indicated that the air output volume of the ceiling recessed fan is small at this time.

[0532] When the angle c is in the range of $-10^\circ \leq c < 0^\circ$, the plane of the first air deflector 4a tilts upward relative to the mounting planar face, and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$. Alternatively, when the angle c is in the range of $0^\circ \leq c < 10^\circ$, the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$.

[0533] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by adjusting the value of the first descending height h. Wherein, with the upward tilting of the plane where the first air deflector 4a is located relative to the mounting planar face of the main body frame 1a (upward reflex of the first air deflector) as a negative angle, and the downward tilting of the plane where the first air deflector 4a is located relative to the mounting planar face of the main body frame 1a (downward swing of the first air deflector) as a positive angle, the simulation results are as follows:

Descending height h (mm)	Angle c	Air volume (m ³ /h)	Air supply distance
20	-10°	753	3.3m
	0°	834	3.5m
	10°	924	2.8m
28	-10°	995	3.7m
	0°	1005	3.5m
	10°	1112	2.2m
36	-10°	1100	2.4m
	0°	1112	2m
	10°	1112	1.4m

[0534] From the experiment results, taking the angle c of -10° as an example, when h reaches 28mm, although the air volume does not reach a maximum value, there is a small difference from the maximum air volume, and its air supply distance reaches a maximum value. When h increases to 36mm, at this time, the air volume substantially reaches a maximum value, but the air supply distance is seriously attenuated, which cannot satisfy the air output requirements of the ceiling recessed fan. When h is reduced to 20mm, the air volume and the air supply distance both begin to decrease, which results in that the ceiling recessed fan cannot achieve a better efficiency. Taking the angle c of 10° as an example, when h reaches 28mm, the air volume and the air supply distance both reach a maximum value. When h increases to 36mm, the air volume still remains at a maximum value, but the air supply distance is seriously attenuated from 3.5m to 1.4m, which cannot satisfy the air output requirements of the ceiling recessed fan. When h is reduced to 20mm, although the air supply distance is relatively large, its air volume is seriously attenuated, and the air output effect of the ceiling recessed fan is still less favorable than the air output effect when h reaches 28 mm. Also that is, when the air outlet assembly 3a descends to 20mm to 28mm, it is possible to improve the air output effect of the ceiling recessed fan.

[0535] The air outlet assembly 3a is arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position descending to a set height to form a height difference. After the ceiling recessed fan begins to work, the air outlet assembly 3a descends downward relative to the main body frame 1a, and when the air outlet assembly 3a reaches a set height, an air outlet 10a is formed, thereby ensuring that the ceiling recessed fan can perform normal heat exchange operation.

[0536] The mounting planar face of the main body frame 1a is parallel to the horizontal plane. Also that is, the main body frame 1a is mounted on a horizontal plane such as a ceiling.

[0537] The first air deflector 4a is provided with an extension plate, and when the air outlet assembly is in an operation position, the extension plate projects out of the first air deflector 4a. In order to further increase the air deflecting effect of the first air deflector 4a on the air output of the ceiling recessed fan, the effective air deflecting dimension of the first air deflector 4a is increased by using the extension plate, thereby increasing the air deflecting effect of the first air deflector 4a.

[0538] The ceiling recessed fan also includes an air deflecting structure arranged in the main body frame 1a, and capable of deflecting the air output of the air outlet when the ceiling recessed fan is in a cooling mode. With the air deflecting structure arranged in the main body frame 1a, the air output of the ceiling recessed fan is further allowed to flow against the ceiling, thereby increasing the air supply distance of the ceiling recessed fan in a cooling mode so as to increase the waterfall refrigeration effect.

[0539] As one embodiment, the main body frame 1a includes a side frame 11a, at least part of the air output of the air outlet passes through the side frame 11a, and the air deflecting structure includes a second air deflector 6a swingably arranged on the side frame 11a. The second air deflector 6a swings to adjust the flow direction of the air flow flowing through the side frame 11a (that is, an upper layer portion of the airflow), and adjust the flow direction of the lower layer airflow in the airflow by the first air deflector 4a, so as to jointly implement adjusting the air output direction of the ceiling recessed fan, thereby effectively improving the air output efficiency of the ceiling recessed fan.

[0540] As another embodiment, the main body frame 1a includes a side frame 11a, at least part of the air output of the air outlet passes through the side frame 11a, and an air deflecting channel 7a formed on the side frame 11a constitutes an air deflecting structure. By directly machining and moulding the air deflecting channel 7a on the side frame 11a, the airflow passing through the side frame 11a (that is, an upper layer portion of the airflow) is deflected by the air deflecting channel 7a, so as to limit a flow direction of this portion of the airflow, and jointly cooperate with the first air deflector 4a to overcome the wall attachment effect of the airflow.

[0541] The air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0542] Wall attachment effect (also referred to as Coanda effect) refers to a flow change tendency of fluid (water flow or air flow) from an initial flow direction to flowing along with a protruding object surface. When there is surface friction between the fluid and the object surface through which the fluid flows (or fluid viscosity, as long as the curvature is not large), the fluid will flow along the object surface. Moreover, when the ceiling recessed fan is in a cooling mode, the air deflector at the air outlet is generally set horizontally to increase the air output distance of the ceiling recessed fan, but in fact, the air output of the ceiling recessed fan will flow along a direction where the air deflector goes away from the ceiling under the wall attachment effect, which finally causes that the actual air output effect of the ceiling recessed fan becomes worse. However, in the related art, in order to ensure the air supply distance of the ceiling recessed fan, it is generally to simply use a method of increasing the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air output volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the

parameters concerning the tilting angle of the air deflector, which are neglected and ignored in the art, are aspects to be improved that can effectively enhance an air supply distance of the ceiling recessed fan in turn.

[0543] According to a sixth embodiment of the present disclosure, a ceiling recessed fan as shown in Figs. 25 to 30 is provided, which includes: a main body frame; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame; and a first air deflector arranged on a swinging mechanism, and swingably arranged at the air outlet. The plane of the first air deflector tilts upward relative to the mounting planar face of the main body frame, and the angle c between the plane of the first air deflector and the mounting planar face is in the range of $-10^{\circ} \leq c \leq 0^{\circ}$. Even if the first air deflector 4a tilts upward at a certain angle to ensure that the air output of the ceiling recessed fan flows against the ceiling as much as possible, the horizontal air supply distance of the ceiling recessed fan in a cooling mode is ensured, and the waterfall refrigeration effect is realized at a maximum efficiency.

[0544] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by adjusting the value of the angle c . Wherein, with the upward tilting of the plane where the first air deflector 4a is located relative to the mounting planar face of the main body frame 1a (upward reflex of the first air deflector) as a negative angle, and the downward tilting of the plane where the first air deflector 4a is located relative to the mounting planar face of the main body frame 1a (downward swing of the first air deflector) as a positive angle, the simulation results are as follows:

Angle c	Air volume (m ³ /h)	Air supply distance
-15° (Figure 30)	838	3.1m
-10° (Figure 26)	995	3.7m
0° (Figure 27)	1005	3.5m
10° (Figure 28)	1112	2.2m
15° (Figure 29)	1112	1.4m

[0545] From the experiment results, when the angle c is -10° , although the air volume does not reach a maximum value, there is a small difference from the maximum air volume, and its air supply distance reaches a maximum value. When the angle c is reduced to -15° , the air volume and the air supply distance both begin to decrease, and at this time, the air volume is attenuated to the extent where the air output requirements of the ceiling recessed fan cannot be satisfied. When the angle c increases to 0° , the attenuation of the air volume begins to decrease, but its air supply distance also begins to decrease. When the angle c continues to increase to 10° , the air volume reaches a maximum value, but the air supply distance is seriously attenuated, so that the limit where the air output requirements of the ceiling recessed fan cannot be satisfied is almost reached. When the angle c continues to increase to 15° , the air volume reaches a maximum value, but the air supply distance has been attenuated from 3.7m to 1.4m, and the horizontal air output of the ceiling recessed fan cannot be realized at this time. Also that is, when the ceiling recessed fan needs a small air output volume, the angle c with a small value (for example, when the angle C is -10° to 0°) is used, and at this time, the first air deflector 4a is upwardly tilted as much as possible to deflect the air output of the ceiling recessed fan to the ceiling to a maximum extent, so that the air output of the ceiling recessed fan flows against the ceiling as much as possible, thereby ensuring the waterfall refrigeration effect of the horizontal air output of the ceiling recessed fan.

[0546] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a.

[0547] The air outlet assembly 3a is arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position descending to a set height to form a height difference. After the ceiling recessed fan begins to work, the air outlet assembly 3a descends downward relative to the main body frame 1a, and when the air outlet assembly 3a reaches a set height, an air outlet 10a is formed, thereby ensuring that the ceiling recessed fan can perform normal heat exchange operation.

[0548] The air outlet assembly 3a has a first descending height h , and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$ when the ceiling recessed fan is in a cooling mode. Wherein, the descending stroke of the air outlet assembly 3a is greater than 28mm. In some embodiments, the descending stroke of the air outlet assembly 3a is greater than 36 mm.

[0549] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by adjusting the value of the first descending height h . Wherein, with the upward tilting of the plane where the first air deflector 4a is located relative to the mounting planar face of the main body frame 1a (upward reflex of the first air deflector) as a negative angle, and the downward tilting of the plane where the first air deflector 4a is located relative to the mounting planar face of

the main body frame 1a (downward swing of the first air deflector) as a positive angle, the simulation results are as follows:

Descending height h (mm)	Angle c	Air volume (m ³ /h)	Air supply distance
20	-10°	753	3.3m
	0°	834	3.5m
	10°	924	2.8m
28	-10°	995	3.7m
	0°	1005	3.5m
	10°	1112	2.2m
36	-10°	1100	2.4m
	0°	1112	2m
	10°	1112	1.4m

[0550] From the experiment results, taking the angle c of -10° as an example, when h reaches 28mm, although the air volume does not reach a maximum value, there is a small difference from the maximum air volume, and its air supply distance reaches a maximum value. When h increases to 36mm, at this time, the air volume substantially reaches a maximum value, but the air supply distance is seriously attenuated, which cannot satisfy the air output requirements of the ceiling recessed fan. When h is reduced to 20mm, the air volume and the air supply distance both begin to decrease, which results in that the ceiling recessed fan cannot achieve a better efficiency. Taking the angle c of 0° as an example, when h reaches 28mm, there is a small difference from the air volume and air supply distance to a maximum value. When h increases to 36mm, the air volume reaches a maximum value, but the air supply distance is seriously attenuated from 3.5m to 2m, which cannot satisfy the air output requirements of the ceiling recessed fan. When h is reduced to 20mm, although the air supply distance is substantially not changed, its air volume is seriously attenuated, and the air output effect of the ceiling recessed fan is still less favorable than the air output effect when h reaches 28 mm. Also that is, in the case where the angle c is in the range of -10° to 0°, when the air outlet assembly 3a descends to 20mm to 28mm, it is possible to improve the air output effect of the ceiling recessed fan.

[0551] The ceiling recessed fan is an air treatment device installed on the ceiling for indoor heat exchange. Due to the structure and installation requirements of the ceiling recessed fan, some structures of the ceiling recessed fan necessarily project out of the ceiling. When the ceiling recessed fan performs cooling, in the related art, it is generally to use a horizontal air supply method to allow that the airflow flows against the ceiling to increase the air supply distance, so as to achieve waterfall refrigeration. However, because of the parts of the ceiling recessed fan projecting out of the ceiling, the actual air output of the ceiling recessed fan cannot be attached to the ceiling, and upon departure from the parts of the ceiling recessed fan projecting out of the ceiling, the air output circulation area of the ceiling recessed fan instantaneously increases, so that the actual air output effect of the ceiling recessed fan becomes worse. The applicant has found through studies on the flow principles of the airflow and analysis of the experiment data in simulation that, the solution of designing the parts of the ceiling recessed fan that project out of the ceiling and providing corresponding structures thereon which can better deflect the air output of the ceiling recessed fan, is an aspect to be improved that can effectively enhance the air output effect of the ceiling recessed fan.

[0552] According to a seventh embodiment of the present disclosure, a ceiling recessed fan as shown in Figs. 30 to 33 is provided, which includes: a main body frame 1a, an air outlet assembly 3a and an air deflecting structure. The air outlet assembly 3a is arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position descending to a predetermined height, wherein an air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a. The air deflecting structure is arranged in the main body frame 1a, and capable of deflecting the air output of the air outlet when the ceiling recessed fan is in a cooling mode.

[0553] In the present disclosure, the airflow passing through the side frame is deflected by the air deflecting structure, and the air deflecting structure can change the direction of an upper layer portion of the airflow at the air outlet, thereby overcoming the problem found by the inventors that the airflow cannot favorably flow against the ceiling because the main body frame projects out of the ceiling, thereby improving the air output effect of the ceiling recessed fan and realizing waterfall refrigeration.

[0554] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a.

[0555] As one embodiment, the main body frame 1a includes a side frame 11a, at least part of the air output of the air

outlet passes through the side frame 11a, and the air deflecting structure includes a first air deflector 6a swingably arranged on the side frame 11a. Part of the air output at the air outlet (particularly the upper layer airflow at the air outlet) is deflected by the first air deflector 6a, and under the deflection of the wall attachment effect, so that the part of the air outlet can further flow to the mounting planar face of the main body frame 1a along with the first air deflector 6a, thereby finally increasing the air supply distance and the air output effect of the ceiling recessed fan. Wherein, the width of the first air deflector 6a which is less than or equal to the width of the side frame 11a, is selected and set according to actual needs.

[0556] The plane where the first air deflector 6a is located tilts upward relative to the horizontal plane to form a tilting angle d , and the angle range of the tilting angle d is $0^\circ < d \leq 10^\circ$; and/or, the plane where the first air deflector 6a is located is parallel to the horizontal plane, that is, the angle of the tilting angle d is 0° at this time.

[0557] Taking the experiment data of a 3 horse power air conditioner as an example, in this solution, the tilting angle d is adjusted, wherein the upward tilting of the plane where the first air deflector 6a is located relative to the horizontal plane is a positive angle and the downward tilting relative to the horizontal plane is a negative angle, and the simulation structure is as follows:

Included angle d	Air volume (m^3/h)	Air supply distance
15°	1112	3.3m
10°	1112	3.4m
5°	1112	3.5m
0°	1100	3m
-5°	1052	2.6m

[0558] From the experiment results, when the included angle d is 5° (that is, the plane where the first air deflector is located tilts upward by 5° relative to the horizontal plane at this time), the air volume reaches a maximum value, and the air supply distance also reaches a maximum value. When the included angle d is 0° (at this time, the plane where the first air deflector is located is parallel to the horizontal plane), the air volume begins to decrease, and the air supply distance also begins to decrease. When the included angle d is -5° (at this time, the plane where the first air deflector is located tilts downward by 5° relative to the horizontal plane), the air volume is seriously attenuated, and the air supply distance is also seriously reduced. When the included angle d is 10° (at this time, the plane where the first air deflector is located tilts upward by 10° relative to the horizontal plane), the air volume is not changed obviously, but the air supply distance begins to decrease. When the included angle d is 15° (at this time, the plane where the first air deflector is located tilts upward by 15° relative to the horizontal plane), the air volume is not changed obviously, and the air supply distance is greatly attenuated. Moreover, the dimension of the ceiling recessed fan projecting out of the ceiling is required to be large at this time, which will affect the aesthetic feeling of the ceiling recessed fan. Taking the first air deflector with a width of 3cm as an example, when the plane where the first air deflector is located tilts upward by 15° relative to the horizontal plane, a conventional dimension of the ceiling recessed fan projecting out of the ceiling cannot satisfy the requirements of this dimension at this time, and thus the included angle of 15° cannot be used.

[0559] The air outlet assembly also includes a second air deflector 4a swingably arranged at the air outlet 10a. The included angle e between the plane of the first air deflector 6a and the plane of the second air deflector 4a is in the angle range of $-10^\circ \leq e \leq 10^\circ$, and when $e=0^\circ$, the plane of the first air deflector 6a is parallel to the plane of the second air deflector 4a. By joint cooperation between the first air deflector 6a and the second air deflector 4a, the air supply distance of the ceiling recessed fan is further enhanced, thereby improving the air output effect of the ceiling recessed fan.

[0560] Taking the experiment data of a 3 horse power air conditioner as an example, in this solution, the plane where the second air deflector 4a is located is parallel to the horizontal plane, and simulation is performed by adjusting the angle of the first air deflector, wherein the upward tilting of the plane where the first air deflector 6a is located is a positive angle and the downward tilting is a negative angle relative to the horizontal plane. The simulation results are as follows:

Included angle e	Air volume (m^3/h)	Air supply distance
15°	748	3.2
10°	830	3.3
0°	995	3.5m
-10°	1005	3.5
-15°	1112	2.5

[0561] From the simulation results, when the angle e is 0° (at this time, the plane where the first air deflector is located is parallel to the plane where the second air deflector is located), at this time, the air volume substantially reaches a maximum value, and the air supply distance also reaches a maximum value. When the angle e is -10° , the air volume can reach a maximum value, but the air supply distance begins to be attenuated. When the angle e is -15° , the air volume still remains at the maximum value, but the air supply distance is seriously attenuated, which cannot achieve horizontal air output against the wall during cooling. When the angle e is 10° , the air volume and the air supply distance both begin to be attenuated. When the angle e is 15° , the air volume and the air supply distance are seriously attenuated, which cannot ensure the normal refrigeration efficiency of the ceiling recessed fan.

[0562] As another embodiment, the main body frame 1a includes a side frame 11a, at least part of the air output of the air outlet 10a passes through the side frame 11a, and an air deflecting channel 7a formed on the side frame 11a constitutes an air deflecting structure. The air deflecting channel is used to reduce the influence of the side frame 11a on the airflow at the air outlet, and deflect the airflow passing through the side frame 11a (the upper layer airflow at the air outlet), so as to change the airflow structure at the air outlet and improve the air output effect of the ceiling recessed fan.

[0563] The width of the air deflecting channel 7a gradually increases along the air output direction. Wherein, the width of the air deflecting channel 7a refers to the dimension in the direction of a connection line between two adjacent corners of the ceiling recessed fan. Wherein, the horizontal section of the air deflecting channel is in the shape of volcano, and wherein, the narrow crater of the volcano shape faces toward the interior of the ceiling recessed fan. On the premise of maintaining a constant overall thickness of the side frame 11a, the side frame 11a is provided with an air deflecting channel 7a in the shape of volcano, and at this time, and when part of the air output of the air outlet 10a passes through the air deflecting channel 7a, it is possible to gradually flow to the corner of the ceiling recessed fan under the deflection of the air deflecting channel 7a, thereby increasing the air output range of the ceiling recessed fan.

[0564] As another embodiment, the depth of the air deflecting channel 7a is gradually increased. Wherein, the depth of the air deflecting channel 7a refers to the dimension of the ceiling recessed fan in the thickness direction. Along the air output direction of the air outlet, the distance from the bottom surface of the air deflecting channel 7a to the same horizontal plane gradually increases. For example, the cross section of the air deflecting channel 7a is a right-angled trapezoid, the diagonal of the right-angled trapezoid constitutes the bottom surface of the air deflecting channel 7a, and the air output of the air outlet 10a sequentially passes through the base of the right-angled trapezoid with a small size and the base of the right-angled trapezoid with a large size. Wherein, the overall dimension of the side frame 11a does not change, and part of the air output of the air outlet 10a can gradually flow to the mounting planar face (for example, the ceiling) of the main body frame 1a along the bottom surface of the air deflecting channel 7a when passing through the air deflecting channel 7a, so that the airflow flowing out of the air deflecting channel 7a can be attached to the mounting planar face in parallel as much as possible, thereby increasing the flow distance of the airflow on the mounting planar face and increasing the air supply distance.

[0565] The air outlet assembly 3a includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0566] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. Moreover, under the structural restriction of the ceiling recessed fan, since the structure of the internal air duct of the ceiling recessed fan is generally fixed, the method of adjusting the air output distance and the air volume by all the ceiling recessed fan is to adjust the air output direction of the ceiling recessed fan by setting the air deflector at the air outlet to enhance the air output effect of the ceiling recessed fan. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the solution of providing the air deflector at the air outlet alone actually has a small influence on the air output effect of the ceiling recessed fan, and the air output direction of the air outlet duct, which is neglected and ignored in the art, is an aspect to be improved that may effectively enhance a heating efficiency of the ceiling recessed fan in turn.

[0567] Accordingly, according to an eighth embodiment of the present disclosure, a ceiling recessed fan with a second air deflector as shown in Figs. 34 and 35 is provided, which includes: a main body frame 1a internally provided with an air outlet duct 2a having a first end 21a and a second end 22a provided along the airflow direction; an air outlet assembly 3a arranged in the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position that descends to a predetermined height, wherein an air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a, and the air outlet 10a communicates with the second end 22a of the air outlet duct 2a; a second air deflector 6a swingably arranged in the air outlet duct 2a and capable of changing an air output direction of the air outlet duct 2a; and a first air deflector 4a swingably arranged on the air outlet assembly 3a and capable of adjusting a height of the air outlet 10a when the air outlet assembly 3a is in an operation position. By joint cooperation

between the first air deflector 4a and the second air deflector 6a, the adjustment of the air output direction of the ceiling recessed fan is further increased, and the air output effect of the ceiling recessed fan is finally improved. When the air outlet assembly 3a is in an operation position, an included angle c is formed between the plane where the first air deflector 4a is located and the plane where the second air deflector 6a is located. The second air deflector 6a is arranged to deflect the airflow direction in the air outlet channel. For example, when the air output volume of the ceiling recessed fan is large, at this time, the obstruction effect produced by the structure of the ceiling recessed fan between the second end of the air outlet channel and the air outlet is not obvious, and the air output direction at the air outlet can achieve preset requirements, so that the second air deflector 6a does not need to deflect the airflow in the air outlet channel 2a at this time. Also that is, at this time, the second air deflector 6a is parallel to the airflow direction in the air outlet duct 2a. However, when the air output volume is small, the structure of the ceiling recessed fan between the second end of the air outlet duct and the air outlet will seriously obstruct the air circulation inside the ceiling recessed fan, and even with turbulence, so that the air output direction of the air outlet 10a will change uncontrollably. At this time, the second air deflector 6a is adjusted to adjust the airflow direction in the air outlet duct 2a. The air output direction of the air outlet duct is closer to the required air output direction of the air outlet 10a, thereby reducing the obstruction effect of the ceiling recessed fan structure between the second end of the air outlet duct and the air outlet as much as possible, and improving the air output effect of the ceiling recessed fan. At the same time, the angle c is defined to provide a standard for a designer, which facilitates determining the parameters of the second air deflector 6a. For example, the width of the second air deflector 6a is determined according to a maximum value of the angle c and the width of a corresponding position of the air outlet duct, which avoids interference between the second air deflector 6a and the inner surface of the air outlet duct when the second air deflector 6a swings to the angle c . Wherein, the maximum value of the angle c is inversely proportional to the width of the second air deflector 6a. The greater the maximum value of the angle c is, the smaller the value of the width of the second air deflector 6a will be. The smaller the maximum value of the angle c is, the greater the value of the width of the second air deflector 6a will be. It is ensured that the air output effect of the ceiling recessed fan product achieves preset requirements.

[0568] Wherein, the air output direction of the air outlet duct 2a is the flow direction of the airflow flowing through the second end 22a of the air outlet duct 2a, and the air output direction of the air outlet is the flow direction of the airflow flowing through the air outlet. The height of the air outlet 10a is the height between the edge of the main body frame 1a forming the lowermost point of the air outlet duct 2a and the outermost edge of the first air deflector 4a in the lifting direction of the air outlet assembly 3a.

[0569] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a.

[0570] The ceiling recessed fan has a cooling mode. When the ceiling recessed fan is in a cooling mode, the included angle c is in the range of 90° to 110° .

[0571] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, under the condition that the width of the second air deflector is 30mm, simulation is performed by adjusting the angle of the included angle c , and the simulation results are as follows:

Angle c	Air volume	Air supply distance
80°	1000	2.9m
90°	1089	3.4m
100°	1112	3.5m
110°	1055	3.4m
120°	990	2.6m

[0572] From the simulation results, when the ceiling recessed fan is in a cooling mode, when the included angle c is 100° , the air volume and the air supply distance both reach a maximum value. When the included angle c increases to 110° , the air volume and the air supply distance both begin to decrease. When the included angle c continues to increase to 120° , the air volume and the air supply distance are both seriously attenuated, which cannot satisfy the requirements of the ceiling recessed fan. When the included angle c is reduced to 90° , the air volume and the air supply distance both begin to decrease. When the included angle c continues to decrease to 80° , the air volume and the air supply distance will also be seriously attenuated, which cannot meet the requirements of the ceiling recessed fan. Also that is, when the ceiling recessed fan is in a cooling mode and the included angle c is in the range of 90° to 110° , the air volume and the air supply distance can be reasonably matched to satisfy the air output requirements of the ceiling recessed fan.

[0573] The ceiling recessed fan has a heating mode. When the ceiling recessed fan is in a heating mode, the included angle c is in the range of 145° to 165° .

[0574] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, under the condition that the width of the second air deflector is 30mm, simulation is performed by adjusting the angle of the included angle c, and the simulation results are as follows:

Angle c	Air volume	Air supply distance
135°	1005	0.5m
145°	1089	0.8m
155°	1112	1.0m
165°	1112	1.2m
175°	1000	1.5m

[0575] From the simulation results, when the ceiling recessed fan is in a heating mode, when the included angle c is 155°, the air volume reaches a maximum value. Although the air supply distance does not reach a minimum value, this air supply distance can allow the air output of the ceiling recessed fan to substantially blow out vertically downward, so as to realize rapid heating. When the included angle c increases to 165°, although the air volume remains unchanged, the air supply distance begins to increase, which indicates that the efficiency of the air output of the ceiling recessed fan flowing to the ground decreases at this time. When the included angle c continues to increase to 175°, the air volume is seriously attenuated, and the air supply distance is seriously increased, which cannot satisfy the requirements of the ceiling recessed fan. When the included angle c decreases to 145°, the air volume begins to decrease, and the air supply distance also begins to decrease. However, as the air output of the ceiling recessed fan surrounds the periphery of the air return gate, when the air supply distance decreases, it is already indicated that there is a possible phenomenon of intaking part of the airflow of the air outlet by the air return gate. When the included angle c continues to decrease to 135°, the air volume and the air supply distance will also be seriously attenuated. At this time, the air supply distance indicates that the ceiling recessed fan is necessarily present with a phenomenon of intaking the air output of the air outlet by the air return gate at this time, so that it is already impossible to improve the air output effect of the ceiling recessed fan. Also that is, when the ceiling recessed fan is in a heating mode and the included angle c is in the range of 145° to 165°, the air volume and the air supply distance can be reasonably matched to satisfy the air output requirements of the ceiling recessed fan.

[0576] The air outlet assembly has a closed position to close the air outlet 10a in cooperation with the main body frame 1a, and the air deflector 4a has a first edge 41a and a second edge 42a. When the air outlet assembly 3a is in the closed position, the first edge 41a is sealed with a corresponding position of the main body frame 1a, and the second edge 42a is sealed with a corresponding edge of the air outlet assembly 3a. By way of a corresponding seal between the first edge 41a and the main body frame 1a and a corresponding seal between the second edge 42a and the air outlet assembly, it is ensured that when the air outlet assembly is in the closed position, the air deflector 4a can enclose a corresponding position of the air outlet 10a, thereby avoiding impurities such as dust entering the interior of the ceiling recessed fan from the position of the air outlet 10a to affect the performance of the ceiling recessed fan.

[0577] When the air outlet assembly 3a is in the closed position, the air outlet assembly 3a and the air deflector 4a jointly cooperate with the main body frame 1a to form a seal.

[0578] The second edge 42a is provided with a first step structure, and the air outlet assembly 3a is provided with a second step structure fit with the first step structure. When the air outlet assembly 3a is in the closed position, the first step structure is sealingly fit with the second step structure. The first step structure and the second step structure not only make the sealing between the air deflector 4a and the air outlet assembly 3a reliable, but also allow that the structure of the air outlet assembly 3a is not be affected by a structural interference between the air deflector 4a and the air outlet assembly 3a during the swinging process of the air deflector 4a.

[0579] The first step structure is provided with a seal, and when the air outlet assembly 3a is in the closed position, the seal is arranged between the first step structure and the second step structure. Also that is, the seal moves together with the air deflector, and when the air deflector is sealed relative to the air outlet assembly, the seal can enclose a slit between the air deflector and the air outlet assembly, thereby enhancing the sealing effect between the air deflector and the air outlet assembly.

[0580] The ceiling recessed fan also includes a swinging mechanism arranged on the air outlet assembly 3a, and the air deflector 4a is arranged on the swinging mechanism.

[0581] The swinging mechanism includes a rotary arm 5a, one end of which is hinged to the air outlet assembly 3a, and the other end of which is arranged on the air deflector 4a. In some embodiments, both ends of the air deflector 4a in the length direction are provided with a rotary arm 5a, thereby ensuring the synchronization of the overall movement of the air deflector 4a.

[0582] The swinging mechanism also includes a driving member arranged on the air outlet assembly 3a and directly or

indirectly driving the rotary arm 5a to rotate. Wherein, one end of the rotary arm 5a is arranged on the driving member, and the air deflector 4a is arranged on the other end of the rotary arm 5a. When the rotary arm 5a rotates with the end arranged on the driving member, the air deflector 4a may move together with the end of the rotary arm 5a, so as to realize the swing of the air deflector 4a, wherein the driving member is a stepper motor.

[0583] The second air deflector 6a divides the air outlet duct 2a into a first air outlet duct and a second air outlet duct.

[0584] Along the airflow direction of the air outlet duct 2a, the width of the first air outlet duct gradually decreases; and/or along the airflow direction of the air outlet duct 2a, the width of the second air outlet duct 2a gradually decreases.

[0585] The ceiling recessed fan has a cooling mode. When the ceiling recessed fan is in a cooling mode, the ratio of the average width D1 of the first air outlet duct to the average width D2 of the second air outlet duct is in the range of $1.0 \leq D1/D2 \leq 1.1$.

[0586] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, under the condition that the width of the second air deflector is 30mm, simulation is performed by adjusting the ratio of D1/D2 and the angle of the included angle c, and the simulation results are as follows:

Angle c	D1/D2	Air volume	Air supply distance
80°	1.1	1000	2.9m
90°	1.1	1089	3.4m
100°	1.1	1112	3.5m
110°	1.0	1055	3.4m
120°	1.0	990	2.6m

[0587] From the simulation results, when the ceiling recessed fan is in a cooling mode, under the condition that D1/D2 is 1.1, when the included angle c is 100°, the air volume and the air supply distance both reach a maximum value. When the included angle c decreases to 90°, the air volume and the air supply distance both begin to decrease. When the included angle c continues to decrease to 80°, the air volume and the air supply distance will also be seriously attenuated, which cannot satisfy the requirements of the ceiling recessed fan. Under the condition that D1/D2 is 1.0, when the included angle c increases to 110°, the air volume and the air supply distance both begin to decrease. When the included angle c continues to increase to 120°, the air volume and the air supply distance are both seriously attenuated, which cannot meet the requirements of the ceiling recessed fan. Also that is, when the ceiling recessed fan is in a cooling mode, under the condition that D1/D2 is 1.1, when the included angle c is within the range of 90° to 100°, the air volume and the air supply distance can be reasonably matched to satisfy the air output requirements of the ceiling recessed fan. Under the condition that D1/D2 is 1.0, when the included angle c is in the range of 100° to 110°, the air volume and the air supply distance can be reasonably matched to satisfy the air output requirements of the ceiling recessed fan.

[0588] The ceiling recessed fan has a heating mode. When the ceiling recessed fan is in a heating mode, the ratio of the average width D1 of the first air outlet duct to the average width D2 of the second air outlet duct is in the range of $1.2 \leq D1/D2 \leq 1.25$.

[0589] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, under the condition that the width of the second air deflector is 30mm, simulation is performed by adjusting the ratio of D1/D2 and the angle of the included angle c, and the simulation results are as follows:

Angle c	D1/D2	Air volume	Air supply distance
135°	1.25	1005	0.5m
145°	1.2	1089	0.8m
155°	1.2	1112	1.0m
165°	1.2	1112	1.2m
175°	1.25	1000	1.5m

[0590] From the simulation results, when the ceiling recessed fan is in a heating mode, under the condition that D1/D2 is 1.2, when the included angle c is 155°, the air volume and the air supply distance both reach a maximum value. When the included angle c is reduced to 145°, the air volume and the air supply distance both begin to decrease. When the included angle c is increased to 165°, although the air volume remains unchanged, the air supply distance begins to increase, which will still make the heating effect of the ceiling recessed fan become worse. Under the condition that D1/D2 is 1.25, when the

included angle c continues to decrease to 135° , the air volume and the air supply distance will also be seriously attenuated, which cannot satisfy the requirements of the ceiling recessed fan. When the included angle c continues to increase to 175° , the air volume is seriously attenuated, and the air supply distance is too large, which cannot satisfy the requirements of the ceiling recessed fan. Also that is, when the ceiling recessed fan is in a heating mode, under the condition that $D1/D2$ is 1.2, when the included angle c is within the range of 145° to 165° , the air volume and the air supply distance can be reasonably matched to satisfy the air output requirements of the ceiling recessed fan. Under the condition that $D1/D2$ is 1.25, when the included angle c is in the range of less than 145° or more than 165° , it is impossible to satisfy the requirements of the ceiling recessed fan.

[0591] The ceiling recessed fan has a cooling mode. When the ceiling recessed fan is in a cooling mode, the included angle between the second air deflector and the vertical surface is in the range of 0° to 20° .

[0592] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, under the condition that the width of the second air deflector is 30mm and the included angle between the first air deflector and the vertical surface is 90° , simulation is performed by adjusting the included angle between the second air deflector and the vertical surface to realize the angle change of the included angle c , and the simulation results are as follows:

Angle c	Included angle between the second air deflector and the vertical surface	Air volume	Air supply distance
80°	-10°	1000	2.9m
90°	0°	1089	3.4m
100°	10°	1112	3.5m
110°	20°	1055	3.4m
120°	30°	990	2.6m

[0593] From the simulation results, when the ceiling recessed fan is in a cooling mode, when the included angle c is 100° , the air volume and the air supply distance both reach a maximum value. When the included angle c increases to 110° , the air volume and the air supply distance both begin to decrease. When the included angle c continues to increase to 120° , the air volume and the air supply distance are both seriously attenuated, which cannot satisfy the requirements of the ceiling recessed fan. When the included angle c is reduced to 90° , the air volume and the air supply distance both begin to decrease. When the included angle c continues to decrease to 80° , the air volume and the air supply distance will also be seriously attenuated, which cannot meet the requirements of the ceiling recessed fan. Also that is, when the ceiling recessed fan is in a cooling mode and the included angle c is in the range of 90° to 110° , i.e., the included angle between the second air deflector and the vertical surface is in the range of 0° to 20° , the air volume and the air supply distance can be reasonably matched to satisfy the air output requirements of the ceiling recessed fan.

[0594] The ceiling recessed fan has a heating mode. When the ceiling recessed fan is in a heating mode, the included angle between the second air deflector and the vertical surface is in the range of -10° to 10° .

[0595] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, under the condition that the width of the second air deflector is 30mm and the included angle between the first air deflector and the vertical surface is 90° , simulation is performed by adjusting the included angle between the second air deflector and the vertical surface to realize the angle change of the included angle c , and the simulation results are as follows:

Angle c	Included angle between the second air deflector and the vertical surface	Air volume	Air supply distance
135°	-10°	1005	0.5m
145°	0°	1089	0.8m
155°	10°	1112	1.0m
165°	20°	1112	1.2m
175°	30°	1000	1.5m

[0596] From the simulation results, when the ceiling recessed fan is in a heating mode, when the included angle c is 155° , the air volume reaches a maximum value. Although the air supply distance does not reach a minimum value, this air supply distance can allow the air output of the ceiling recessed fan to substantially blow out vertically downward, so as to realize rapid heating. When the included angle c increases to 165° , although the air volume remains unchanged, the air supply

distance begins to increase, which indicates that the efficiency of the air output of the ceiling recessed fan flowing to the ground decreases at this time. When the included angle c continues to increase to 175° , the air volume is seriously attenuated, and the air supply distance is seriously increased, which cannot satisfy the requirements of the ceiling recessed fan. When the included angle c decreases to 145° , the air volume begins to decrease, and the air supply distance also begins to decrease. However, as the air output of the ceiling recessed fan surrounds the periphery of the air return gate, when the air supply distance decreases, it is already indicated that there is a possible phenomenon of intaking part of the airflow of the air outlet by the air return gate. When the included angle c continues to decrease to 135° , the air volume and the air supply distance will also be seriously attenuated. At this time, the air supply distance indicates that the ceiling recessed fan is necessarily present with a phenomenon of intaking the air output of the air outlet by the air return gate at this time, so that it is already impossible to improve the air output effect of the ceiling recessed fan. When the ceiling recessed fan is in a heating mode and the included angle c is in the range of 145° to 165° , i.e., the included angle between the second air deflector and the vertical surface is in the range of -10° to 10° , the air volume and the air supply distance can be reasonably matched to satisfy the air output requirements of the ceiling recessed fan.

[0597] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1a, and the air outlet assembly 3a is arranged on the lifting mechanism. The air outlet assembly 3a may project from or retract into the main body frame 1a by means of the lifting mechanism, so that the air outlet assembly 3a may move freely between the operation position and the closed position.

[0598] The air outlet assembly 3a includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0599] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. In view of the problem that the air outlet volume is attenuated more when the air supply distance is long present in the ceiling recessed fan that has been found by the inventors, in the related art, it is generally to simply increase the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air outlet volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the relationship concerning the height of the air outlet and the minimum circulation area of the air outlet duct, which is neglected and ignored in the art, can effectively enhance an improved matching degree between the air supply distance and the air volume of the ceiling recessed fan in turn.

[0600] Therefore, in order to ensure that the air supply distance and the air output volume of the ceiling recessed fan reach a better level as much as possible, a ceiling recessed fan with an air outlet as shown in Figure 36 is provided in a ninth embodiment of the present disclosure, which includes: a main body frame 1a internally provided with an air outlet duct 2a having a first end 21a and a second end 22a; and an air outlet assembly 3a arranged in the main body frame 1a in a way so as to be able to be raised and lowered, wherein the air outlet assembly 3a descends so that an air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a, and the air outlet 10a communicates with the air outlet duct 2a. The ratio of the circulation area $S1$ of the air outlet 10a to the circulation area $S2$ of the first end 21a is in the range of $0.7 \leq S1/S2 \leq 1.27$.

[0601] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a.

[0602] In some embodiments, the circulation area $S2$ of the first end 21a of the air outlet duct 2a is a fixed value, and the circumference of the air outlet assembly 3a is also a fixed value. With the change of the descending height of the air outlet assembly 3a, the height $h1$ of the air outlet 10a also changes gradually. At this time, the circulation area $S1$ of the air outlet 10a is the product of the height $h1$ of the air outlet 10a and the circumference of a portion of the air outlet assembly 3a for forming the air outlet 10a. Also that is, with the change of the height $h1$ of the air outlet 10a, the circulation area $S1$ of the air outlet also changes synchronously. The height $h1$ of the air outlet 10a refers to the height between the edge of the main body frame 1a forming the lowermost point of the air outlet duct 2a and the outermost edge of the air outlet module 3a in the lifting direction of the air outlet assembly 3a. When the structure of the air outlet assembly 3a for forming the air outlet 10a with the main body frame 1a is a horizontal structure, the height $h1$ of the air outlet 10a is also expressed as the descending height of the air outlet assembly 3a.

[0603] Taking the experiment data of a 3 horse power air conditioner as an example, the value of $S1/S2$ is adjusted for simulation. The simulation results are as follows:

S1/S2	Air volume (m ³ /h)	Air supply distance
0.53	667	3.3m
0.7	834	3.5m
0.98	1112	3.5m
1.27	1112	2m
1.58	1112	1.2m

[0604] From the simulation results, when S1/S2 is 0.98, the air volume reaches a maximum value, and the air supply distance also reaches a maximum value. When S1/S2 increased to 1.27, although the air volume remained at the maximum value, the air supply distance begins to decrease. When S1/S2 continues to increase to 1.58, the air volume remains at the maximum value, but the air supply distance is seriously attenuated. When S1/S2 is reduced to 0.7, although the air supply distance remains at the maximum value, the air volume begins to decrease. When S1/S2 continues to decrease to 0.53, the air volume further decreases and the air supply distance also begins to decrease. Also that is, only when S1/S2 is in the range of 0.7 to 1.27, the air volume and the air supply distance can be both ensured. When S1/S2 is too large, the air supply distance is too small, and when S1/S2 is too small, the air volume is too small.

[0605] The air outlet assembly 3a includes a rotatable air deflector 4a, and the air deflector 4a and the main body frame 1a form an air outlet 10a. The height h1 of the air outlet 10a can be adjusted during the rotation process of the air deflector 4a. At this time, the height h1 of the air outlet 10a refers to the height between the edge of the main body frame 1a forming the lowermost point of the air outlet duct 2a and the outermost edge of the air deflector 4a in the lifting direction of the air outlet assembly 3a.

[0606] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly 3a, and the air deflector 4a is arranged on the rotating mechanism.

[0607] The rotating mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly 3a, and the other end of which is arranged on the air deflector 4a. In some embodiments, both ends of the air deflector 4a in the length direction are provided with a rotary arm, thereby ensuring the synchronization of the overall movement of the air deflector 4a.

[0608] The rotating mechanism also includes a driving member arranged on the air outlet assembly 3a and drivingly connected with the rotary arm. Wherein, one end of the rotary arm is arranged on the driving member, and the air deflector 4a is arranged on the other end of the rotary arm. When the rotary arm rotates with the end arranged on the driving member, the air deflector 4a may move together with the end of the rotary arm, so as to realize the rotation of the air deflector 4a, wherein the driving member is a stepper motor.

[0609] The air outlet assembly 3a has a closed position to close the air outlet 10a in cooperation with the main body frame 1a, and the air deflector 4a has a first edge 41a and a second edge 42a. When the air outlet assembly 3a is in the closed position, the first edge 41a is sealed with a corresponding position of the main body frame 1a, and the second edge 42a is sealed with a corresponding edge of the air outlet frame.

[0610] A sealing structure is provided between the second edge 42a and the air outlet assembly 3a.

[0611] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1a, and the air outlet assembly 3a is arranged on the lifting mechanism. The air outlet assembly 3a may project from or retract into the main body frame 1a by means of the lifting mechanism, so that the air outlet assembly 3a may move freely between the operation position and the closed position.

[0612] The air outlet assembly 3a includes an air outlet frame, wherein an air outlet 10a is formed between the air outlet frame and the main body frame 1a, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein an air outlet 10a is formed between the air outlet frame and the main body frame 1a, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0613] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. Since the existing structure of the internal air duct of the ceiling recessed fan is generally fixed, the method of adjusting the air output distance and the air volume by all the ceiling recessed fan is to adjust the air output direction of the ceiling recessed fan by setting the air deflector at the air outlet to enhance the air output effect of the ceiling recessed fan. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the solution of providing the air deflector at the air outlet alone actually has a small influence on the air output effect of the ceiling recessed fan, and the parameters concerning the matching relationship between the air output direction of the air outlet duct and the angle of the air deflector, which are neglected and ignored in the art, are aspects to be improved that may effectively enhance a

heating efficiency of the ceiling recessed fan in turn.

[0614] Accordingly, according to a tenth embodiment of the present disclosure, a ceiling recessed fan as shown in Figure 37 is provided, which includes: a main body frame 1a internally provided with an air outlet duct 2a having a first end 21a and a second end 22a provided along the airflow direction; an air outlet assembly 3a disposed on the main body frame 1a in a way so as to be able to be raised and lowered, and the air outlet assembly 3a has an operation position that descends to a predetermined height, wherein an air outlet 10a is formed between the air outlet assembly 3a and the main body frame 1a, and the air outlet 10a communicates with the second end 22a of the air outlet duct 2a. When the air outlet assembly 3a is in an operation position, the angle b between the air outlet 10a and the air outlet duct 2a is in the angle range of $130^\circ \leq b \leq 150^\circ$. Wherein, the air output direction of the air outlet refers to the flow direction of air when passing through the flow section of the air outlet, and the air output direction of the air outlet duct 2a refers to the flow direction of air when flowing out of the air outlet duct 2a, that is, the flow direction of the airflow at the second end 22a.

[0615] Taking the experiment data of a 3 horse power air conditioner as an example, the value of the angle b is adjusted for simulation. The simulation results are as follows:

Angle b	Air volume (m ³ /h)	Air supply distance
125°	838	3.1m
130°	995	3.5m
140°	1005	3.5m
150°	1112	2.2m
155°	1112	1.4m

[0616] From the simulation results, when the angle b is 140°, the air volume substantially reaches a maximum value, and the air supply distance can reach a maximum value. When the angle b increases to 150°, although the air volume reaches a maximum value, the air supply distance begins to decrease. When the angle b continues to increase to 155°, the air volume remains unchanged at the maximum value, and the air supply distance is seriously attenuated, which cannot achieve the waterfall refrigeration effect by horizontal air output. When the angle b is reduced to 130°, although the air supply distance remains unchanged at the maximum value, the air volume begins to decrease. When the angle b continues to decrease to 125°, the air volume and the air supply distance both begin to decrease. Also that is, when the angle b is too large, although the air volume can remain unchanged at the maximum value, the air supply distance is seriously attenuated, which may result in a poor air output effect of the ceiling recessed fan. When the angle b is too small, the air volume and the air supply distance both begin to decrease, which may also result in a poor air output effect of the ceiling recessed fan. Only when the angle b is between 130° and 150°, the air volume and the air supply distance can be reasonably matched, which finally improves the air output effect of the ceiling recessed fan.

[0617] The air outlet assembly includes an air deflector 4a and an air outlet frame, wherein the air outlet frame is arranged in the main body frame 1a; the air deflector 4a is swingably arranged on the air outlet frame; and when the air outlet assembly 3a is in an operation position, the air deflector 4a may adjust the height of the air outlet 10a. When the air deflector 4a swings upward, the height of the air outlet 10a gradually decreases, and at this time, the air output direction at the air outlet may also gradually tilt upward, thereby increasing the wall attachment effect of the airflow at the air outlet. When the air deflector swings downward, the height of the air outlet 10a gradually increases, and at this time, the air output direction at the air outlet also gradually tilts downward. Further, since the air output direction of the air outlet duct 2a is substantially vertically downward, under the air output direction of the air outlet duct 2a and the structural definition of the air outlet 10a, at this time, the airflow of the air outlet 10a can be gradually adjusted from horizontal air output to vertical air output, so that the requirements of horizontal air output for cooling and vertical air output for heating can be satisfied at the same time under the cooperation of the air deflector and the air output direction of the air outlet duct.

[0618] The ceiling recessed fan has a cooling mode. When the ceiling recessed fan is in a cooling mode, in order to achieve waterfall refrigeration, it is necessary to allow the airflow to flow along the mounting planar face of the main body frame 1a of the ceiling recessed fan as much as possible. Therefore, the angle c between the plane where the air deflector 4a is located and the air output direction of the air outlet duct 2a is in the range of $120^\circ \leq c \leq 140^\circ$, so as to ensure that the air supply distance of the ceiling recessed fan meets the requirements of waterfall refrigeration.

[0619] Taking the experiment data of a 3 horse power air conditioner as an example, the value of the angle c is adjusted for simulation. The simulation results are as follows:

Angle c	Air volume	Air supply distance
115°	838	3.1m

(continued)

Angle c	Air volume	Air supply distance
120°	995	3.5m
130°	1005	3.5m
140°	1112	2.2m
145°	1112	1.4m

[0620] From the simulation results, when the angle c reaches 130°, the air volume substantially reaches a maximum value, and the air supply distance can reach a maximum value. When the angle c increases to 140°, although the air volume reaches a maximum value, the air supply distance begins to decrease. When the angle c continues to increase to 145°, the air volume remains unchanged at the maximum value, and the air supply distance is seriously attenuated, which cannot achieve the waterfall refrigeration effect by horizontal air output. When the angle c is reduced to 120°, although the air supply distance remains unchanged at the maximum value, the air volume begins to decrease. When the angle c continues to decrease to 115°, the air volume and the air supply distance both begin to decrease. Also that is, when the ceiling recessed fan is in a cooling mode, when the angle c is too large, although the air volume can remain unchanged at the maximum value, the air supply distance is seriously attenuated, which may result in a poor air output effect of the ceiling recessed fan. When the angle c is too small, the air volume and the air supply distance both begin to decrease, which may also result in a poor air output effect of the ceiling recessed fan. Only when the angle c is between 120° and 140°, the air volume and the air supply distance can be reasonably matched, which finally improves the air output effect of the ceiling recessed fan.

[0621] Furthermore, When the ceiling recessed fan is in a cooling mode, the angle range of the included angle a between the plane where the air deflector 4a is located and the horizontal plane is $-10^\circ \leq a \leq 10^\circ$, and when $a=0^\circ$, the plane where the air deflector 4a is located is parallel to the horizontal plane. Wherein, the upward tilting of the plane where the air deflector 4a is located relative to the horizontal plane (upward reflex of the air deflector 4a) is taken as a negative angle, and the downward tilting of the plane where the air deflector 4a is located relative to horizontal plane (downward swing of the air deflector 4a) is taken as a positive angle.

[0622] The ceiling recessed fan has a heating mode. When the ceiling recessed fan is in a cooling mode, in order to achieve rapid heating, it is necessary to allow the airflow to directly blow to the ground as much as possible. Therefore, the angle c between the plane where the air deflector 4a is located and the air output direction of the air outlet duct 2a is in the range of $180^\circ \leq c \leq 190^\circ$, so as to ensure that the air output angle of the ceiling recessed fan meets the requirements of rapid heating.

[0623] Taking the experiment data of a 3 horse power air conditioner as an example, the value of the angle c is adjusted for simulation. The simulation results are as follows:

Anglec	Air volume (m ³ /h)	Air supply distance
175°	1005	/(the airflow flows in midair without landing)
180°	1110	1.2m
185°	1112	0.8m
190°	1112	0.3m
195°	1112	/(the airflow is entrained by the air return gate without landing)

[0624] From the simulation results, when the angle c reaches 185°, the air volume reaches a maximum value, and the air supply distance also substantially reaches a maximum value. When the angle c increases to 190°, although the air volume reaches a maximum value, the air supply distance begins to decrease. When the angle c continues to increase to 195°, the air volume remains unchanged at the maximum value, but the airflow of the air outlet is entrained by the air return gate without landing. Also that is, at this time, it is impossible to realize the effect of rapid heating by vertical air output. When the angle c is reduced to 180°, although the air supply distance reaches a maximum value, the air volume begins to decrease. When the angle c continues to decrease to 175°, the air volume continues to decrease, and the airflow can only blow in midair rather than directly blowing to the ground, so that it is also impossible to realize the effect of rapid heating by vertical air output. Also that is, when the ceiling recessed fan is in a heating mode, when the angle c is too large, although the air volume can remain unchanged at the maximum value, the air supply distance is seriously attenuated, even with entrained reflux, which may result in a poor air output effect of the ceiling recessed fan. When the angle c is too small, the air volume

begins to decrease, and the airflow cannot reach the ground so that it is impossible to realize the effect of rapid heating by vertical air output, which may also result in a poor air output effect of the ceiling recessed fan. Only when the angle c is between 180° and 190° , the air volume and the air supply distance can be reasonably matched, which finally improves the air output effect of the ceiling recessed fan.

[0625] By defining the angle c between the air deflector 4a and the air output direction of the air outlet duct 2a, the design and assembly process of the air deflector 4a are defined. After the angle c is defined, according to the exposed surface formed between the main body frame 1a and the air outlet assembly 3a (in order to form the air outlet 10a, when the air outlet assembly 3a is retracted into the main body frame 1a, the appearance of the ceiling recessed fan may still be present with some area where the internal structure of the ceiling recessed fan is directly viewed, which may affect the aesthetic feeling of the ceiling recessed fan, and the area where the internal structure of the ceiling recessed fan is directly viewed constitutes the exposed surface), the dimension of the air deflector 4a is determined. Also that is, the exposed surface is obstructed by the air deflector 4a of this dimension, which overcomes the problem of a poor air output effect of the ceiling recessed fan due to the design of the air deflector only by the appearance structure of the ceiling recessed fan in the related art that has been found by the inventors, and ensures that the air output effect of the finished ceiling recessed fan achieves preset requirements.

[0626] It is to be noted that, the main body frame 1a is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1a is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1a and fixed to the ceiling through the main body frame 1a.

[0627] The height of the air outlet is the height between the edge of the main body frame 1a forming the lowermost point of the air outlet duct 2a and the outermost edge of the air deflector 4a in the lifting direction of the air outlet assembly.

[0628] The air outlet assembly has a closed position to close the air outlet 10a in cooperation with the main body frame 1a, and the air deflector 4a has a first edge 41a and a second edge 42a. When the air outlet assembly 3a is in the closed position, the first edge 41a is sealed with a corresponding position of the main body frame 1a, and the second edge 42a is sealed with a corresponding edge of the air outlet frame. By way of a corresponding seal between the first edge 41a and the main body frame 1a and a corresponding seal between the second edge 42a and the air outlet frame, it is ensured that when the air outlet assembly is in the closed position, the air deflector 4a can enclose a corresponding position of the air outlet 10a, thereby avoiding impurities such as dust entering the interior of the ceiling recessed fan from the position of the air outlet 10a to affect the performance of the ceiling recessed fan.

[0629] When the air outlet assembly 3a is in the closed position, the air outlet frame and the air deflector 4a jointly cooperate with the main body frame 1a to form a seal. Wherein, when the air outlet assembly 3a is in the closed position, the included angle a between the air deflector 4a and the horizontal plane is in the range of -10° to 0° . Also that is, when the air deflector 4a is at 0° , the plane where the air deflector 4a is located is parallel to the horizontal plane. When the air deflector 4a is at -10° , the plane where the air deflector 4a is located tilts upward by 10° relative to the horizontal plane.

[0630] The second edge 42a is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure, so that the first step structure can be sealingly fit with the second step structure. The first step structure and the second step structure not only make the sealing between the air deflector 4a and the air outlet assembly 3a reliable, but also allow that the structure of the air outlet assembly 3a is not be affected by a structural interference between the air deflector 4a and the air outlet frame during the swinging process of the air deflector 4a.

[0631] The first step structure is provided with a seal, and when the first step structure is sealingly fit with the second step structure, the seal is arranged between the first step structure and the second step structure. Also that is, the seal moves together with the air deflector, and when the air deflector is sealed relative to the air outlet frame, the seal can enclose a slit between the air deflector and the air outlet assembly, thereby enhancing the sealing effect between the air deflector and the air outlet frame.

[0632] The ceiling recessed fan also includes a swinging mechanism arranged on the air outlet assembly 3a, and the air deflector 4a is arranged on the swinging mechanism.

[0633] The swinging mechanism includes a rotary arm 5a, one end of which is hinged to the air outlet frame, and the other end of which is arranged on the air deflector 4a. In some embodiments, both ends of the air deflector 4a in the length direction are provided with a rotary arm 5a, thereby ensuring the synchronization of the overall movement of the air deflector 4a.

[0634] The swinging mechanism also includes a driving member arranged on the air outlet frame and directly or indirectly driving the rotary arm 5a to rotate. Wherein, one end of the rotary arm 5a is arranged on the driving member, and the air deflector 4a is arranged on the other end of the rotary arm 5a. When the rotary arm 5a rotates with the end arranged on the driving member, the air deflector 4a may move together with the end of the rotary arm 5a, so as to realize the swing of the air deflector 4a, wherein the driving member is a stepper motor.

[0635] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1a, and the air outlet assembly 3a is arranged on the lifting mechanism. The air outlet assembly 3a may project from or retract into the main body frame 1a by means of the lifting mechanism, so that the air outlet assembly 3a may move freely between the operation position and the closed position.

[0636] The air outlet assembly 3a includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3a includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0637] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. Since the existing structure of the internal air duct of the ceiling recessed fan is generally fixed, the method of adjusting the air output distance and the air volume by all the ceiling recessed fan is to adjust the air output direction of the ceiling recessed fan by setting the air deflector at the air outlet to enhance the air output effect of the ceiling recessed fan. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the solution of providing the air deflector at the air outlet alone actually has a small influence on the air output effect of the ceiling recessed fan, and the parameters concerning the matching relationship between the air output direction of the air outlet duct and the angle of the air deflector, which are neglected and ignored in the art, are aspects to be improved that may effectively enhance a heating efficiency of the ceiling recessed fan in turn.

[0638] Accordingly, the ceiling recessed fan as shown in Figure 1 includes: a main body frame 1b internally provided with an air outlet duct 2b having a first end 21b and a second end 22b provided along the airflow direction; an air outlet assembly 3b disposed on the main body frame 1b in a way so as to be able to be raised and lowered, and the air outlet assembly 3b has an operation position that descends to a predetermined height, wherein an air outlet 10b is formed between the air outlet assembly 3b and the main body frame 1b, and the air outlet 10b communicates with the second end 22b of the air outlet duct 2b. When the air outlet assembly 3b is in an operation position, the angle b between the air outlet 10b and the air outlet duct 2b is in the angle range of $130^\circ \leq b \leq 150^\circ$. Wherein, the air output direction of the air outlet refers to the flow direction of air when passing through the flow section of the air outlet, and the air output direction of the air outlet duct 2b refers to the flow direction of air when flowing out of the air outlet duct 2b, that is, the flow direction of the airflow at the second end 22b.

[0639] It is to be noted that, the main body frame 1b is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1b is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1b and fixed to the ceiling through the main body frame 1b. The ceiling recessed fan has an indoor unit installed in the ceiling, the main body frame 1b is connected with the indoor unit, the air outlet assembly 3b is connected with the main body frame 1b, and the indoor unit has an indoor unit air exhaust. The first end 21b of the air outlet duct 2b of the main body frame 1b communicates with the indoor unit air exhaust, and the air flow path is: air return gate-evaporator-indoor unit air exhaust-first end 21b of the air outlet duct 2b-second end 22b of the air outlet duct 2b-air outlet (blowing out).

[0640] Taking the experiment data of a 3 horse power air conditioner as an example, the value of the angle b is adjusted for simulation. The simulation results are as follows:

Angle b	Air volume (m ³ /h)	Air supply distance
125°	838	3.1m
130°	995	3.5m
140°	1005	3.5m
150°	1112	2.2m
155°	1112	1.4m

[0641] From the simulation results, when the angle b is 140°, the air volume substantially reaches a maximum value, and the air supply distance can reach a maximum value. When the angle b increases to 150°, although the air volume reaches a maximum value, the air supply distance begins to decrease. When the angle b continues to increase to 155°, the air volume remains unchanged at the maximum value, and the air supply distance is seriously attenuated, which cannot achieve the waterfall refrigeration effect by horizontal air output. When the angle b is reduced to 130°, although the air supply distance remains unchanged at the maximum value, the air volume begins to decrease. When the angle b continues to decrease to 125°, the air volume and the air supply distance both begin to decrease. Also that is, when the angle b is too large, although the air volume can remain unchanged at the maximum value, the air supply distance is seriously attenuated, which may result in a poor air output effect of the ceiling recessed fan. When the angle b is too small, the air volume and the air supply distance both begin to decrease, which may also result in a poor air output effect of the ceiling recessed fan. Only when the angle b is between 130° and 150°, the air volume and the air supply distance can be reasonably matched, which finally

improves the air output effect of the ceiling recessed fan.

[0642] The air outlet assembly includes an air deflector 4b and an air outlet frame, wherein the air outlet frame is arranged in the main body frame 1b; the air deflector 4b is swingably arranged on the air outlet frame; and when the air outlet assembly 3b is in an operation position, the air deflector 4b may adjust the height of the air outlet 10b. When the air deflector 4b swings upward, the height of the air outlet 10b gradually decreases, and at this time, the air output direction at the air outlet may also gradually tilt upward, thereby increasing the wall attachment effect of the airflow at the air outlet. When the air deflector swings downward, the height of the air outlet 10b gradually increases, and at this time, the air output direction at the air outlet also gradually tilts downward. Further, since the air output direction of the air outlet duct 2b is substantially vertically downward, under the air output direction of the air outlet duct 2b and the structural definition of the air outlet 10b, at this time, the airflow of the air outlet 10b can be gradually adjusted from horizontal air output to vertical air output, so that the requirements of horizontal air output for cooling and vertical air output for heating can be satisfied at the same time under the cooperation of the air deflector and the air output direction of the air outlet duct.

[0643] The ceiling recessed fan has a cooling mode. When the ceiling recessed fan is in a cooling mode, in order to achieve waterfall refrigeration, it is necessary to allow the airflow to flow along the mounting planar face of the main body frame 1b of the ceiling recessed fan as much as possible. Therefore, the angle c between the plane where the air deflector 4b is located and the air output direction of the air outlet duct 2b is in the range of $120^\circ \leq c \leq 140^\circ$, so as to ensure that the air supply distance of the ceiling recessed fan meets the requirements of waterfall refrigeration.

[0644] Taking the experiment data of a 3 horse power air conditioner as an example, the value of the angle c is adjusted for simulation. The simulation results are as follows:

Angle c	Air volume	Air supply distance
115°	838	3.1m
120°	995	3.5m
130°	1005	3.5m
140°	1112	2.2m
145°	1112	1.4m

[0645] From the simulation results, when the angle c reaches 130° , the air volume substantially reaches a maximum value, and the air supply distance can reach a maximum value. When the angle c increases to 140° , although the air volume reaches a maximum value, the air supply distance begins to decrease. When the angle c continues to increase to 145° , the air volume remains unchanged at the maximum value, and the air supply distance is seriously attenuated, which cannot achieve the waterfall refrigeration effect by horizontal air output. When the angle c is reduced to 120° , although the air supply distance remains unchanged at the maximum value, the air volume begins to decrease. When the angle c continues to decrease to 115° , the air volume and the air supply distance both begin to decrease. Also that is, when the ceiling recessed fan is in a cooling mode, when the angle c is too large, although the air volume can remain unchanged at the maximum value, the air supply distance is seriously attenuated, which may result in a poor air output effect of the ceiling recessed fan. When the angle c is too small, the air volume and the air supply distance both begin to decrease, which may also result in a poor air output effect of the ceiling recessed fan. Only when the angle c is between 120° and 140° , the air volume and the air supply distance can be reasonably matched, which finally improves the air output effect of the ceiling recessed fan.

[0646] Furthermore, When the ceiling recessed fan is in a cooling mode, the angle range of the included angle a between the plane where the air deflector 4b is located and the horizontal plane is $-10^\circ \leq a \leq 10^\circ$, and when $a=0^\circ$, the plane where the air deflector 4b is located is parallel to the horizontal plane. Wherein, the upward tilting of the plane where the air deflector 4b is located relative to the horizontal plane (upward reflex of the air deflector 4b) is taken as a negative angle, and the downward tilting of the plane where the air deflector 4b is located relative to horizontal plane (downward swing of the air deflector 4b) is taken as a positive angle.

[0647] The ceiling recessed fan has a heating mode. When the ceiling recessed fan is in a cooling mode, in order to achieve rapid heating, it is necessary to allow the airflow to directly blow to the ground as much as possible. Therefore, the angle c between the plane where the air deflector 4b is located and the air output direction of the air outlet duct 2b is in the range of $180^\circ \leq c \leq 190^\circ$, so as to ensure that the air output angle of the ceiling recessed fan meets the requirements of rapid heating.

[0648] Taking the experiment data of a 3 horse power air conditioner as an example, the value of the angle c is adjusted for simulation. The simulation results are as follows:

Angle c	Air volume (m ³ /h)	Air supply distance
175°	1005	/(the airflow flows in midair without landing)
180°	1110	1.2m
185°	1112	0.8m
190°	1112	0.3m
195°	1112	/(the airflow is entrained by the air return gate without landing)

[0649] From the simulation results, when the angle c reaches 185°, the air volume reaches a maximum value, and the air supply distance also substantially reaches a maximum value. When the angle c increases to 190°, although the air volume reaches a maximum value, the air supply distance begins to decrease. When the angle c continues to increase to 195°, the air volume remains unchanged at the maximum value, but the airflow of the air outlet is entrained by the air return gate without landing. Also that is, at this time, it is impossible to realize the effect of rapid heating by vertical air output. When the angle c is reduced to 180°, although the air supply distance reaches a maximum value, the air volume begins to decrease. When the angle c continues to decrease to 175°, the air volume continues to decrease, and the airflow can only blow in midair rather than directly blowing to the ground, so that it is also impossible to realize the effect of rapid heating by vertical air output. Also that is, when the ceiling recessed fan is in a heating mode, when the angle c is too large, although the air volume can remain unchanged at the maximum value, the air supply distance is seriously attenuated, even with entrained reflux, which may result in a poor air output effect of the ceiling recessed fan. When the angle c is too small, the air volume begins to decrease, and the airflow cannot reach the ground so that it is impossible to realize the effect of rapid heating by vertical air output, which may also result in a poor air output effect of the ceiling recessed fan. Only when the angle c is between 180° and 190°, the air volume and the air supply distance can be reasonably matched, which finally improves the air output effect of the ceiling recessed fan.

[0650] By defining the angle c between the air deflector 4b and the air output direction of the air outlet duct 2b, the design and assembly process of the air deflector 4b are defined. After the angle c is defined, according to the exposed surface formed between the main body frame 1b and the air outlet assembly 3b (in order to form the air outlet 10b, when the air outlet assembly 3b is retracted into the main body frame 1b, the appearance of the ceiling recessed fan may still be present with some area where the internal structure of the ceiling recessed fan is directly viewed, which may affect the aesthetic feeling of the ceiling recessed fan, and the area where the internal structure of the ceiling recessed fan is directly viewed constitutes the exposed surface), the dimension of the air deflector 4b is determined. Also that is, the exposed surface is obstructed by the air deflector 4b of this dimension, which overcomes the problem of a poor air output effect of the ceiling recessed fan due to the design of the air deflector only by the appearance structure of the ceiling recessed fan in the related art that has been found by the inventors, and ensures that the air output effect of the finished ceiling recessed fan achieves preset requirements.

[0651] It is to be noted that, the main body frame 1b is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1b is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1b and fixed to the ceiling through the main body frame 1b.

[0652] The height of the air outlet is the height between the edge of the main body frame 1b forming the lowermost point of the air outlet duct 2b and the outermost edge of the air deflector 4b in the lifting direction of the air outlet assembly.

[0653] The air outlet assembly has a closed position to close the air outlet 10b in cooperation with the main body frame 1b, and the air deflector 4b has a first edge 41b and a second edge 42b. When the air outlet assembly 3b is in the closed position, the first edge 41b is sealed with a corresponding position of the main body frame 1b, and the second edge 42b is sealed with a corresponding edge of the air outlet frame. By way of a corresponding seal between the first edge 41b and the main body frame 1b and a corresponding seal between the second edge 42b and the air outlet frame, it is ensured that when the air outlet assembly is in the closed position, the air deflector 4b can enclose a corresponding position of the air outlet 10b, thereby avoiding impurities such as dust entering the interior of the ceiling recessed fan from the position of the air outlet 10b to affect the performance of the ceiling recessed fan.

[0654] When the air outlet assembly 3b is in the closed position, the air outlet frame and the air deflector 4b jointly cooperate with the main body frame 1b to form a seal. Wherein, when the air outlet assembly 3b is in the closed position, the included angle a between the air deflector 4b and the horizontal plane is in the range of -10° to 0°. Also that is, when the air deflector 4b is at 0°, the plane where the air deflector 4b is located is parallel to the horizontal plane. When the air deflector 4b is at -10°, the plane where the air deflector 4b is located tilts upward by 10° relative to the horizontal plane.

[0655] The second edge 42b is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure, so that the first step structure can be sealingly fit with the second step structure. The first step structure and the second step structure not only make the sealing between the air deflector 4b and the air outlet assembly 3b reliable, but also allow that the structure of the air outlet assembly 3b is not be affected by a structural

interference between the air deflector 4b and the air outlet frame during the swinging process of the air deflector 4b.

[0656] The first step structure is provided with a seal, and when the first step structure is sealingly fit with the second step structure, the seal is arranged between the first step structure and the second step structure. Also that is, the seal moves together with the air deflector, and when the air deflector is sealed relative to the air outlet frame, the seal can enclose a slit between the air deflector and the air outlet assembly, thereby enhancing the sealing effect between the air deflector and the air outlet frame.

[0657] The ceiling recessed fan also includes a swinging mechanism arranged on the air outlet assembly 3b, and the air deflector 4b is arranged on the swinging mechanism.

[0658] The swinging mechanism includes a rotary arm 5b, one end of which is hinged to the air outlet frame, and the other end of which is arranged on the air deflector 4b. In some embodiments, both ends of the air deflector 4b in the length direction are provided with a rotary arm 5b, thereby ensuring the synchronization of the overall movement of the air deflector 4b.

[0659] The swinging mechanism also includes a driving member arranged on the air outlet frame and directly or indirectly driving the rotary arm 5b to rotate. Wherein, one end of the rotary arm is arranged on the driving member, and the air deflector 4b is arranged on the other end of the rotary arm. When the rotary arm rotates with the end arranged on the driving member, the air deflector 4b may move together with the end of the rotary arm, so as to realize the rotation of the air deflector 4b, wherein the driving member is a stepper motor.

[0660] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1b, and the air outlet assembly 3b is arranged on the lifting mechanism. The air outlet assembly 3b may project from or retract into the main body frame 1b by means of the lifting mechanism, so that the air outlet assembly 3b may move freely between the operation position and the closed position.

[0661] The air outlet assembly 3b includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3b includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0662] As shown in Figs. 2 and 3, another embodiment of the ceiling recessed fan is provided. The air outlet assembly 3b is provided with at least one second air outlet 13b communicating with the air outlet duct. The second air outlet 13b is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the air outlet 10b with the second air outlet 13b, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0663] When the air outlet assembly 3b descends so that an air outlet 10b is formed between the air outlet assembly 3b and the main body frame 1b, a gap which is formed between the air outlet assembly 3b and the main body frame 1b, forms an air supply duct 14b. One end of the air supply duct 14b communicates with the air outlet duct, and the other end of the air supply duct 14b forms a first air outlet 10b. The airflow in the air outlet duct 2b is blown out by the air outlet 10b after air deflecting by the air supply duct 14b, and the vertically downward airflow in the air outlet duct 2b is deflected by the air supply duct 14b to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0664] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflecting. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 1b of the present disclosure further includes a side frame 15b. When the air outlet assembly 3b descends so that an air outlet 10b is formed between the air outlet assembly 3b and the main body frame 1b, an air supply duct 14b is formed between the air outlet assembly 3b and the side frame 15b, and on the mounting planar face of the main body frame 1b (for example, the ceiling), the projection of the air outlet assembly 3b at least partially coincides with the projection of the side frame 15b. When the projection of the air outlet assembly 3b coincides with the projection of the side frame 15b, the air outlet assembly is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the air outlet 10b, the air outlet assembly 3b gradually goes away from the main body frame 1b to form an air supply duct 14b. At this time, a corresponding portion of the air outlet assembly 3b forms a lower side surface of the air supply duct 14b. When the airflow flows through the air supply duct 14b, under the air deflecting effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0665] As another embodiment, the projection of the air outlet assembly 3b completely coincides with the projection of the side frame 15b. In this case, compared with the case where the projection of the air outlet assembly 3b partially

coincides with the projection of the side frame 15b, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 3b is attached to the main body frame 1b, and a corresponding portion of the air outlet assembly 3b is attached to the side frame 15b, so that a person can only see the air outlet assembly 3b instead of the main body frame 1b when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0666] As another embodiment, the projection of the air outlet assembly 3b exceeds the projection of the side frame 15b. In this case, compared with the case where the projection of the air outlet assembly 3b completely coincides with the projection of the side frame 15b, the air outlet assembly can be further extended, thereby further increasing a horizontal blow effect and an air supply distance of the ceiling recessed fan.

[0667] In some embodiments, the projection of the air outlet assembly 3b exceeds the projection of the main body frame 1b, so that the air outlet assembly 3b effectively increases the air deflecting dimension relative to the related art, so as to increase the air supply distance of the ceiling recessed fan.

[0668] The ceiling recessed fan further includes an air deflector 4b which is rotatably arranged at the second air outlet 13b and capable of closing or opening the second air outlet 13b. When the second air outlet 13b needs to be opened, the air deflector 4b rotates gradually, so that the second air outlet 13b communicates with the air outlet duct 2b to allow that the airflow in the air outlet duct 2b is blown out by the second air outlet 13b, and the air deflector 4b adjusts its tilting angle according to actual needs to adjust the air output direction and/or the air output volume of the second air outlet 13b. When the second air outlet 13b needs to be closed, the air deflector 4b returns to the state of sealing fit with the air outlet assembly 3b so as to close the second air outlet 13b. At this time, the airflow in the air outlet duct 2b can only be blown out from the air outlet 10b under the joint deflection effect of the air outlet assembly 3b and the air deflector 4b.

[0669] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. In view of the problem that the air outlet volume is attenuated more when the air supply distance is long present in the ceiling recessed fan that has been found by the inventors, in the related art, it is generally to simply increase the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air outlet volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the relationship concerning the height of the air outlet and the target air output volume, which is neglected and ignored in the art, can effectively enhance an improved matching degree between the air supply distance and the air volume of the ceiling recessed fan in turn.

[0670] Therefore, in order to ensure that the air supply distance and the air output volume of the ceiling recessed fan reach a better level as much as possible, the present disclosure provides a ceiling recessed fan as shown in Figure 41, which includes: a main body frame 1c; and an air outlet assembly 3c arranged in the main body frame 1c in a way so as to be able to be raised and lowered. Moreover, the air outlet assembly 3a has an operation position descending to a set height and forming an air outlet 10c with the main body frame 1c. The height h_1 of the air outlet 10c is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$.

[0671] It is to be noted that, the main body frame 1c is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1c is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1c and fixed to the ceiling through the main body frame 1c. The height h_1 of the air outlet 10c refers to the height between the edge of the main body frame 1c forming the lowermost point of the air outlet duct and the outermost edge of the air outlet module 3c in the lifting direction of the air outlet assembly 3c. When the structure of the air outlet assembly 3c for forming the air outlet 10c with the main body frame 1c is a horizontal structure, the height h_1 of the air outlet 10c is also expressed as the descending height of the air outlet assembly 3c. The rated air output volume of the ceiling recessed fan refers to the air volume of the highest stage in an air supply mode under set conditions (set environments such as dry bulb temperature and wet bulb temperature). The ceiling recessed fan has an indoor unit installed in the ceiling, the main body frame 1c is connected with the indoor unit, the air outlet assembly 3c is connected with the main body frame 1c, and the indoor unit has an indoor unit air exhaust. The first end of the air outlet duct of the main body frame 1c communicates with the indoor unit air exhaust, and the air flow path is: air return gate-evaporator-indoor unit air exhaust-first end of the air outlet duct-second end of the air outlet duct-air outlet (blowing out).

[0672] When the height h_1 of the air outlet 10c is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$, the air output volume of the ceiling recessed fan is greater than or equal to 75% of a rated air output volume of the ceiling recessed fan.

[0673] Taking the experiment data of a 3 horse power air conditioner as an example, the value of h_1 is adjusted for simulation. The simulation results are as follows:

EP 4 495 495 A1

h1	Air volume (m ³ /h)	Air supply distance
15	667	3.3m
20	834	3.5m
28	1005	3.5m
36	1112	2m
45	1112	1.2m

[0674] From the simulation results, when h1 is 28mm, although the air volume does not reach a maximum value, the air supply distance reaches a maximum value. When h1 increases to 36mm, the air supply distance begins to decrease. When h1 continues to increase to 45mm, the air volume remains at the maximum value, but the air supply distance is apparently shortened. When h1 is reduced to 20mm, the air supply distance remains at the maximum value, but the air volume begins to decrease. When h1 continues to decrease to 15mm, the air volume continues to decrease, and at the same time, the air supply distance also begins to decrease. Also that is, when h1 is too large, although the air volume can be maintained, the air supply distance may be seriously reduced, which results in a poor air output effect of the ceiling recessed fan. When h1 is too small, the air outlet at this time cannot meet the requirements of the air output volume of the ceiling recessed fan. When h1 is in the range of 20mm to 36mm, the ceiling recessed fan reasonably matches the air volume and the air supply distance, which finally improves the air output effect of the ceiling recessed fan. When the ceiling recessed fan is designed, the target air volume of the ceiling recessed fan is set, and then the height of the air outlet 10c is designed according to the target air volume, so as to select a better height of the air outlet 10c. In this way, it is possible to set a descending stroke of the air outlet assembly 3c and a driving mechanism for driving the air outlet assembly 3c to ascend and descend, thereby effectively improving the design efficiency and solving the design and manufacturing cost.

[0675] Taking the experiment data of a 3 horse power air conditioner as an example, the value of h1 is adjusted for simulation. The simulation results are as follows:

h1	Air velocity (m/s)
15	16.1
20	12.0
28	8.6
36	6.7
45	5.4

[0676] From the simulation results, when h1 is 28mm, the air velocity reaches a comfortable value of 8.6m/s. When h1 increases to 36mm, the air velocity begins to decrease, which will reduce the indoor heat exchange effect. When h1 continues to increase to 45mm, the air velocity continues to decrease, so that the air velocity at the air outlet cannot meet the preset requirements. When h1 decreases to 20mm, the air velocity begins to increase, which might lead to a poor experience of air output skin blow at the air outlet. When h1 continues to decrease to 15mm, the air velocity continues to increase and exceeds a maximum limit, which leads to direct blow. Also that is, when h1 is too large, the air velocity cannot make the airflow blow into indoor effectively. When h1 is too small, the air velocity is so large as to cause skin blow. Only when h1 is in the range of 20mm to 36mm, the ceiling recessed fan reasonably matches the air velocity and the air supply distance, which finally improves the air output effect of the ceiling recessed fan.

[0677] The ceiling recessed fan also includes a fan, and there is a relationship between the rotation speed of the fan and the height h1 of the air outlet 10c. Also that is, at this time, the fan is a variable frequency fan, and the rotation speed of the fan can be adjusted as necessary. In order to ensure that the ceiling recessed fan reaches the target air output volume, the height h1 of the air outlet 10c is mated with the rotation speed of the fan, which effectively reduces the energy consumption and structural complexity of the ceiling recessed fan.

[0678] The air outlet assembly 3c includes a rotatable air deflector 4c, and the air deflector 4c and the main body frame 1c form an air outlet 10c. The height h1 of the air outlet 10c can be adjusted during the rotation process of the air deflector 4c. At this time, the height h1 of the air outlet 10c refers to the height between the edge of the main body frame 1c forming the lowermost point of the air outlet duct and the outermost edge of the air deflector 4c in the lifting direction of the air outlet assembly 3c.

[0679] When the ceiling recessed fan is in a cooling mode, the angle range of the included angle α between the plane where the air deflector 4c is located and the horizontal plane is $-10^\circ \leq \alpha \leq 10^\circ$, and when $\alpha=0^\circ$, the plane where the air

deflector 4c is located is parallel to the horizontal plane.

[0680] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by changing the value of α . With the upward tilting of the plane where the air deflector 4c is located relative to the mounting planar face of the main body frame 1c (upward reflex of the air deflector) as a negative angle, and the downward tilting of the plane where the air deflector 4c is located relative to the mounting planar face of the main body frame 1c (downward swing of the air deflector) as a positive angle, the simulation results are as follows:

Angle α	Air volume (m^3/h)	Air supply distance
-15°	838	3.1m
-10°	995	3.7m
0°	1005	3.5m
10°	1112	2.2m
15°	1112	1.4m

[0681] From the simulation results, when α is 0°, although the air volume does not reach a maximum value, the air supply distance substantially reaches a maximum value. When α is increased to 0°, the air volume reaches a maximum value, but the air supply distance begins to decrease. When h_1 continues to increase to 45mm, the air volume remains at the maximum value, but the air supply distance is apparently reduced, which cannot meet the waterfall refrigeration effect by horizontal air supply. When h_1 decreases to 20, although the air supply distance does not change, the air volume begins to decrease. When h_1 continues to decrease to 15mm, the air volume continues to decrease, and the air supply distance also begins to decrease at the same time. Also that is, when h_1 is between 20mm and 36mm, the air supply distance and the air volume of the ceiling recessed fan can be reliably balanced. When h_1 is too large, the air volume will not increase, but the air supply distance may be seriously attenuated, which affects the air output effect of the ceiling recessed fan. When h_1 is too small, the air outlet 10c may cover the air output of the ceiling recessed fan to a certain extent, and the air supply distance may also be relatively reduced at the same time.

[0682] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly 3c and the air deflector 4c is arranged on the rotating mechanism.

[0683] The rotating mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly 3c, and the other end of which is arranged on the air deflector 4c. In some embodiments, both ends of the air deflector 4c in the length direction are provided with a rotary arm, thereby ensuring the synchronization of the overall movement of the air deflector 4c.

[0684] The rotating mechanism also includes a driving member arranged on the air outlet assembly 3c and drivingly connected with the rotary arm. Wherein, one end of the rotary arm is arranged on the driving member, and the air deflector 4c is arranged on the other end of the rotary arm. When the rotary arm rotates with the end arranged on the driving member, the air deflector 4c may move together with the end of the rotary arm, so as to realize the rotation of the air deflector 4c, wherein the driving member is a stepper motor.

[0685] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1c, and the air outlet assembly 3c is arranged on the lifting mechanism. The air outlet assembly 3c may project from or retract into the main body frame 1c by means of the lifting mechanism, so that the air outlet assembly 3c may move freely between the operation position and the closed position.

[0686] The air outlet assembly 3c includes an air outlet frame, wherein an air outlet 10c is formed between the air outlet frame and the main body frame 1c, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3c includes an air outlet frame and an air return panel, wherein an air outlet 10c is formed between the air outlet frame and the main body frame 1c, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0687] Wall attachment effect (also referred to as Coanda effect) refers to a flow change tendency of fluid (water flow or air flow) from an initial flow direction to flowing along with a protruding object surface. When there is surface friction between the fluid and the object surface through which the fluid flows (or fluid viscosity, as long as the curvature is not large), the fluid will flow along the object surface. Moreover, when the ceiling recessed fan is in a cooling mode, the air deflector at the air outlet is generally set horizontally to increase the air output distance of the ceiling recessed fan, but in fact, the air output of the ceiling recessed fan will flow along a direction where the air deflector goes away from the ceiling under the wall attachment effect, which finally causes that the actual air output effect of the ceiling recessed fan becomes worse. However, in the related art, in order to ensure the air supply distance of the ceiling recessed fan, it is generally to simply use a method of increasing the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air output volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan

or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the parameters concerning the tilting angle of the air deflector, which are neglected and ignored in the art, can effectively enhance an improved air supply distance of the ceiling recessed fan in turn.

[0688] Accordingly, in some embodiments of the present disclosure, a ceiling recessed fan as shown in Figs. 42 to 47 is provided, which includes: a main body frame 1d; an air outlet assembly 3d arranged in the main body frame 1d, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly 3d and the main body frame 1d, and an air outlet 10d is formed between the air outlet assembly 3d and the main body frame 1d; and a first air deflector 4d arranged on a swinging mechanism, and swingably arranged at the air outlet. The angle c between the plane of the first air deflector 4d and the mounting planar face of the main body frame 1d is in the range of $-10^\circ \leq c \leq 10^\circ$, and when the angle c is 0° , the plane of the first air deflector 4d is parallel to the mounting planar face. The air outlet assembly 3d has a first descending height h , and the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$ when the ceiling recessed fan is in a cooling mode. Even if the first air deflector 4d tilts upward at a certain angle to ensure that the air output of the ceiling recessed fan flows against the ceiling as much as possible, the horizontal air supply distance of the ceiling recessed fan in a cooling mode is ensured, and the waterfall refrigeration effect is realized at a maximum efficiency. Wherein, the descending stroke of the air outlet assembly 3d is greater than 36 mm.

[0689] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by adjusting the value of the angle c . Wherein, with the upward tilting of the plane where the first air deflector 4d is located relative to the mounting planar face of the main body frame 1d (upward reflex of the first air deflector) as a negative angle, and the downward tilting of the plane where the first air deflector 4d is located relative to the mounting planar face of the main body frame 1d (downward swing of the first air deflector) as a positive angle, the simulation results are as follows:

Angle c	Air volume (m^3/h)	Air supply distance
-15° (Figure 47)	838	3.1m
-10° (Figure 43)	995	3.7m
0° (Figure 44)	1005	3.5m
10° (Figure 45)	1112	2.2m
15° (Figure 46)	1112	1.4m

[0690] From the experiment results, when the angle c is -10° , although the air volume does not reach a maximum value, there is a small difference from the maximum air volume, and its air supply distance reaches a maximum value. When the angle c is reduced to -15° , the air volume and the air supply distance both begin to decrease, and at this time, the air volume is attenuated to the extent where the air output requirements of the ceiling recessed fan cannot be satisfied. When the angle c increases to 0° , the attenuation of the air volume begins to decrease, but its air supply distance also begins to decrease. When the angle c continues to increase to 10° , the air volume reaches a maximum value, but the air supply distance is seriously attenuated, so that the limit where the air output requirements of the ceiling recessed fan cannot be satisfied is almost reached. When the angle c continues to increase to 15° , the air volume reaches a maximum value, but the air supply distance has been attenuated from 3.7m to 1.4m, and the horizontal air output of the ceiling recessed fan cannot be realized at this time. Also that is, when the ceiling recessed fan needs a large air output volume, the angle c with a large value (for example, when the angle C is 0° to 10°) is used, and it is also possible to raise the air output volume without being affected by the first air deflector 4d on the premise of ensuring that the first air deflector realizes all the air output distances of the ceiling recessed fan. When the ceiling recessed fan needs a small air output volume, the angle c with a small value (for example, when the angle C is -10° to 0°) is used, and at this time, the first air deflector 4d is upwardly tilted as much as possible to deflect the air output of the ceiling recessed fan to the ceiling to a maximum extent, so that the air output of the ceiling recessed fan flows against the ceiling as much as possible, thereby ensuring the waterfall refrigeration effect of the horizontal air output of the ceiling recessed fan.

[0691] It is to be noted that, the main body frame 1d is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1d is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1d and fixed to the ceiling through the main body frame 1d. The ceiling recessed fan has an indoor unit installed in the ceiling, the main body frame 1d is connected with the indoor unit, the air outlet assembly 3d is connected with the main body frame 1d, and the indoor unit has an indoor unit air exhaust. The first end of the air outlet duct of the main body frame 1d communicates with the indoor unit air exhaust, and the air flow path is: air return gate-evaporator-indoor unit air exhaust-first end of the air outlet duct-second end of the air outlet duct-air outlet 10d (blowing out).

[0692] The ceiling recessed fan also includes a fan, wherein the rotation speed of the fan is adjustable. According to the rotation speed of the fan, the air output volume of the ceiling recessed fan is determined. When the rotation speed of the fan is large, it is indicated that the air output volume of the ceiling recessed fan is large at this time. On the contrary, when the rotation speed of the fan is small, it is indicated that the air output volume of the ceiling recessed fan is small at this time.

[0693] When the angle c is in the range of $-10^\circ \leq c < 0^\circ$, the plane of the first air deflector 4d tilts upward relative to the mounting planar face, and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$. Alternatively, when the angle c is in the range of $0^\circ \leq c < 10^\circ$, the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$.

[0694] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by adjusting the value of the first descending height h . Wherein, with the upward tilting of the plane where the first air deflector 4d is located relative to the mounting planar face of the main body frame 1d (upward reflex of the first air deflector) as a negative angle, and the downward tilting of the plane where the first air deflector 4d is located relative to the mounting planar face of the main body frame 1d (downward swing of the first air deflector) as a positive angle, the simulation results are as follows:

Descending height h (mm)	Angle c	Air volume (m^3/h)	Air supply distance
20	-10°	753	3.3m
	0°	834	3.5m
	10°	924	2.8m
28	-10°	995	3.7m
	0°	1005	3.5m
	10°	1112	2.2m
36	-10°	1100	2.4m
	0°	1112	2m
	10°	1112	1.4m

[0695] From the experiment results, taking the angle c of -10° as an example, when h reaches 28mm, although the air volume does not reach a maximum value, there is a small difference from the maximum air volume, and its air supply distance reaches a maximum value. When h increases to 36mm, at this time, the air volume substantially reaches a maximum value, but the air supply distance is seriously attenuated, which cannot satisfy the air output requirements of the ceiling recessed fan. When h is reduced to 20mm, the air volume and the air supply distance both begin to decrease, which results in that the ceiling recessed fan cannot achieve a better efficiency. Taking the angle c of 10° as an example, when h reaches 28mm, the air volume and the air supply distance both reach a maximum value. When h increases to 36mm, the air volume still remains at a maximum value, but the air supply distance is seriously attenuated from 3.5m to 1.4m, which cannot satisfy the air output requirements of the ceiling recessed fan. When h is reduced to 20mm, although the air supply distance is relatively large, its air volume is seriously attenuated, and the air output effect of the ceiling recessed fan is still less favorable than the air output effect when h reaches 28 mm. Also that is, when the air outlet assembly 3d descends to 20mm to 28mm, it is possible to improve the air output effect of the ceiling recessed fan.

[0696] The air outlet assembly 3d is arranged in the main body frame 1d in a way so as to be able to be raised and lowered, and the air outlet assembly 3d has an operation position descending to a set height to form a height difference. After the ceiling recessed fan begins to work, the air outlet assembly 3d descends downward relative to the main body frame 1d, and when the air outlet assembly 3d reaches a set height, an air outlet 10d is formed, thereby ensuring that the ceiling recessed fan can perform normal heat exchange operation.

[0697] The mounting planar face of the main body frame 1d is parallel to the horizontal plane. Also that is, the main body frame 1d is mounted on a horizontal plane such as a ceiling.

[0698] The first air deflector 4d is provided with an extension plate, and when the air outlet assembly is in an operation position, the extension plate projects out of the first air deflector 4d. In order to further increase the air deflecting effect of the first air deflector 4d on the air output of the ceiling recessed fan, the effective air deflecting dimension of the first air deflector 4d is increased by using the extension plate, thereby increasing the air deflecting effect of the first air deflector 4d.

[0699] The ceiling recessed fan also includes an air deflecting structure arranged in the main body frame 1d, and capable of deflecting the air output of the air outlet when the ceiling recessed fan is in a cooling mode. With the air deflecting structure arranged in the main body frame 1d, the air output of the ceiling recessed fan is further allowed to flow against the ceiling, thereby increasing the air supply distance of the ceiling recessed fan in a cooling mode so as to increase the waterfall refrigeration effect.

[0700] As one embodiment, the main body frame 1a includes a side frame 11d, at least part of the air output of the air

outlet passes through the side frame 11d, and the air deflecting structure includes a second air deflector 6d swingably arranged on the side frame 11d. The second air deflector 6d swings to adjust the flow direction of the air flow flowing through the side frame 11d (that is, an upper layer portion of the airflow), and adjust the flow direction of the lower layer airflow in the airflow by the first air deflector 4d, so as to jointly implement adjusting the air output direction of the ceiling recessed fan, thereby effectively improving the air output efficiency of the ceiling recessed fan.

[0701] As another embodiment, the main body frame 1d includes a side frame 11d, at least part of the air output of the air outlet passes through the side frame 11d, and an air deflecting channel 7d formed on the side frame 11d constitutes an air deflecting structure. By directly machining and moulding the air deflecting channel 7d on the side frame 11d, the airflow passing through the side frame 11d (that is, an upper layer portion of the airflow) is deflected by the air deflecting channel 7d, so as to limit a flow direction of this portion of the airflow, and jointly cooperate with the first air deflector 4d to overcome the wall attachment effect of the airflow.

[0702] The air outlet assembly includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3d includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0703] According to another aspect of the present disclosure, a ceiling recessed fan is provided, which includes: a main body frame; an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame; and a first air deflector arranged on a swinging mechanism, and swingably arranged at the air outlet. The plane of the first air deflector tilts upward relative to the mounting planar face of the main body frame, and the angle c between the plane of the first air deflector and the mounting planar face is in the range of $-10^\circ \leq c \leq 0^\circ$. Even if the first air deflector 4d tilts upward at a certain angle to ensure that the air output of the ceiling recessed fan flows against the ceiling as much as possible, the horizontal air supply distance of the ceiling recessed fan in a cooling mode is ensured, and the waterfall refrigeration effect is realized at a maximum efficiency.

[0704] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by adjusting the value of the angle c . Wherein, with the upward tilting of the plane where the first air deflector 4d is located relative to the mounting planar face of the main body frame 1d (upward reflex of the first air deflector) as a negative angle, and the downward tilting of the plane where the first air deflector 4d is located relative to the mounting planar face of the main body frame 1d (downward swing of the first air deflector) as a positive angle, the simulation results are as follows:

Angle c	Air volume (m ³ /h)	Air supply distance
-15° (Figure 47)	838	3.1m
-10° (Figure 43)	995	3.7m
0° (Figure 44)	1005	3.5m
10° (Figure 45)	1112	2.2m
15° (Figure 46)	1112	1.4m

[0705] From the experiment results, when the angle c is -10° , although the air volume does not reach a maximum value, there is a small difference from the maximum air volume, and its air supply distance reaches a maximum value. When the angle c is reduced to -15° , the air volume and the air supply distance both begin to decrease, and at this time, the air volume is attenuated to the extent where the air output requirements of the ceiling recessed fan cannot be satisfied. When the angle c increases to 0° , the attenuation of the air volume begins to decrease, but its air supply distance also begins to decrease. When the angle c continues to increase to 10° , the air volume reaches a maximum value, but the air supply distance is seriously attenuated, so that the limit where the air output requirements of the ceiling recessed fan cannot be satisfied is almost reached. When the angle c continues to increase to 15° , the air volume reaches a maximum value, but the air supply distance has been attenuated from 3.7m to 1.4m, and the horizontal air output of the ceiling recessed fan cannot be realized at this time. Also that is, when the ceiling recessed fan needs a small air output volume, the angle c with a small value (for example, when the angle C is -10° to 0°) is used, and at this time, the first air deflector 4d is upwardly tilted as much as possible to deflect the air output of the ceiling recessed fan to the ceiling to a maximum extent, so that the air output of the ceiling recessed fan flows against the ceiling as much as possible, thereby ensuring the waterfall refrigeration effect of the horizontal air output of the ceiling recessed fan.

[0706] It is to be noted that, the main body frame 1d is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1d is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1d and fixed to the ceiling through the main body frame 1d.

[0707] The air outlet assembly 3d is arranged in the main body frame 1d in a way so as to be able to be raised and lowered, and the air outlet assembly 3d has an operation position descending to a set height to form a height difference. After the ceiling recessed fan begins to work, the air outlet assembly 3d descends downward relative to the main body frame 1d, and when the air outlet assembly 3d reaches a set height, an air outlet 10d is formed, thereby ensuring that the ceiling recessed fan can perform normal heat exchange operation.

[0708] The air outlet assembly 3d has a first descending height h, and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$ when the ceiling recessed fan is in a cooling mode. Wherein, the descending stroke of the air outlet assembly 3d is greater than 28mm. In some embodiments, the descending stroke of the air outlet assembly 3d is greater than 36 mm.

[0709] Taking the experiment data of a 3 horse power air conditioner as an example, simulation is performed by adjusting the value of the first descending height h. Wherein, with the upward tilting of the plane where the first air deflector 4d is located relative to the mounting planar face of the main body frame 1d (upward reflex of the first air deflector) as a negative angle, and the downward tilting of the plane where the first air deflector 4d is located relative to the mounting planar face of the main body frame 1d (downward swing of the first air deflector) as a positive angle, the simulation results are as follows:

Descending height h (mm)	Angle c	Air volume (m ³ /h)	Air supply distance
20	-10°	753	3.3m
	0°	834	3.5m
	10°	924	2.8m
28	-10°	995	3.7m
	0°	1005	3.5m
	10°	1112	2.2m
36	-10°	1100	2.4m
	0°	1112	2m
	10°	1112	1.4m

[0710] From the experiment results, taking the angle c of -10° as an example, when h reaches 28mm, although the air volume does not reach a maximum value, there is a small difference from the maximum air volume, and its air supply distance reaches a maximum value. When h increases to 36mm, at this time, the air volume substantially reaches a maximum value, but the air supply distance is seriously attenuated, which cannot satisfy the air output requirements of the ceiling recessed fan. When h is reduced to 20mm, the air volume and the air supply distance both begin to decrease, which results in that the ceiling recessed fan cannot achieve a better efficiency. Taking the angle c of 0° as an example, when h reaches 28mm, there is a small difference from the air volume and air supply distance to a maximum value. When h increases to 36mm, the air volume reaches a maximum value, but the air supply distance is seriously attenuated from 3.5m to 2m, which cannot satisfy the air output requirements of the ceiling recessed fan. When h is reduced to 20mm, although the air supply distance is substantially not changed, its air volume is seriously attenuated, and the air output effect of the ceiling recessed fan is still less favorable than the air output effect when h reaches 28 mm. Also that is, in the case where the angle c is in the range of -10° to 0°, when the air outlet assembly 3d descends to 20mm to 28mm, it is possible to improve the air output effect of the ceiling recessed fan.

[0711] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. In view of the problem that the air outlet volume is attenuated more when the air supply distance is long present in the ceiling recessed fan that has been found by the inventors, in the related art, it is generally to simply increase the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air outlet volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the parameters concerning the dimension of the air outlet and the dimension of the air duct inside the ceiling recessed fan, which are neglected and ignored in the art, are aspects to be improved that can effectively enhance a matching degree between the air supply distance and the air volume of the ceiling recessed fan in turn.

[0712] Therefore, in order to ensure that the air supply distance and the air output volume of the ceiling recessed fan in a cooling mode reach a better level as much as possible, the present disclosure provides the ceiling recessed fan with a

cooling mode as shown in Figs. 48 and 49, which includes: a main body frame 1e internally provided with an air outlet duct 2e having a first end 21e and a second end 22e provided along the airflow direction; an air outlet assembly 3e arranged in the main body frame 1e, wherein there is a height difference between the air outlet assembly 3e and the main body frame 1e when the ceiling recessed fan is in a cooling mode, and an air outlet 10e is formed between the air outlet assembly 3e and the main body frame 1e, and the air outlet 10e communicates with the second end 22e of the air outlet duct 2e. The ratio range of the height h1 of the air outlet 10e to the width h2 of the first end 21e of the air outlet duct 2e is $1/3 \leq h1/h2 \leq 3/5$.

[0713] It is to be noted that, the main body frame 1e is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1e is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1e and fixed to the ceiling through the main body frame 1e. The height h1 of the air outlet 10e refers to the height between the edge of the main body frame forming the lowermost point of the air outlet duct and the outermost edge of the air outlet assembly 2e in the direction of a height difference between the air outlet assembly and the main body frame. The ceiling recessed fan has an indoor unit installed in the ceiling, the main body frame 1e is connected with the indoor unit, the air outlet assembly 3e is connected with the main body frame 1e, and the indoor unit has an indoor unit air exhaust. The first end of the air outlet duct of the main body frame 1e communicates with the indoor unit air exhaust, and the air flow path is: air return gate-evaporator-indoor unit air exhaust-first end 21e of the air outlet duct 2e-second end 22e of the air outlet duct 2e-air outlet (blowing out).

[0714] During the operation of the ceiling recessed fan, the air flows from the first end 21e to the second end 22e of the air outlet duct, and is finally expelled from the ceiling recessed fan through the air outlet 10e. When the ceiling recessed fan is designed, in order to ensure the balance between the air supply distance and the air outlet volume of the ceiling recessed fan, the designer determines the specific parameters of the ceiling recessed fan according to the ratio range of the height h1 of the air outlet to the width of the first end 21e of the air outlet duct 2e, so as to ensure that the air output effect of the produced ceiling recessed fan achieves preset requirements.

[0715] Taking the experiment data of a 3 horse power air conditioner as an example, in this solution, h2 is 60mm, and the value of h1 is adjusted for simulation. The simulation results are as follows:

h1	h1/h2	Air volume (m ³ /h)	Air supply distance
15	0.25	667	3.3m
20	0.33	834	3.5m
28	0.47	1005	3.5m
36	0.6	1112	2m
45	0.75	1112	1.2m

[0716] From the experiment results, when h1/h2 is 0.47, the air volume is attenuated less and the air supply distance is also far enough, which is the most desirable (Figure 50). When h1/h2 is increased to 0.6, the air volume reaches a maximum value, but the air supply distance is apparently shortened (Figure 51). When h1/h2 continues to increase to 0.75, the air supply distance is severely shortened, which cannot be accepted (Figure 52). When h1/h2 is reduced to 0.33, the air volume is about 75% of a maximum value (Figure 53). When h1/h2 continues to decrease to 0.25, the air volume is severely attenuated, which cannot be accepted (Figure 54).

[0717] The air outlet assembly 3e is arranged in the main body frame 1e in a way so as to be able to be raised and lowered, and the air outlet assembly 3e has an operation position descending to a set height to form a height difference. When the air outlet assembly 3e is in an operation position, the ratio range of the height h1 of the air outlet 10e to the width h2 of the first end 21e of the air outlet duct 2e is $1/3 \leq h1/h2 \leq 3/5$. At this time, the height h1 of the air outlet 10e is the height between the edge of the main body frame forming the lowermost point of the air outlet duct 2e and the outermost edge of the air outlet assembly in the lifting direction of the air outlet assembly 3e.

[0718] The air outlet assembly 3e includes an air deflector 4e and an air outlet frame, wherein the air outlet frame is arranged in the main body frame 1e; the air deflector 4e is rotatably arranged on the air outlet frame; and when the air outlet assembly 3e is in an operation position, the air deflector 4e may adjust the height of the air outlet 10e. At this time, the height of the air outlet is the height between the edge of the main body frame forming the lowermost point of the air outlet duct 2e and the outermost edge of the air deflector in the lifting direction of the air outlet assembly.

[0719] The air deflector 4e has a first position to allow the height h1 of the air outlet 10e to reach a minimum value, and the ratio range of the minimum height h1 of the air outlet 10e to the width of the first end 21e of the air outlet duct 2e is $1/3 \leq h1/h2 \leq 3/5$, so that the rotation range of the air deflector is determined by the ratio range to improve the air output effect of the ceiling recessed fan.

[0720] The air deflector 4e may deflect the air output at the air outlet 10e. When the ceiling recessed fan is in a cooling mode, in order to achieve the waterfall refrigeration effect, the angle range of the included angle α between the plane where

the air deflector 4e is located and the horizontal plane is $-10^{\circ} \leq a \leq 10^{\circ}$, and when $a=0^{\circ}$, the plane where the air deflector 4e is located is parallel to the horizontal plane. At this time, the air output at the air outlet 10e may flow against the wall (against the ceiling) as much as possible under the definition of the air deflector 4e, and then a waterfall refrigeration effect is formed by the downward flow characteristic of cold air.

[0721] In some embodiments, when the ceiling recessed fan is in a cooling mode, the angle range of the included angle a is $10^{\circ} \geq a > 0^{\circ}$, and when $a > 0^{\circ}$, the air deflector 4e tilts upward relative to the horizontal plane, also that is, the air deflector 4e is always in a state of tilting upwards relative to the horizontal plane, thereby increasing the attachment effect of the air output of the air outlet 10e against the wall and increasing the air supply distance and the refrigeration effect of the ceiling recessed fan.

[0722] The air outlet assembly has a closed position to close the air outlet 10e in cooperation with the main body frame 1e, and the air deflector 4e has a first edge 41e and a second edge 42e. When the air outlet assembly 3e is in the closed position, the first edge 41e is sealed with a corresponding position of the main body frame 1e, and the second edge 42e is sealed with a corresponding edge of the air outlet frame. By way of a corresponding seal between the first edge 41e and the main body frame 1e and a corresponding seal between the second edge 42e and the air outlet frame, it is ensured that when the air outlet assembly is in the closed position, the air deflector 4e can enclose a corresponding position of the air outlet 10e, thereby avoiding impurities such as dust entering the interior of the ceiling recessed fan from the position of the air outlet 10e to affect the performance of the ceiling recessed fan.

[0723] When the air outlet assembly 3e is in the closed position, the air outlet frame and the air deflector 4e jointly cooperate with the main body frame 1e to form a seal. At this time, the air outlet assembly is attached to the main body frame, and the opening on the main body frame is completely covered by the air outlet assembly, so that the ceiling recessed fan has a favorable aesthetic effect.

[0724] The second edge 42e is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure. When the air outlet assembly 3e is in the closed position, the first step structure is sealingly fit with the second step structure. The first step structure and the second step structure not only make the sealing between the air deflector 4e and the air outlet frame reliable, but also allow that the structure of the air outlet assembly 3e is not be affected by a structural interference between the air deflector 4a and the air outlet assembly 3e during the rotation process of the air deflector 4e.

[0725] The first step structure is provided with a seal, and when the air outlet assembly 3e is in the closed position, the seal is arranged between the first step structure and the second step structure. Also that is, the seal moves together with the air deflector, and when the air deflector is sealed relative to the air outlet frame, the seal can enclose a slit between the air deflector and the air outlet frame, thereby enhancing the sealing effect between the air deflector and the air outlet frame.

[0726] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet frame, and the air deflector 4e is arranged on the rotating mechanism.

[0727] The rotating mechanism includes a rotary arm 5e, one end of which is hinged to the air outlet frame, and the other end of which is arranged on the air deflector 4e. In some embodiments, both ends of the air deflector 4e in the length direction are provided with a rotary arm 5e, thereby ensuring the synchronization of the overall movement of the air deflector 4e.

[0728] The rotating mechanism also includes a driving member arranged on the air outlet frame and directly or indirectly driving the rotary arm 5e to rotate. Wherein, one end of the rotary arm 5e is arranged on the driving member, and the air deflector 4e is arranged on the other end of the rotary arm 5e. When the rotary arm 5e rotates with the end arranged on the driving member, the air deflector 4e may move together with the end of the rotary arm 5e, so as to realize the rotation of the air deflector 4e, wherein the driving member is a stepper motor.

[0729] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1e, and the air outlet assembly 3e is arranged on the lifting mechanism. The air outlet assembly 3e may project from or retract into the main body frame 1e by means of the lifting mechanism, so that the air outlet assembly 3e may move freely between the operation position and the closed position.

[0730] The air outlet assembly 3e includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3e includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0731] As shown in Figs. 55 and 56, another embodiment of the ceiling recessed fan is provided. The air outlet assembly 3e is provided with at least one second air outlet 13e communicating with the second end 22e of the air outlet duct 2e. The second air outlet 13e is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the air outlet 10e with the second air outlet 13e, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0732] When the air outlet assembly 3e descends so that an air outlet 10e is formed between the air outlet assembly 3e

and the main body frame 1e, a gap which is formed between the air outlet assembly 3e and the main body frame 1e, forms an air supply duct 14e. One end of the air supply duct 14e communicates with the air outlet duct, and the other end of the air supply duct 14e forms a first air outlet 10e. The airflow in the air outlet duct 2e is blown out by the air outlet 10e after air deflecting by the air supply duct 14e, and the vertically downward airflow in the air outlet duct 2e is deflected by the air supply duct 14e to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0733] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflecting. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 1e of the present disclosure further includes a side frame 15e. When the air outlet assembly 3e descends so that an air outlet 10e is formed between the air outlet assembly 3e and the main body frame 1e, an air supply duct 14e is formed between the air outlet assembly 3e and the side frame 15e, and on the mounting planar face of the main body frame 1e (for example, the ceiling), the projection of the air outlet assembly 3e at least partially coincides with the projection of the side frame 15e. When the projection of the air outlet assembly 3e coincides with the projection of the side frame 15e, the air outlet assembly is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the air outlet 10e, the air outlet assembly 3e gradually goes away from the main body frame 1e to form an air supply duct 14e. At this time, a corresponding portion of the air outlet assembly 3e forms a lower side surface of the air supply duct 14e. When the airflow flows through the air supply duct 14e, under the air deflecting effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0734] As another embodiment, the projection of the air outlet assembly 3e completely coincides with the projection of the side frame 15e. In this case, compared with the case where the projection of the air outlet assembly 3e partially coincides with the projection of the side frame 15e, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 3e is attached to the main body frame 1e, and a corresponding portion of the air outlet assembly 3e is attached to the side frame 15e, so that a person can only see the air outlet assembly 3e instead of the main body frame 1e when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0735] As another embodiment, the projection of the air outlet assembly 3e exceeds the projection of the side frame 15e. In this case, compared with the case where the projection of the air outlet assembly 3e completely coincides with the projection of the side frame 15e, the air outlet assembly can be further extended, thereby further increasing a horizontal blow effect and an air supply distance of the ceiling recessed fan.

[0736] In some embodiments, the projection of the air outlet assembly 3e exceeds the projection of the main body frame 1e, so that the air outlet assembly 3e effectively increases the air deflecting dimension relative to the related art, so as to increase the air supply distance of the ceiling recessed fan.

[0737] The ceiling recessed fan further includes an air deflector 4e which is rotatably arranged at the second air outlet 13e and capable of closing or opening the second air outlet 13e. When the second air outlet 13e needs to be opened, the air deflector 4e rotates gradually, so that the second air outlet 13e communicates with the air outlet duct 2e to allow that the airflow in the air outlet duct 2e is blown out by the second air outlet 13e, and the air deflector 4e adjusts its tilting angle according to actual needs to adjust the air output direction and/or the air output volume of the second air outlet 13e. When the second air outlet 13e needs to be closed, the air deflector 4e returns to the state of sealing fit with the air outlet assembly 3e so as to close the second air outlet 13e. At this time, the airflow in the air outlet duct 2e can only be blown out from the air outlet 10e under the joint deflection effect of the air outlet assembly 3e and the air deflector 4e.

[0738] The following relationship is present between the air supply distance and the air outlet volume of the ceiling recessed fan in the related art: when the air supply distance is long, the air outlet volume thereof is attenuated more, and when the air supply distance is short, the air outlet volume is attenuated less. In view of the problem that the air outlet volume is attenuated more when the air supply distance is long present in the ceiling recessed fan that has been found by the inventors, in the related art, it is generally to simply increase the relevant parameters of the fan (the diameter and rotation speed of the fan) so as to raise the air outlet volume, which results in that it is necessary to increase the overall dimension of the ceiling recessed fan or add to the cost. However, the applicant has found through studies on the air output airflow of the ceiling recessed fan and analysis of the simulation experiment data that, the technical solution of increasing the relevant parameters of the fan actually does more harm than good, which is not conducive to further development of the industry. Whereas, the relationship concerning the height of the air outlet and the minimum circulation area of the air outlet duct, which is neglected and ignored in the art, can effectively enhance an improved matching degree between the air supply distance and the air volume of the ceiling recessed fan in turn.

[0739] Therefore, in order to ensure that the air supply distance and the air output volume of the ceiling recessed fan reach a better level as far as possible, a ceiling recessed fan with an air outlet as shown in Figure 57 is provided in the present disclosure, which includes a main body frame 1f and an air outlet assembly 3f. The main body frame 1f is internally provided with an air outlet duct 2f having a first end 21f and a second end 22f. The air outlet assembly 3f is arranged in the main body frame 1f in a way so as to be able to be raised and lowered, wherein the air outlet assembly 3f descends so that an air outlet 10f is formed between the air outlet assembly 3f and the main body frame 1f, and the air outlet 10f communicates with the air outlet duct 2f. The ratio of the circulation area S1 of the air outlet 10f to the circulation area S2 of the first end 21f is in the range of $0.7 \leq S1/S2 \leq 1.27$.

[0740] It is to be noted that, the main body frame 1f is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1f is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1f and fixed to the ceiling through the main body frame 1f. The ceiling recessed fan has an indoor unit installed in the ceiling, the main body frame 1f is connected with the indoor unit, the air outlet assembly 3f is connected with the main body frame 1f, and the indoor unit has an indoor unit air exhaust. The first end of the air outlet duct of the main body frame 1f communicates with the indoor unit air exhaust, and the air flow path is: air return gate-evaporator-indoor unit air exhaust-first end 21f of the air outlet duct 2f-second end 22f of the air outlet duct 2f-air outlet (blowing out).

[0741] In some embodiments, the circulation area S2 of the first end 21f of the air outlet duct 2f is a fixed value, and the circumference of the air outlet assembly 3f is also a fixed value. With the change of the descending height of the air outlet assembly 3f, the height h1 of the air outlet 10f also changes gradually. At this time, the circulation area S1 of the air outlet 10f is the product of the height h1 of the air outlet 10f and the circumference of a portion of the air outlet assembly 3f for forming the air outlet 10f. Also that is, with the change of the height h1 of the air outlet 10f, the circulation area S1 of the air outlet also changes synchronously. The height h1 of the air outlet 10f refers to the height between the edge of the main body frame 1f forming the lowermost point of the air outlet duct and the outermost edge of the air outlet module 3f in the lifting direction of the air outlet assembly 3f. When the structure of the air outlet assembly 3f for forming the air outlet 10f with the main body frame 1f is a horizontal structure, the height h1 of the air outlet 10f is also expressed as the descending height of the air outlet assembly 3f.

[0742] Taking the experiment data of a 3 horse power air conditioner as an example, the value of S1/S2 is adjusted for simulation. The simulation results are as follows:

S1/S2	Air volume (m ³ /h)	Air supply distance
0.53	667	3.3m
0.7	834	3.5m
0.98	1112	3.5m
1.27	1112	2m
1.58	1112	1.2m

[0743] From the simulation results, when S1/S2 is 0.98, the air volume reaches a maximum value, and the air supply distance also reaches a maximum value. When S1/S2 increased to 1.27, although the air volume remained at the maximum value, the air supply distance begins to decrease. When S1/S2 continues to increase to 1.58, the air volume remains at the maximum value, but the air supply distance is seriously attenuated. When S1/S2 is reduced to 0.7, although the air supply distance remains at the maximum value, the air volume begins to decrease. When S1/S2 continues to decrease to 0.53, the air volume further decreases and the air supply distance also begins to decrease. Also that is, when S1/S2 is in the range of 0.7 to 1.27, the air volume and the air supply distance may be both incorporated. When S1/S2 is too large, the air supply distance is too small, and when S1/S2 is too small, the air volume is too small.

[0744] The air outlet assembly 3f includes a rotatable air deflector 4f, and the air deflector 4f and the main body frame 1f form an air outlet 10f. The height h1 of the air outlet 10f can be adjusted during the rotation process of the air deflector 4f. At this time, the height h1 of the air outlet 10f refers to the height between the edge of the main body frame 1f forming the lowermost point of the air outlet duct 2f and the outermost edge of the air deflector 4f in the lifting direction of the air outlet assembly 3f.

[0745] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly 3f and the air deflector 4f is arranged on the rotating mechanism.

[0746] The rotating mechanism includes a rotary arm, one end of which is hinged to the air outlet assembly 3f, and the other end of which is arranged on the air deflector 4f. In some embodiments, both ends of the air deflector 4f in the length direction are provided with a rotary arm, thereby allowing the synchronization of the overall movement of the air deflector 4f.

[0747] The rotating mechanism also includes a driving member arranged on the air outlet assembly 3f and drivingly connected with the rotary arm. Wherein, one end of the rotary arm is arranged on the driving member, and the air deflector 4f is arranged on the other end of the rotary arm. When the rotary arm rotates with the end arranged on the driving member, the air deflector 4f may move together with the end of the rotary arm, so as to realize the rotation of the air deflector 4f, wherein the driving member is a stepper motor.

[0748] The air outlet assembly 3f has a closed position to close the air outlet 10f in cooperation with the main body frame 1f, and the air deflector 4f has a first edge 41 and a second edge 42. When the air outlet assembly 3f is in the closed position, the first edge 41 is sealed with a corresponding position of the main body frame 1f, and the second edge 42 is sealed with a corresponding edge of the air outlet assembly 3f.

[0749] A sealing structure is provided between the second edge 42 and the air outlet assembly 3f.

[0750] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 1f, and the air outlet assembly 3f is arranged on the lifting mechanism. The air outlet assembly 3f may project from or retract into the main body frame 1f by means of the lifting mechanism, so that the air outlet assembly 3f may move freely between the operation position and the closed position.

[0751] The air outlet assembly 3f includes an air outlet frame, wherein an air outlet 10f is formed between the air outlet frame and the main body frame 1f, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3f includes an air outlet frame and an air return panel, wherein an air outlet 10f is formed between the air outlet frame and the main body frame 1f, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0752] As shown in Figs. 58 and 59, another embodiment of the ceiling recessed fan is provided. The air outlet assembly 3f is provided with at least one second air outlet 13f communicating with the second end 22f of the air outlet duct 2f. The second air outlet 13f is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the air outlet 10f with the second air outlet 13f, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0753] When the air outlet assembly 3f descends so that an air outlet 10f is formed between the air outlet assembly 3f and the main body frame 1f, a gap which is formed between the air outlet assembly 3f and the main body frame 1f, forms an air supply duct 14f. One end of the air supply duct 14f communicates with the air outlet duct, and the other end of the air supply duct 14f forms a first air outlet 10f. The airflow in the air outlet duct 2f is blown out by the air outlet 10f after air deflecting by the air supply duct 14f, and the vertically downward airflow in the air outlet duct 2f is deflected by the air supply duct 14f to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0754] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflecting. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 1f of the present disclosure further includes a side frame 15f. When the air outlet assembly 3f descends so that an air outlet 10f is formed between the air outlet assembly 3f and the main body frame 1f, an air supply duct 14f is formed between the air outlet assembly 3f and the side frame 15f, and on the mounting planar face of the main body frame 1f (for example, the ceiling), the projection of the air outlet assembly 3f at least partially coincides with the projection of the side frame 15f. When the projection of the air outlet assembly 3f coincides with the projection of the side frame 15f, the air outlet assembly is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the air outlet 10f, the air outlet assembly 3f gradually goes away from the main body frame 1f to form an air supply duct 14f. At this time, a corresponding portion of the air outlet assembly 3f forms a lower side surface of the air supply duct 14f. When the airflow flows through the air supply duct 14f, under the air deflecting effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0755] As another embodiment, the projection of the air outlet assembly 3f completely coincides with the projection of the side frame 15f. In this case, compared with the case where the projection of the air outlet assembly 3f partially coincides with the projection of the side frame 15f, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 3f is attached to the main body frame 1f, and a corresponding portion of the air outlet assembly 3f is attached to the side frame 15f, so that a person can only see the air outlet assembly 3f instead of the main body frame 1f when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0756] As another embodiment, the projection of the air outlet assembly 3f exceeds the projection of the side frame 15f.

In this case, compared with the case where the projection of the air outlet assembly 3f completely coincides with the projection of the side frame 15f, the air outlet assembly can be further extended, thereby further increasing a horizontal blow effect and an air supply distance of the ceiling recessed fan.

[0757] In some embodiments, the projection of the air outlet assembly 3f exceeds the projection of the main body frame 1f, so that the air outlet assembly 3f effectively increases the air deflecting dimension relative to the related art, so as to increase the air supply distance of the ceiling recessed fan.

[0758] The ceiling recessed fan further includes an air deflector 4f which is rotatably arranged at the second air outlet 13f and capable of closing or opening the second air outlet 13f. When the second air outlet 13f needs to be opened, the air deflector 4f rotates gradually, so that the second air outlet 13f communicates with the air outlet duct 2f to allow that the airflow in the air outlet duct 2f is blown out by the second air outlet 13f, and the air deflector 4f adjusts its tilting angle according to actual needs to adjust the air output direction and/or the air output volume of the second air outlet 13f. When the second air outlet 13f needs to be closed, the air deflector 4f returns to the state of sealing fit with the air outlet assembly 3f so as to close the second air outlet 13f. At this time, the airflow in the air outlet duct 2f can only be blown out from the air outlet 10f under the joint deflection effect of the air outlet assembly 3f and the air deflector 4f.

[0759] The terms used in the embodiments of the present disclosure are only for the purpose of describing specific embodiments, rather than limiting the present disclosure. The singular forms of "a", "said" and "the" used in the embodiments of the present disclosure and the appended claims are also intended to include multiple forms, and unless other meanings are explicitly indicated in the context, the term "a plurality of" generally includes at least two.

[0760] It should be understood that, the term "and/or" used herein is only an associated relationship to describe associated objects, which means that there are three relationships, for example, A and/or B, which means such three circumstances as A present alone, A and B present at the same time, and B present alone. In addition, the character "j" herein generally indicates that the contextual objects are in an "or" relationship.

[0761] It should be understood that, although the terms such as first and second might be used to describe the air outlets in the embodiments of the present disclosure, these air outlets should not be limited to these terms. These terms are only used to distinguish different air outlets. For example, without departing from the scope of the embodiments of the present disclosure, the first air outlet is also referred to as the second air outlet, and similarly, the second air outlet is also referred to as the first air outlet.

[0762] Depending on the context, the words "if" and "in the case where" as used here are interpreted as "when" or "as" or "in response to the determination" or "in response to the detection". Similarly, depending on the context, the phrases "if determined" or "if detected (stated conditions or events)" are interpreted as "when determined" or "in response to the determination" or "when detected (stated conditions or events)" or "in response to the detection (stated conditions or events)".

[0763] It should also be noted that, the terms "including", "including" or any other variation thereof is intended to cover non-exclusive inclusions, so that a product or device that includes a series of elements includes not only those elements, but also other elements that are not explicitly listed, or elements inherent to such product or device. In the case where there are no more restrictions, an element defined by the phrase "including one..." does not exclude an additional identical element also present in the goods or devices including the element.

[0764] The alternative embodiments of the present disclosure will be described in detail below in conjunction with the accompanying drawings.

Embodiments 1

[0765] An air outlet is formed between the air outlet assembly and the main body frame of the ceiling recessed fan in the related art, and the fan blows air from the inside of the ceiling recessed fan and horizontally outputs air through the air outlet, thus reducing and even avoiding the discomfort caused by direct skin blow of cold air.

[0766] However, in some cases, for example, when the ceiling recessed fan is just turned on and the room is still very hot, the user might feel unbearable in dry and hot air. However, since cold air cannot be directly blown to the skin, it is impossible to rapidly relieve the discomfort in hot air, so that it is impossible to rapidly meet the needs of the user.

[0767] In some embodiments of the present disclosure, a control method of a ceiling recessed fan is provided. Figure 60 is a structural view of a ceiling recessed fan provided by some embodiments applying the present disclosure. As shown in Figure 60, the ceiling recessed fan includes: a main body frame 1g and an air outlet assembly 2g mounted on the main body frame 1g, wherein a height difference is formed between the air outlet assembly 2g and the main body frame 1g to form a first air outlet 4g. The first air outlet 4g outputs air horizontally or obliquely upward. When air is output obliquely upward, the included angle between the air output angle and the horizontal direction is less than a first predetermined angle, for example, 10°. The air outlet assembly is also provided with a second air outlet 5g. The second air outlet 5g outputs air vertically downward or obliquely downward. When air is output obliquely upwards, the included angle between the air output angle and the vertical direction is less than a second predetermined angle, wherein the predetermined angle may be set to be 45°.

[0768] As long as there is a height difference between the air outlet assembly 2g and the main body frame 1g, the first air outlet can be formed. The height difference is also fixed or variable, and the variable height difference is formed by the lifting of the air outlet assembly 2g. In some embodiments of the present disclosure, the air outlet assembly 2g is mounted on the main body frame 1g by means of the lifting mechanism, and when it is necessary to control the opening of the first air outlet, the lifting mechanism is controlled to drive the air outlet assembly 2g to descend so as to form a height difference between the air outlet assembly 2g and the main body frame 1g to form the first air outlet 4g.

[0769] As shown in Figure 60, the air outlet assembly 2g is further provided with a second air deflecting portion 32g, so that when the second air deflecting portion 32g is opened, the second air outlet 5g is opened, and when the second air deflecting portion 32g is closed, the second air outlet 5g is closed.

[0770] As mentioned previously, the height difference between the air outlet assembly 2g and the main body frame is also fixed. Figure 61 is a structural view of another ceiling recessed fan applying the present disclosure. In this implementation, the air outlet assembly 2g is fixedly mounted on the main body frame 1g, and the height difference between the air outlet assembly 2g and the main body frame 1g is fixed. As shown in Figure 61, the above-described ceiling recessed fan includes a first air deflecting portion 31g; and a second air deflecting portion 32g arranged on the air outlet assembly. The opening of the first air outlet 4g is controlled by controlling the opening of the first air deflecting portion 31g; and the opening of the second air outlet 5g is controlled by controlling the opening of the second air deflecting portion 32g.

[0771] The first air deflecting portion 31g and the second air deflecting portion 32g are rotatably arranged at the corresponding air outlets, and the opening or closing of the corresponding air outlets is controlled by changing the angles of the air deflecting portions.

[0772] In other embodiments of the present disclosure, the air outlet assembly 2g or the main body frame 1g is internally provided with a first accommodating portion, so that the first air deflecting portion 31g closes the first air outlet 4g by sliding out of the accommodating portion, and opens the first air outlet 4g by sliding into the first accommodating portion. The air outlet assembly is provided with a second accommodating portion 2g, so that the second air deflecting portion 32g closes the second air outlet 5g by sliding out of the accommodating portion, and opens the second air outlet 5g by sliding into the second accommodating portion.

[0773] In other embodiments of the present disclosure, the first air outlet and the second air outlet are also controlled to be opened at the same time by the same air deflecting member, or the first air outlet is opened and the second air outlet is closed. Figure 62 is a structural view of an air outlet and an air deflecting member according to another embodiment of the present disclosure. As shown in Figure 62, the height h of the first air outlet 4g is the same as the width w of the second air outlet 5g, and the length of the first air outlet is also the same as that of the second air outlet. When the air deflecting member 6g is in the first position, the first air outlet 4g and the second air outlet 5g are opened at the same time. When the air deflecting member rotates around the O point to the second position, the first air outlet 4g is opened. When the air deflecting member rotates around the O point to the third position, the second air outlet 5g is closed.

[0774] Figure 63 is a flowchart of a control method of a ceiling recessed fan according to an embodiment of the present disclosure. As shown in Figure 63, the control method includes:
In S101g, it is judged whether a fast cooling condition is met.

[0775] In general, if the customer chooses a fast cooling mode, it means that the user has a relatively high cooling requirement, and if the customer does not choose a fast cooling mode, it means that the user has a relatively low cooling requirement. Therefore, in order to better meet the needs of the user, it is necessary to first judge whether the ceiling recessed fan meets a fast cooling condition before controlling the ceiling recessed fan to output air.

[0776] In S102g, when the judgment result is YES, the first air outlet and the second air outlet are controlled to be opened at the same time.

[0777] In S103g, when the judgment result is NO, only the first air outlet is controlled to be opened.

[0778] The opening of the first air outlet means that the air outlet assembly descends to form a first air outlet between the air outlet assembly 2g and the main body frame 1g.

[0779] After it is judged that the ceiling recessed fan meets a fast cooling condition, it means that the user has a relatively high cooling requirement. At this time, the first air outlet and the second air outlet are controlled to be opened at the same time, so that cold air is controlled to be directly blown to the user whilst satisfying normal cooling, so as to realize fast cooling.

[0780] In a control method of a ceiling recessed fan according to some embodiments of the present disclosure, when a fast cooling condition is met, the first air outlet is opened to perform horizontal air output, and the second air outlet is opened to perform downward air output, so that cold air is directly blown to the user, which can reduce the skin-felt temperature of the user as soon as possible and relieve the discomfort of the user in hot air as soon as possible, thereby improving the user experience.

[0781] The step of judging whether a fast cooling condition is met includes: judging whether an instruction for fast cooling is received or whether an indoor temperature is higher than a first preset temperature. If YES, it is judged that a fast cooling condition is met. If NO, it is judged that a fast cooling condition is not met. Wherein, the above-described instruction for fast cooling is generated according to an operation of the user on a corresponding button of the remote controller. The first

preset temperature is the temperature at which the skin can feel hot and dry, and obtained through experimental tests.

[0782] When the second air outlet is opened for a period of time, the user no longer feels hot. At this time, the wind deflector is controlled to be closed so that the second air outlet is closed, and only the first air outlet is left open to realize horizontal blow and reduce or even avoid direct skin blow of cold air to the user. Therefore, after the first air outlet and the second air outlet are controlled to be opened at the same time, the control method further includes: judging whether a fast cooling exit condition is met. If YES, the second air outlet is controlled to be closed, and the first air outlet is kept open. If NO, the first air outlet and the second air outlet are controlled to be kept open.

[0783] The step of judging whether a fast cooling exit condition is met includes: judging whether a fast cooling exit instruction is received. If YES, it is judged that a fast cooling exit condition is met. If NO, it is judged that a fast cooling exit condition is not met. The fast cooling exit instruction is a remote control instruction input through the remote controller, an instruction input through a button set on the air conditioner, or an instruction automatically generated by the system when a particular condition is met.

[0784] During the process of using the air conditioner, the user might be busy with other things and forget to exit fast cooling after turning on fast cooling, and it is likely to catch a cold after realizing so until feeling uncomfortable due to direct skin blow of cold air for a long time. Therefore, in some embodiments of the present disclosure, a solution of controlling the second air outlet to be automatically closed after a certain opening duration is provided. The step of judging whether a fast cooling exit condition is met further includes: judging whether an opening duration of the second air outlet reaches a first preset duration, or judging whether an indoor temperature is lower than a second preset temperature. If NO, it is judged that a fast cooling exit condition is not met. The above-described second preset temperature is lower than the first preset temperature. The second preset temperature is determined according to a comfortable temperature of the skin that can be achieved, and the first duration is determined by obtaining the durations required for a comfortable duration of the skin and calculating a minimum value or an average value of these durations according to experimental tests. If YES, it is judged that a fast cooling exit condition is met.

[0785] In some cases, if the second air outlet is directly closed after meeting a fast cooling exit condition, cold air is suddenly no longer directly blown to the skin of the user, and the user might not feel accustomed again. In order to allow the user to be gradually accustomed to a temperature change, after it is judged that a fast cooling exit condition is met, before controlling the second air outlet to be closed, the above-described control method further includes: controlling the second air outlet to be opened intermittently, that is, controlling the second air outlet to be closed for a period of time after opening for a period of time, and repeating this step. After a second preset duration, the second air outlet is controlled to be closed, wherein the second preset duration is obtained through experimental tests. By way of the above-described solution, it is possible to reduce or even avoid direct switching from direct skin blow of cold air to a state without direct skin blow of cold air, which provides the user a certain period of time to be accustomed and reduce the discomfort of the user.

[0786] Figure 64 is a flowchart of a control method of a ceiling recessed fan according to another embodiment of the present disclosure. As shown in Figure 64, the control method includes the following preferred steps:

In S01g, the ceiling recessed fan is controlled to enter a cooling mode.

In S02g, it is judged whether a fast cooling instruction is received or whether an indoor temperature is higher than a first preset temperature. If YES, step S03g is performed. If NO, step S04g is performed.

In S03g, the first air outlet and the second air outlet are controlled to supply air at the same time.

In S04g, only the first air outlet is controlled to supply air.

In S05g, it is judged whether a fast cooling exit instruction is received. If YES, step S04g is performed. If NO, return to step S03g.

[0787] During the process of using the air conditioner, the user might be busy with other things and forget to exit fast cooling after turning on fast cooling, and it is likely to catch a cold after realizing so until feeling uncomfortable due to direct skin blow of cold air for a long time. In order to reduce or even avoid the above-described circumstance, a solution of automatically closing the second air outlet after opening for a certain duration is designed.

[0788] Figure 65 is a flowchart of a control method of a ceiling recessed fan according to a further embodiment of the present disclosure. As shown in Figure 65, the control method includes the following preferred steps:

In S1g, the ceiling recessed fan is controlled to enter a cooling mode.

In S2g, it is judged whether a fast cooling instruction is received or whether an indoor temperature is higher than a first preset temperature. If YES, step S3g is performed. If NO, step S4g is performed.

In S3g, the first air outlet and the second air outlet are controlled to supply air at the same time.

In S4g, only the first air outlet is controlled to supply air.

In S5g, it is judged whether an air supply duration of the second air outlet reaches the first preset duration or whether an indoor temperature is lower than the second preset temperature. If YES, step S4g is performed. If NO, return to step S3g.

Embodiments 2

[0789] In some embodiments of the present disclosure, a control apparatus of a ceiling recessed fan is provided, which is used to realize the control method according to the above-described embodiments. Figure 66 is a structural block view of a control apparatus according to an embodiment of the present disclosure, and as shown in Figure 66, the control apparatus includes:

The first judging module 10g is configured to judge whether a fast cooling condition is met.

[0790] In general, if the customer chooses a fast cooling mode, it means that the user has a relatively high cooling requirement, and if the customer does not choose a fast cooling mode, it means that the user has a relatively low cooling requirement. Therefore, in order to better meet the needs of the user, it is necessary to first judge whether the ceiling recessed fan meets a fast cooling condition before controlling the ceiling recessed fan to output air.

[0791] The first control module 20g is configured to control the first air outlet and the second air outlet to be opened at the same time when the judgment result is YES.

[0792] After it is judged that the ceiling recessed fan meets a fast cooling condition, it means that the user has a relatively high cooling requirement. At this time, the first air outlet and the second air outlet are controlled to be opened at the same time, so that cold air is controlled to be directly blown to the user whilst satisfying normal cooling, so as to realize fast cooling.

[0793] In a control apparatus of a ceiling recessed fan according to some embodiments of the present disclosure, the first control module 20g opens the first air outlet to perform horizontal air output, and opens the second air outlet to perform downward air output when a fast cooling condition is met, so that cold air is directly blown to the user, which can reduce the skin-felt temperature of the user as soon as possible and relieve the discomfort of the user in hot air as soon as possible, thereby improving the user experience.

[0794] The first judging module 10g is specifically configured to: judge whether an instruction for fast cooling is received or whether an indoor temperature is higher than a first preset temperature. If YES, it is judged that a fast cooling condition is met. If NO, it is judged that a fast cooling condition is not met. Wherein, the above-described instruction for fast cooling is generated according to an operation of the user on a corresponding button of the remote controller.

[0795] When the second air outlet is opened for a period of time, the user no longer feels hot. At this time, the wind deflector is controlled to be closed so that the second air outlet is closed, and only the first air outlet is left open. Figure 67 is a structural block view of a control apparatus according to another embodiment of the present disclosure. As shown in Figure 67, the above-described control apparatus further includes: a second judging module 30g configured to judge whether a fast cooling exit condition is met; and a second execution module 40 configured to control the second air outlet to be closed and the first air outlet to be kept open when a fast cooling exit condition is met. When a fast cooling exit condition is not met, the first control module 20g controls the first air outlet and the second air outlet to both keep open.

[0796] The second judging module 30g is specifically configured to: judge whether a fast cooling exit instruction is received. If YES, it is judged that a fast cooling exit condition is met. If NO, it is judged that a fast cooling exit condition is not met. The fast cooling exit instruction is a remote control instruction input through the remote controller, an instruction input through a button set on the air conditioner, or an instruction automatically generated by the system when a particular condition is met.

[0797] During the process of using the air conditioner, the user might be busy with other things and forget to exit fast cooling after turning on fast cooling, and it is likely to catch a cold after realizing so until feeling uncomfortable due to direct skin blow of cold air for a long time. In order to reduce or even avoid the above-described circumstance, in some embodiments of the present disclosure, the following technical solution is provided: the second air outlet is automatically closed after opening for a certain duration. The second judging module 30g is also specifically configured to: judge whether an opening duration of the second air outlet reaches the first preset duration or whether an indoor temperature is lower than the second preset temperature. If YES, it is judged that a fast cooling exit condition is met. If NO, it is judged that a fast cooling exit condition is not met.

[0798] In some cases, if the second air outlet is directly closed after meeting a fast cooling exit condition, cold air is suddenly no longer directly blown to the skin of the user, and the user might not feel accustomed again. In order to allow the user to be gradually accustomed to a temperature change, the above-described first control module 20g is further configured to: control the second air outlet to be intermittently opened before controlling the second air outlet to be closed after it is judged that a fast cooling exit condition is met. After a second preset duration, the second control module 40g controls the second air outlet to be closed. By way of the above-described solution, it is possible to reduce or even avoid direct switching from direct skin blow of cold air to a state without direct skin blow of cold air, which provides the user a certain period of time to be accustomed and reduce or even avoid the discomfort of the user.

Embodiments 3

[0799] In some embodiments of the present disclosure, a ceiling recessed fan is provided. As shown in Figure 60

mentioned previously, the ceiling recessed fan includes a main body frame 1g and an air outlet assembly 2g mounted on the main body frame 1g, wherein a first air outlet 4g is formed between the air outlet assembly 2g arranged in a way so as to be able to be raised and lowered and the main body frame 1g. The second air deflecting portion 32g is arranged on the air outlet assembly 2g, and when the second air deflecting portion 32g is opened, a second air outlet 5g is formed. The above-described ceiling recessed fan further includes the control apparatus in the above-described embodiments.

Embodiments 4

[0800] In some embodiments of the present embodiment, a computer readable storage medium is provided. The storage medium has a computer program stored thereon that, when executed by a processor implements the control method in the above-described embodiments.

[0801] The device embodiments described above are only schematic, wherein the modules described as separate components are or are not physically divided, and the components displayed as modules are or are not physical modules, that is, they are located in a place or distributed over multiple network modules. Some or all of the modules are selected to achieve the solutions in some embodiments of the present disclosure according to actual needs.

[0802] From the above illustrations of the embodiments, those skilled in the art are explicitly appreciated that, each embodiment may be implemented by means of software and a requisite general-purpose hardware platform, and of course, it is also implemented by hardware. Based on such understanding, part of the above-described technical solution that is essential or contributing to the relevant art is embodied in the form of a software product. The computer software product is stored in a computer-readable storage medium, such as ROM/RAM, magnetic disk and optical disk, and includes several instructions to cause a computer device (which is a personal computer, a server, or a network device and the like) to implement the control method described in various embodiments or some embodiments.

[0803] In view that almost all the gravity of the air outlet assembly of the ceiling recessed fan in the related art is borne by the lifting mechanism, in order to reduce the gravity borne by the lifting mechanism and prevent the lifting mechanism from being likely to be damaged due to excessive pressure, the present disclosure provides the following embodiments to solve the problem.

[0804] Referring to Figs. 68 to 70, according to a first embodiment of the present disclosure, a ceiling recessed fan with a load-bearing member is provided, which includes a main body frame 10h, an air outlet assembly 20h and a lifting mechanism 30h. The air outlet assembly 20h is connected to the main body frame 10h through the lifting mechanism 30h, and the air outlet assembly 20h descends so that a first air outlet 41h is formed between the air outlet assembly 20h and the main body frame 10h. The main body frame 10h is provided with a load-bearing member 11h, and the air outlet assembly 20h is provided with a lapped joint member 21h configured to be movable relative to the load-bearing member 11h. During the ascending process of the air outlet assembly 20h, the load-bearing member 11h is separated from a lapped joint member 21h. When the air outlet assembly 20h descends to an operation position, the lapped joint member 21h is in lapped joint with the load-bearing member 11h, and the load-bearing member 11h bears at least part of the gravity of the air outlet assembly 20h.

[0805] The ceiling recessed fan in some embodiments of the present disclosure is provided with the load-bearing member 11h and the lapped joint member 21h, which cooperate to transfer the gravity of the air outlet assembly 20h to the main body frame 10h when the air outlet assembly descends to an operation position, and at least part of the gravity of the air outlet assembly is directly transferred to the main body frame through the load-bearing member 11h and the lapped joint member 21h, instead of being totally borne by the lifting mechanism 30h. This greatly reduces the pressure borne by the lifting mechanism 30h during the operation process and reduces the deformation and stress concentration of the lifting mechanism under the effect of pressure, which solves the problem that the lifting mechanism is likely to be damaged during use for a long time that has been found by the inventors.

[0806] Referring to Figure 68, a movement stroke A of the lapped joint member 21h is equal to a maximum descending height of the air outlet assembly 20h. Since the lapped joint member 21h is mounted on the air outlet assembly 20h and ascends and descends along with the air outlet assembly 20h, the movement stroke A of the lapped joint member 21h is directly related to the maximum descending height of the air outlet assembly 20h. In some embodiments of the present disclosure, when the air outlet assembly 20h ascends to the closed position, the lapped joint member 21h ascends to the highest position, and the distance between the highest position of the lapped joint member 21h and the position where the lapped joint member 21h is in lapped joint with the load-bearing member 11h is A. Reference may be specifically made to the position shown in Figure 68.

[0807] In some embodiments, the maximum lifting distance of the lifting mechanism 30h is greater than the movement stroke of the lapped joint member 21h. This arrangement is to ensure that the lapped joint member 21h can be accurately in lapped joint with the load-bearing member 11h. When the lifting mechanism 30h controls the air outlet assembly 20h to descend, the lapped joint member 21h will also descend along with the same, and after the movement stroke of the lapped joint member 21h is completed, the lapped joint member 21h will be in lapped joint with the load-bearing member 11h. At this time, the lifting mechanism 30h will continue to control the air outlet assembly 20h to descend so as to ensure that the

lapped joint member 21h and the load-bearing member 11h completely reach a cooperating state. In this way, the weight of the air outlet assembly 20h falls on the load-bearing member 11h, so as to prevent a phenomenon that the lifting distance of the lifting mechanism 30h is too short to realize the cooperation between the lapped joint member 21h and the load-bearing member 11h.

[0808] Specifically referring to Figure 70, the lifting mechanism 30h includes a driving device 31h, a gear 32h and a rack 33h, wherein the driving device 31h is arranged in the main body frame 10h, the gear 32h is mounted on the output shaft of the driving device 31h, the rack 33h is fixedly connected with the air outlet assembly 20h, and the rack 33h meshes with the gear 32h. The driving device 31h drives the air outlet assembly 20h to ascend and descend by cooperation between the gear 32h and the rack 33h, and the meshing length of the rack 33h is equal to the maximum lifting distance of the lifting mechanism 30h. The meshing length of the rack 33h directly determines the maximum lifting distance of the lifting mechanism 30h (the maximum lifting distance here is the lifting distance that can be achieved by the lifting mechanism 30h, not the lifting distance of the assembled lifting mechanism 30h), and further determines the descending height of the air outlet assembly 20h. The specific structure of the lifting mechanism 30h can complete the lifting function, and the maximum lifting distance can be adjusted by selecting a structural dimension during the process of assembling and manufacturing the products.

[0809] It is to be noted that, the gear and the rack constitute a transmission mechanism, and there are a plurality of transmission mechanisms. In some embodiments of the present disclosure, there are four transmission mechanisms, which are located at the four corners of the ceiling recessed fan respectively, so as to allow a uniform stress. Of course, the transmission mechanism also uses other methods such as a belt transmission structure, or a guide rail structure. The driving device in some embodiments of the present disclosure is an electric motor, and each electric motor drives a transmission mechanism. However, the cooperation method between the electric motor and the transmission mechanism is not limited thereto. In another embodiment not shown, other structures are the same as some embodiments of the present disclosure. The difference lies in that one electric motor drives two transmission mechanisms, thereby lessening the number of electric motors and reducing the cost. Similarly, as an alternative, one electric motor drives four transmission mechanisms to ascend and descend at the same time, thereby further saving the manufacturing cost.

[0810] In order to further transfer the weight of the air outlet assembly to the ceiling or the main body frame mounted on the ceiling, in some embodiments of the present disclosure, the lifting mechanism 30h is mounted on the load-bearing member 11h. The weight borne by the lifting mechanism 30h may also be borne by the ceiling or the main body frame mounted on the ceiling, especially when the air outlet assembly of the ceiling recessed fan ascends to the highest position, and the weight of the air outlet assembly is still borne by the ceiling or the main body frame mounted on the ceiling.

[0811] In conjunction with Figs. 68 and 69, the specific structure and cooperation of the load-bearing member 11h and the lapped joint member 21h will be introduced: the load-bearing member 11h includes a load-bearing plate 11ah and a load-bearing step 11bh, wherein the load-bearing plate 11ah is connected with the main body frame 10h, and the load-bearing step 11bh is connected with the load-bearing plate 11ah. The lapped joint member 21h includes a lapped joint plate 21ah and a lapped joint step 21bh, wherein the lapped joint plate 21ah is connected with the air outlet assembly 20h, and the lapped joint step 21bh is connected with the lapped joint plate 21ah. During the ascending process of the air outlet assembly 20h, the lap jointed step 21bh ascends away from the load-bearing step 11bh. When the air outlet assembly 20h descends to an operation position, the lap jointed step 21bh descends and is in lapped joint with the load-bearing step 11bh. The lap jointed step 21bh descends and is in lapped joint with the load-bearing step 11bh so that it is impossible to realize the above-described lapped joint load-bearing function.

[0812] Moreover, in some embodiments of the present disclosure, since the load-bearing member 11h and the lapped joint member 21h are located at the first air outlet position, the lap jointed step 21bh descends and is in lapped joint with the load-bearing step 11bh so that it is impossible to produce a sealing effect. Specifically, in order to allow a smooth lifting movement of the air outlet assembly and the main body frame, a movement gap is retained between the lifting assembly and the main body frame. With the presence of the movement gap, the movement gap is not sealed in the structure in the related art, and the first air outlet may communicate with the air return gate through the movement gap, which will lead to air output entering the air return gate through the movement gap so that it is likely to cause condensation. When the lapped joint step 21bh descends and is in lapped joint with the load-bearing step 11bh, both of them are compressed under the gravity effect of the air outlet assembly. That is, there is no slit for ventilation therebetween, thereby blocking the flow of the airflow between the first air outlet and the air return gate and achieving the sealing effect. In some embodiments, thermal insulation cotton is provided on a lapped joint surface of the lapped joint step 21bh and the load-bearing step 11bh, so as to allow a better sealing effect and reduce the condensation phenomenon.

[0813] The bearing plate 11ah has a first side surface and a second side surface that are oppositely arranged. A load-bearing step 11bh is formed on the first side surface, and a lifting mechanism 30h is mounted on the second side surface.

[0814] In some embodiments, the cross-sectional shape of the load-bearing member 11h is C-shaped, and the cross-sectional shape of the lapped joint member 21h is L-shaped or T-shaped.

[0815] In some embodiments of the present disclosure, the air outlet assembly 20h includes an air outlet frame, wherein a first air outlet 41h is formed between the air outlet frame and the main body frame 10h, and the air outlet frame is lifted

independently. In other embodiments not shown, the air outlet assembly 20h includes an air outlet frame and an air return panel, wherein a first air outlet 41h is formed between the air outlet frame and the main body frame 10h, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together. In some embodiments of the present disclosure, the main body frame 10h is configured to be mounted on the ceiling, and the main body frame 10h bears the weight of the ceiling recessed fan.

[0816] Referring to Figs. 71 to 72, according to a second embodiment of the present disclosure, a ceiling recessed fan with a load-bearing member is provided, which includes a main body frame 10h, an air outlet assembly 20h and a lifting mechanism. The air outlet assembly 20h is connected to the main body frame 10h through the lifting mechanism 30h, and the air outlet assembly 20h descends so that a first air outlet 41h is formed between the air outlet assembly 20h and the main body frame 10h. The main body frame 10h is provided with a load-bearing member 11h, and the air outlet assembly 20h is provided with a lapped joint member 21h configured to be movable relative to the load-bearing member 11h. During the ascending process of the air outlet assembly 20h, the load-bearing member 11h is separated from a lapped joint member 21h. When the air outlet assembly 20h descends to an operation position, the lapped joint member 21h is in lapped joint with the load-bearing member 11h, and the load-bearing member 11h bears at least part of the gravity of the air outlet assembly 20h.

[0817] The air outlet assembly 20h descends to form an air supply duct 50h with the main body frame 10h, so that one end of the air supply duct 50h forms a first air outlet 41h, and the other end of the air supply duct 50h communicates with the air outlet duct of the ceiling recessed fan. The air outlet assembly is also provided with a second air outlet 42h communicating with the air outlet duct of the ceiling recessed fan. The air outlet assembly is provided with an air deflector located at the position of the first air outlet 41h and/or the second air outlet 42h.

[0818] The ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode: When the ceiling recessed fan is in the first air output mode, the first air outlet is open and the second air outlet is closed. At this time, all the air in the air outlet duct is blown out through the first air outlet, that is, a horizontal air output or even a tilting air output is formed. The air output state of the first air output mode is shown in Figure 71.

[0819] When the ceiling recessed fan is in the second air output mode, the first air outlet is open and the second air outlet is open. At this time, part of the airflow in the air outlet duct is blown out through the first air outlet, and the remaining is blown out through the second air outlet, so as to realize circumferential air supply and improve the uniformity of room temperature. The air output state of the second air output mode is shown in Figure 72.

[0820] When the ceiling recessed fan is in the third air output mode, the first air outlet is closed and the second air outlet is open. At this time, all the air in the air outlet duct is blown out through the second air outlet, that is, a tiltingly downward air output or even a vertically downward air output is formed.

[0821] The ceiling recessed fan resumes planning the heating mode and the cooling mode according to the above-described air output mode. When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode. When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0822] The second air outlet is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet with the second air outlet, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output range of the ceiling recessed fan and the accuracy and rate of temperature adjustment. The airflow in the air outlet duct is blown out by the first air outlet after air deflection by the air supply duct, and the vertically downward airflow in the air outlet duct is deflected by the air supply duct to output air horizontally or even output air in a tiltingly upward direction relative to a horizontal plane.

[0823] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflection. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. In view of the shortcomings in the related art, the present disclosure makes an improvement. The specific improvement lies in that: the main body frame 10h further includes a side frame 12h. When the air outlet assembly 20h descends so that a first air outlet 41h is formed between the air outlet assembly 20h and the main body frame 10h, an air supply duct 50h is formed between the air outlet assembly 20h and the side frame 12h. The projection of the air outlet assembly 20h at least partially coincides with the projection of the side frame 12h on the mounting planar face of the main body frame 10h. The side frame 12h is a portion mounted on the ceiling. When the projection of the air outlet assembly coincides with the projection of the side frame, the air outlet assembly is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet, the air outlet assembly gradually goes away from the main body frame to form an air supply duct. At this time, a corresponding portion of the air outlet assembly forms a lower side surface of the air supply duct. When the airflow flows through the air supply duct, under the air deflection effect of a lower side surface of the air supply duct, the airflow flows

along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0824] As another embodiment, the projection of the air outlet assembly completely coincides with the projection of the side frame. In this case, compared with the case where the projection of the air outlet assembly partially coincides with the projection of the side frame, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly is attached to the main body frame, and a corresponding portion of the air outlet assembly is attached to the side frame, so that a person can only see the air outlet assembly instead of the main body frame when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0825] As another embodiment, the projection of the air outlet assembly exceeds the projection of the side frame. In this case, compared with the case where the projection of the air outlet assembly completely coincides with the projection of the side frame, the air outlet assembly can be further extended, thereby further increasing a horizontal blow effect and an air supply distance of the ceiling recessed fan.

[0826] In the related art, in order to allow a smooth lifting movement of the air outlet assembly and the main body frame, a movement gap is retained between the lifting assembly and the main body frame. With the presence of the movement gap, the air outlet may communicate with the air return gate through the movement gap, which will lead to air output entering the air return gate through the movement gap so that it is likely to cause condensation. Therefore, the inventors have found that, how to allow a smooth lifting movement and reduce the air output from entering the air return gate is an urgent problem to be solved.

[0827] Therefore, as shown in a third embodiment of the present disclosure in Figs. 73 and 74, a ceiling recessed fan is disclosed, which includes: a main body frame 10h, an air outlet assembly 20h, a lifting mechanism and a flexible windshield 40h. The main body frame 10h is internally formed with an air outlet duct 14h, and the air outlet assembly 20h is connected to the main body frame 10h through a lifting mechanism. A first air outlet 31h is formed between the air outlet duct 14h and the main body frame 10h, and the air outlet assembly 20h descends so that a first air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h. A flexible windshield 40h is located between the air outlet duct 14h and the air return gate, so that a first end of the flexible windshield 40h is connected with the air outlet assembly 20h; and a second end of the flexible windshield 40h is connected with the main body frame 10h. When the air outlet assembly 20h descends to an operation position, the flexible windshield 40h is unfolded to block the air return gate and the first air outlet 21h of the ceiling recessed fan.

[0828] In the ceiling recessed fan provided by some embodiments of the present disclosure, both ends of the flexible windshield 40h are connected to the main body frame 10h and the air outlet assembly 20h respectively, and when the air outlet assembly 20h first descends to an operation position, the flexible windshield 40h is unfolded to block the air return gate and the first air outlet 21h of the ceiling recessed fan so as to partition the airflow between the air outlet and the first air outlet 31h, thereby preventing the air output from entering the air outlet from the movement gap and reducing or even avoiding the generation of condensation.

[0829] It is to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0830] The main body frame 10h has a first thermal insulation portion 11h. That is, the first thermal insulation portion 11h is arranged in the main body frame 10h and located between the air outlet duct 14h and the air return gate, and the first end of the flexible windshield 40h is connected to the first thermal insulation portion 11h. The first thermal insulation portion 11h is provided to prevent the air in the air duct from exchanging heat with the outside, thereby effectively reducing the loss of cold or heat.

[0831] The first thermal insulation portion 11h has a first side surface and a second side surface that are oppositely arranged, wherein the first side surface faces towards the first air outlet 31h and the second side surface faces towards the return air outlet. The first side surface is laid with a thermal insulation material, and the second side surface is mounted with a lifting mechanism. By laying the thermal insulation material on a first side of the first thermal insulation portion 11h, and arranging the lifting mechanism on the second side of the first thermal insulation portion 11h, the first thermal insulation portion 11h not only has the thermal insulation function, but also bears the weight of the lifting mechanism and the air outlet assembly 20h, which is multi-functional, thereby allowing a more compact internal structure of the ceiling recessed fan, reducing the overall size and improving the competitiveness.

[0832] The air outlet assembly 20h has a second thermal insulation portion 21h. That is, the second thermal insulation portion 21h is arranged on the air outlet assembly 20h and located between the air outlet duct 14h and the air return gate, and the second end of the flexible windshield 40h is connected to the second thermal insulation portion 21h. When the air outlet assembly 20h descends to an operation position, the first thermal insulation portion 11h and the second thermal insulation portion 21h cooperate to form a thermal insulation layer for performing thermal insulation on the airflow between the air return gate and the first air outlet 31h. By arranging the second thermal insulation portion 21h, the airflow in the air

outlet duct is further prevented from exchanging heat with the outside. When the air outlet assembly 20h descends to an operation position, the first thermal insulation portion 11h and the second thermal insulation portion 21h cooperate to form a thermal insulating partition, which blocks the airflow between the air return gate and the first air outlet 31h to achieve a thermal insulation effect. This structure effectively prevents the dissipation of cold or heat in the air outlet duct, and further prevents the generation of condensation.

[0833] It is to be noted that, the flexible windshield 40h refers to a deformable windshield made from one or more of the following materials: corrugated board, waterproof cloth and windproof fabric. In addition, in some embodiments, the flexible windshield 40h has a member with a deformable metallic framework, the surface of which is laid with a structure of waterproof cloth, wherein the metallic framework is arranged telescopically, so that the deformation of the flexible windshield 40h is realized by telescoping of the metallic framework.

[0834] In the above-described embodiments, when the air outlet assembly 20h descends to an operation position, the windward surface of the flexible windshield 40h forms an air deflecting surface 41h for deflecting the air output to the first air outlet 31h. When the air outlet assembly 20h descends to an operation position, the unfolded flexible windshield 40h will cover at least part of the surface structure of the first thermal insulation portion 11h and at least part of the surface structure of the second thermal insulation portion 21h, and the shielded parts of the first thermal insulation portion 11h and the second thermal insulation portion 21h are irregular structures, which are likely to generate vortex. In other words, the irregular structure inside the air duct is shielded by the flexible windshield 40h, which not only prevents the air output from entering the air return gate through the movement gap, but also reduces the generation of condensation. Moreover, the air output may not flow through the irregular structure so as to reduce or even avoid the generation of turbulence. The air output is deflected to the first air outlet 31h through the air deflecting surface 41h of the flexible windshield 40h, so as to allow a higher air output efficiency and reduce the air volume loss, which is multi-functional.

[0835] In some embodiments shown in Figs. 74 and 75, the ceiling recessed fan further includes an elastic reel 50h arranged in the main body frame 10h, so that one end of the flexible windshield 40h is connected with the elastic reel 50h. The elastic reel 50h is configured to wind up the flexible windshield 40h when the air outlet assembly 20h ascends. By providing the elastic reel 50h to wind up the flexible windshield 40h when the air outlet assembly 20h ascends, it is possible to reduce or even avoid the risk of damage caused by the accumulation of the flexible windshield 40h in the air duct, which produces the effect of protecting the flexible windshield 40h. In addition, by performing wind-up by the elastic reel, during the ascending or descending process of the air outlet assembly 20h, the surface of the flexible windshield 40h always remains in a flat state without bending and folding. In other words, even if the air outlet assembly 20h is located at different lifting heights, the flexible windshield 40h always blocks the air return gate and the first air outlet 31h of the ceiling recessed fan, so as to block the flow of the airflow between the air return gate and the first air outlet 31h, thereby preventing the air output from entering the air return gate through the movement gap and reducing the generation of condensation.

[0836] It is to be noted that, in some embodiments of the present disclosure, the air outlet assembly 20h includes an air outlet frame, wherein a first air outlet 31h is formed between the air outlet frame and the main body frame 10h, and the air outlet frame is lifted independently. In another embodiment not shown, the air outlet assembly 20h includes an air outlet frame and an air return panel, wherein a first air outlet 31h is formed between the air outlet frame and the main body frame 10h, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0837] It is to be noted that, the lifting mechanism includes a transmission mechanism and a driving device. The transmission mechanism is connected between the main body frame 10h and the air outlet assembly 20h, and the driving device is drivingly connected with the transmission mechanism, so that the driving device drives the transmission mechanism to drive the air outlet assembly 20h to ascend and descend. Wherein, there are a plurality of transmission mechanisms. In some embodiments of the present disclosure, there are four transmission mechanisms, which are located at the four corners of the ceiling recessed fan respectively, so as to allow a uniform stress. In some embodiments, the transmission mechanism uses a belt transmission structure, a rack and pinion transmission structure or a guide rail structure.

[0838] It is also to be noted that, in some embodiments of the present disclosure, the driving device is an electric motor, and each electric motor drives a transmission mechanism. However, the cooperation method between the electric motor and the transmission mechanism is not limited thereto. In another embodiment not shown, other structures are the same as some embodiments of the present disclosure. The difference lies in that one electric motor drives two transmission mechanisms, thereby lessening the number of electric motors and reducing the cost. Similarly, in some embodiments, one electric motor drives four lifting transmission mechanisms at the same time, thereby further saving the manufacturing cost.

[0839] According to a fourth embodiment shown in Figs. 75 and 76, a ceiling recessed fan is disclosed, the structure of which is substantially the same as the third embodiment, and the differences lie in that: the air outlet assembly 20h is provided with at least one second air outlet 32h communicating with the air outlet duct 14h; when the air outlet assembly 20h descends to an operation position, the flexible windshield 40h is unfolded to block the flow of the airflow between the air return gate and the first air outlet 31h and between the air return gate and the second air outlet 32h.

[0840] In the ceiling recessed fan provided by some embodiments of the present disclosure, both ends of the flexible

windshield 40h are connected to the main body frame 10h and the air outlet assembly 20h respectively, and when the air outlet assembly 20h first descends to an operation position, the flexible windshield 40h is unfolded to block the air return gate and the first air outlet 21h of the ceiling recessed fan so as to partition the airflow between the air outlet and the first air outlet 31h and between the air return gate and the second air outlet 32h, thereby preventing the air output from entering the air outlet from the movement gap and reducing the generation of condensation.

[0841] With the first air outlet 31h, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not be downward to directly blow the skin. At the same time, the second air outlet 32h is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 31h with the second air outlet 32h, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0842] It is to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0843] When the air outlet assembly 20h descends so that a first air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h, a gap which is formed between the air outlet assembly 20h and the main body frame 10h, forms an air supply duct 12h. One end of the air supply duct 12h communicates with the air outlet duct 11h, and the other end of the air supply duct 12h forms a first air outlet 31h. The airflow in the air outlet duct 11h is blown out by the first air outlet 31h after air deflection by the air supply duct 12h, and the vertically downward airflow in the air outlet duct 11h is deflected by the air supply duct 12h to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0844] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflection. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 10h of the present disclosure further includes a side frame 13h. When the air outlet assembly 20h descends so that an air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h, an air supply duct 12h is formed between the air outlet assembly 20h and the side frame 13h, and on the mounting planar face of the main body frame 10h (for example, the ceiling), the projection of the air outlet assembly 20h at least partially coincides with the projection of the side frame 13h. When the projection of the air outlet assembly 20h coincides with the projection of the side frame 13h, the air outlet assembly 20h is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet 31h, the air outlet assembly 20h gradually goes away from the main body frame 10h to form an air supply duct 12h. At this time, a corresponding portion of the air outlet assembly 20h forms a lower side surface of the air supply duct 12h. When the airflow flows through the air supply duct 12h, under the air deflection effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0845] As another embodiment, the projection of the air outlet assembly 20h completely coincides with the projection of the side frame 13h. In this case, compared with the case where the projection of the air outlet assembly 20h partially coincides with the projection of the side frame 13h, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 20h is attached to the main body frame 10h, and a corresponding portion of the air outlet assembly 20h is attached to the side frame 13h, so that a person can only see the air outlet assembly 20h instead of the main body frame 10h when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0846] It is to be noted that, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode.

[0847] When the ceiling recessed fan is in the first air output mode, the first air outlet 31h is open and the second air outlet 32h is closed. At this time, all the airflow in the air outlet duct is blown out through the first air outlet 31h, that is, a horizontal air output or even a tilting air output is formed.

[0848] When the ceiling recessed fan is in the second air output mode, the first air outlet 31h is open and the second air outlet 32h is open. At this time, part of the airflow in the air outlet duct is blown out through the first air outlet 31h, and the remaining is blown out through the second air outlet 32h, so as to realize circumferential air supply and improve the uniformity of room temperature.

[0849] When the ceiling recessed fan is in the third air output mode, the first air outlet 31h is closed and the second air outlet 32h is open. At this time, all the air in the air outlet duct is blown out through the second air outlet 32h, that is, a tiltingly downward air output or even a vertically downward air output is formed.

[0850] The ceiling recessed fan resumes planning the heating mode and the cooling mode according to the above-described air output mode. When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode. When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0851] In the related art, since the air output assembly is of a structure arranged in a way so as to be raised and lowered, the structure of the air duct also changes accordingly during the lifting process of the air outlet assembly, and many irregular structures are added inside the air duct, which is likely to cause energy loss of air output. Therefore, the inventors believe that, how to reduce the energy loss of air output in the air duct is an urgent problem to be solved.

[0852] According to a fifth embodiment of the present disclosure as shown in Figs. 77 and 78, a ceiling recessed fan is disclosed, which includes a main body frame 10h, an air outlet assembly 20h, a lifting mechanism and an air deflector 4h0h, wherein the main body frame 10h is internally formed with an air outlet duct 14h. The air outlet assembly 20h is connected to the main body frame 10h through a lifting mechanism, and the air outlet assembly 20h descends so that a first air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h. The main body frame 10h has a first windshield 11h located between the air outlet duct 14h and the air return gate, and the air outlet assembly 20h has a second windshield 21h located between the air outlet duct 14h and the air return gate. When the air outlet assembly 20h descends to an operation position, the first windshield 11h cooperates with the second windshield 21h to block the air return gate and the first air outlet 31h. The air deflector 4h0h is located in the air outlet duct 14h. The first end of the air deflector 4h0h is swingably arranged in the main body frame 10h. When the air outlet assembly 20h descends to an operation position, the second end of the air deflector 4h0h is in lapped joint with the second windshield 21h. The air deflector 4h0h covers at least part of the surface structure of the first windshield 11h and at least part of the surface structure of the second windshield 21h, and the air deflector 4h0h is configured to deflect the air output to the first air outlet 31h.

[0853] In the ceiling recessed fan provided by some embodiments of the present disclosure, one end of the air deflector 4h0h is swingably arranged in the main body frame 10h. When the air outlet assembly 20h first descends to an operation position, the air deflector 4h0h swings so that the other end of the air deflector 4h0h is in lapped joint with the second windshield 21h by swinging, and covers at least part of the surface structure of the first windshield 11h and at least part of the surface structure of the second windshield 21h. That is, the irregular structure inside the air duct is blocked by the air deflector 4h0h, which not only prevents the outlet air from flowing through the irregular structure to reduce the generation of turbulence, but also deflects the air output in the air duct to the first air outlet 31h through the air deflector 4h0h, thereby allowing a higher air output efficiency and reducing the air volume loss.

[0854] It is to be noted that, the air deflector 4h0h covers at least part of the surface structure of the first windshield 11h and at least part of the surface structure of the second windshield 21h, which means that the first windshield 11h cooperates with the second windshield 21h to block part of the space of the air return gate and the first air outlet 31h. When the air outlet assembly 20h descends to an operation position, the part of the space may form a groove structure (for example, C-shaped, L-shaped, inverted T-shaped) so that vortex may be generated after the air output flows through the groove structure. When the air outlet assembly 20h descends to an operation position, the air deflector 4h0h is located at the opening position of the first windshield 11h, and the air deflector 4h0h shields the groove structure at the opening position, thereby reducing the generation of vortex and reducing the air volume loss of the air output.

[0855] It is also to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0856] In some embodiments, one end of the air deflector 4h0h is provided with a rotary shaft through which the air deflector 4h0h is mounted on the top of the first windshield 11h. The air deflector 4h0h swings around the rotary shaft. The second end of the air deflector 4h0h extends to the bottom of the first windshield 11h.

[0857] The air outlet assembly 20h ascends and descends to swing the air deflector 4h0h. When the ceiling recessed fan is turned on, the air outlet assembly 20h descends, and the second end of the air deflector 4h0h descends by gravity and is in lapped joint with the air outlet assembly 20h. During the ascending process of the air outlet assembly 20h, the air outlet assembly 20h pushes the air deflector 4h0h to ascend. The air outlet assembly 20h ascends and descends to swing the air deflector 4h0h, so that the air outlet assembly 20h forms linkage with the air deflector 4h0h. When the air outlet assembly 20h descends, the air deflector 4h0h automatically swings to a position covering the first windshield 11h and the second windshield 21h, and when the air outlet assembly 20h ascends, the air outlet assembly 20h is automatically retracted without manual adjustment, which simplifies the operation and improves the user experience.

[0858] The second windshield 21h is provided with a first air deflecting surface 211h arranged on one side of the second windshield 21h facing towards the first air outlet 31h, and the second end of the air deflecting plate 4h0h may be in lapped joint with the first air deflecting surface 211h. By providing the first air deflecting surface 211h on the second windshield 21h, the airflow is deflected to the first air outlet 31h, so that the air volume loss is reduced and the air supply effect is improved.

[0859] The windward surface of the air deflector 4h0h forms a second air deflecting surface 41h. When the air outlet assembly 20h descends to an operation position, the second air deflecting surface 41h is connected with the first air

deflecting surface 211h to form an air deflecting structure. The first air deflecting surface 211h is connected with the second air deflecting surface 41h to form an air deflecting structure, which deflects the air output initially blown to the first windshield 11h and the second windshield 21h to the first air outlet 31h, so as to not only reduce the generation of vortex, but also allow a more smooth flowing path of the air output, thereby greatly reducing the air volume loss and improving the air output effect.

[0860] As shown in Figure 78, when the ceiling recessed fan is turned off, when the air outlet assembly 20h ascends to a retracted position, the air deflector 4h0h is located in an avoidance position, and the air deflector 4h0h swings upward to avoid the retracted air outlet assembly 20h. By setting an avoidance position, the air outlet assembly 20h when retracted will not interfere with the air deflector 4h0h, so as to prevent them from being damaged and improve the reliability of the ceiling recessed fan.

[0861] In some embodiments, the first windshield 11h and/or the second windshield 21h are/is provided with a thermal insulation layer. By setting a thermal insulation layer, it is possible to effectively prevent dissipation of cold and improve the air supply effect, and also prevent the generation of condensation.

[0862] It is to be noted that, in some embodiments of the present disclosure, the air outlet assembly 20h includes an air outlet frame, wherein a first air outlet 31h is formed between the air outlet frame and the main body frame 10h, and the air outlet frame is lifted independently.

[0863] In another embodiment not shown, the air outlet assembly 20h includes an air outlet frame and an air return panel, wherein a first air outlet 31h is formed between the air outlet frame and the main body frame 10h, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0864] It is to be noted that, the lifting mechanism includes a transmission mechanism and a driving device. The transmission mechanism is connected between the main body frame 10h and the air outlet assembly 20h, and the driving device is drivingly connected with the transmission mechanism, so that the driving device drives the transmission mechanism to drive the air outlet assembly 20h to ascend and descend. Wherein, there are a plurality of transmission mechanisms. In some embodiments of the present disclosure, there are four transmission mechanisms, which are located at the four corners of the ceiling recessed fan respectively, so as to allow a uniform stress. In some embodiments, the transmission mechanism uses a belt transmission structure, a rack and pinion transmission structure or a guide rail structure.

[0865] It is also to be noted that, in some embodiments of the present disclosure, the driving device is an electric motor, and each electric motor drives a transmission mechanism. However, the cooperation method between the electric motor and the transmission mechanism is not limited thereto. In another embodiment not shown, other structures are the same as some embodiments of the present disclosure. The difference lies in that one electric motor drives two transmission mechanisms, thereby lessening the number of electric motors and reducing the cost. Similarly, in some embodiments, one electric motor drives four lifting transmission mechanisms at the same time, thereby further saving the manufacturing cost.

[0866] According to a six embodiment shown in Figs. 79 and 80, a ceiling recessed fan is disclosed, the structure of which is substantially the same as the fifth embodiment, and the differences lie in that: the air outlet assembly 20h is provided with at least one second air outlet 32h, and the second air outlet 32h communicates with the air outlet duct 14h. When the air outlet assembly 4h0h descends to an operation position, the first windshield 11h cooperates with the second windshield 21h to block the flow of the airflow between the air return gate and the first air outlet 31h, and between the air return gate and the second air outlet 32h. The ceiling recessed fan further includes: an air deflector 4h0h located in the air outlet duct 14h of the ceiling recessed fan. The first end of the air deflector 4h0h is swingably arranged in the main body frame 10h. When the air outlet assembly 20h descends to an operation position, the second end of the air deflector 4h0h is in lapped joint with the second windshield 21h. The air deflector 4h0h covers at least part of the surface structure of the first windshield 11h and at least part of the surface structure of the second windshield 21h, and the air deflector 4h0h is configured to deflect the air output to the first air outlet 31h and/or the second air output 32h.

[0867] In the ceiling recessed fan provided by some embodiments of the present disclosure, one end of the air deflector 4h0h is swingably arranged in the main body frame 10h. When the air outlet assembly 20h first descends to an operation position, the air deflector 4h0h swings so that the other end of the air deflector 4h0h is in lapped joint with the second windshield 21h by swinging, and covers at least part of the surface structure of the first windshield 11h and at least part of the surface structure of the second windshield 21h. That is, the irregular structure inside the air duct is blocked by the air deflector 4h0h, which not only prevents the outlet air from flowing through the irregular structure to reduce the generation of turbulence, but also deflects the air output in the air duct to the first air outlet 31h through the air deflector 4h0h, thereby allowing a higher air output efficiency and reducing the air volume loss.

[0868] With the first air outlet 31h, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not blow downward to directly blow the skin. At the same time, the second air outlet 32h is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 31h with the second air outlet 32h, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0869] It is to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0870] When the air outlet assembly 20h descends so that a first air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h, a gap which is formed between the air outlet assembly 20h and the main body frame 10h, forms an air supply duct 12h. One end of the air supply duct 12h communicates with the air outlet duct 11h, and the other end of the air supply duct 12h forms a first air outlet 31h. The airflow in the air outlet duct 11h is blown out by the first air outlet 31h after air deflection by the air supply duct 12h, and the vertically downward airflow in the air outlet duct 11h is deflected by the air supply duct 12h to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0871] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflection. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 10h of the present disclosure further includes a side frame 13h. When the air outlet assembly 20h descends so that an air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h, an air supply duct 12h is formed between the air outlet assembly 20h and the side frame 13h, and on the mounting planar face of the main body frame 10h (for example, the ceiling), the projection of the air outlet assembly 20h at least partially coincides with the projection of the side frame 13h. When the projection of the air outlet assembly 20h coincides with the projection of the side frame 13h, the air outlet assembly 20h is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet 31h, the air outlet assembly 20h gradually goes away from the main body frame 10h to form an air supply duct 12h. At this time, a corresponding portion of the air outlet assembly 20h forms a lower side surface of the air supply duct 12h. When the airflow flows through the air supply duct 12h, under the air deflection effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0872] As another embodiment, the projection of the air outlet assembly 20h completely coincides with the projection of the side frame 13h. In this case, compared with the case where the projection of the air outlet assembly 20h partially coincides with the projection of the side frame 13h, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 20h is attached to the main body frame 10h, and a corresponding portion of the air outlet assembly 20h is attached to the side frame 13h, so that a person can only see the air outlet assembly 20h instead of the main body frame 10h when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0873] It is to be noted that, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

[0874] When the ceiling recessed fan is in the first air output mode, the first air outlet 31h is open and the second air outlet 32h is closed. At this time, all the airflow in the air outlet duct is blown out through the first air outlet 31h, that is, a horizontal air output or even a tilting air output is formed.

[0875] When the ceiling recessed fan is in the second air output mode, the first air outlet 31h is open and the second air outlet 32h is open. At this time, part of the airflow in the air outlet duct is blown out through the first air outlet 31h, and the remaining is blown out through the second air outlet 32h, so as to realize circumferential air supply and improve the uniformity of room temperature.

[0876] When the ceiling recessed fan is in the third air output mode, the first air outlet 31h is closed and the second air outlet 32h is open. At this time, all the air in the air outlet duct is blown out through the second air outlet 32h, that is, a tiltingly downward air output or even a vertically downward air output is formed.

[0877] The ceiling recessed fan resumes planning the heating mode and the cooling mode according to the above-described air output mode. When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode. When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0878] In the related art, in order to allow a smooth lifting movement of the air outlet assembly and the main body frame, it is necessary that a movement gap is retained between the lifting assembly and the main body frame. With the presence of the movement gap, the air outlet may communicate with the air return gate through the movement gap, which will lead to air output entering the air return gate through the movement gap so that it is likely to cause condensation. Therefore, the inventors believe that, how to allow a smooth lifting movement and reduce or even avoid the air output from entering the air return gate is an urgent problem to be solved.

[0879] Therefore, according to a seventh embodiment of the present disclosure as shown in Figs. 81 and 82, a ceiling

recessed fan is disclosed, which includes a main body frame 10h, an air outlet assembly 20h, a first windshield 40h, a second windshield 50h and a lifting mechanism 60h. The main body frame 10h is internally formed with an air outlet duct 11h, and the air outlet assembly 20h is connected to the main body frame 10h through the lifting mechanism 60h. The air outlet assembly 20h descends so that a first air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h, and the first windshield 40h is arranged in the main body frame 10h and located between the air outlet duct 11h and the air return gate. The first windshield has an accommodating groove 41h. The second windshield 50h is arranged on the air outlet assembly 20h and located between the air outlet duct 11h and the air return gate. The first end of the second windshield 50h is connected with the air outlet assembly 20h, the second end of the second windshield 50h is movably arranged in the accommodating groove 41h. When the air outlet assembly 20h descends to an operation position, the first windshield 40h cooperates with the second windshield 50h to block the flow of the airflow between the air return gate and the first air outlet 31h.

[0880] The ceiling recessed fan provided by some embodiments of the present disclosure is provided with a first windshield 40h and a second windshield 50h. The first windshield 40h is provided with an accommodating groove 41h, and the second end of the second windshield 50h is movably arranged in the accommodating groove 41h. When the air outlet assembly 20h descends to an operation position, the first windshield 40h cooperates with the second windshield 50h so as to block the flow of the airflow between the air return gate and the first air outlet 31h, thereby preventing the air output from entering the air return gate through the movement gap and reducing the generation of condensation.

[0881] It is to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0882] As shown in Figs. 81 and 82, the notch 411h of the accommodating groove 41h is arranged towards the descending direction of the air outlet assembly 20h, and the second windshield 50h passes through the notch 411h. When the air outlet assembly 20h ascends, a major part of the second windshield 50h is received in the accommodating groove 41h, thereby saving the space. When the air outlet assembly 20h descends, part of the second windshield 50h projects out of the accommodating groove 41h, and the other part of the second windshield 50h is located inside the accommodating groove 41h, thereby blocking the flow of the airflow between the air return gate and the first air outlet 31h.

[0883] In some embodiments, a sealing structure 43h is provided between the notch 411h and the second windshield 50h. By arranging the sealing structure 43h between the notch 411h and the second windshield 50h, it is possible to effectively prevent the airflow from passing between the notch 411h and the second windshield 50h, thereby reducing or even avoiding the airflow entering the air return gate through the air outlet.

[0884] In some embodiments, in order to reduce the resistance of the sealing structure 43h to the second windshield 50h whilst performing sealing, the sealing structure 43h is a sealing brush. By providing a sealing brush, the resistance is also reduced whilst sealing a gap between the notch 411h and the second windshield 50h. Moreover, it is also possible to clean the second windshield 50h during each lifting process so as to prevent dust accumulation, which is multi-functional.

[0885] The first windshield 40h cooperates with the second windshield 50h to form a maze sealing structure, wherein the maze sealing structure is shown by the arrow in Figure 82. The first windshield 40h cooperates with the second windshield 50h to form a maze sealing structure, which increases a length of the movement gap and increases the flow resistance of the airflow, thereby blocking the flow of the airflow.

[0886] Specifically, the second end of the second windshield 50h has a step structure 51h, so that the step structure 51h, the notch 411h and the inner wall of the accommodating groove 41h together form a maze sealing structure. By arranging the step structure 51h at the second end of the second windshield 50h, the step structure 51h, the notch 411h and the inner wall of the accommodating groove 41h together form a maze sealing structure. When the airflow flows between the second windshield 50h and the first windshield 40h, the flow distance increases, and there are a plurality of corners in the flow path of the airflow, which greatly increases the flow resistance of the airflow and gradually reduces the flow of the airflow, thereby blocking the flow of the airflow.

[0887] In some embodiments, the groove wall of the accommodating groove 41h is provided with a sealing protrusion 412h. When the air outlet assembly 20h descends to an operation position, the sealing protrusion 412h abuts against or is lapped joint with the step structure 51h to form cooperation, so as to block the air return gate and the first air outlet 31h. By cooperating the sealing protrusion 412h with the step structure 51h, the movement gap between the air outlet assembly 20h and the main body frame 10h is completely blocked to prevent passage of the airflow.

[0888] The ceiling recessed fan has an air outlet duct 11h, and the first windshield 40h has a first side surface located in the air outlet duct 11h, wherein the first side surface is an air deflecting surface 42h for deflecting the air output to the first air outlet 31h. By providing the air deflecting surface 42h, the first windshield 40h not only blocks the airflow, but also deflects the air output of the air outlet duct 11h of the ceiling recessed fan to the first air outlet 31h, thereby reducing the generation of vortex and improving the air output efficiency, which is typically multi-functional.

[0889] In some embodiments, the ceiling recessed fan also has an air return duct, the first windshield 40h also has a second side surface located in the air return duct, and the lifting mechanism 60h is mounted on the second side surface. The first windshield 40h not only blocks the airflow in the movement gap and deflects the air output, but also serves as an

assembly structure of the lifting mechanism 60h to assemble the lifting mechanism 60h on the first windshield 40h. Thus, after installation, the structure in the ceiling recessed fan is more compact and the internal layout is more reasonable.

[0890] The first windshield 40h has an annular structure arranged along an outer circumference of the air return gate, and the accommodating groove 41h is an annular groove. The first air outlet 31h of the ceiling recessed fan is mostly around the air return gate. In order to improve the windshield effect, the first windshield 40h also has an annular structure, which is around the air return gate and located between the first air outlet 31h and the air return gate. Moreover, the accommodating groove 41h is an annular groove provided on the annular structure, and the second windshield 50h also has an annular structure, which cooperates with the annular groove to form a 360° windshield structure.

[0891] In order to prevent dissipation of cold, the ceiling recessed fan also includes a thermal insulation layer arranged on the inner wall of the accommodating groove 41h and/or the second windshield 50h, thereby effectively reducing dissipation of cold by a heat transfer method and reducing or even preventing the generation of condensation.

[0892] In some embodiments of the present disclosure, the air outlet assembly 20h includes an air outlet frame, wherein a first air outlet 31h is formed between the air outlet frame and the main body frame 10h, and the air outlet frame is lifted independently.

[0893] In another embodiment not shown, the air outlet assembly 20h includes an air outlet frame and an air return panel, wherein a first air outlet 31h is formed between the air outlet frame and the main body frame 10h, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0894] It is to be noted that, the lifting mechanism 60h includes a transmission mechanism and a driving device. The transmission mechanism is connected between the main body frame 10h and the air outlet assembly 20h, and the driving device is drivingly connected with the transmission mechanism, so that the driving device drives the transmission mechanism to drive the air outlet assembly 20h to ascend and descend. Wherein, there are a plurality of transmission mechanisms. In some embodiments of the present disclosure, there are four transmission mechanisms, which are located at the four corners of the ceiling recessed fan respectively, so as to allow a uniform stress. In some embodiments, the transmission mechanism uses a belt transmission structure, a rack and pinion transmission structure or a guide rail structure.

[0895] It is also to be noted that, in some embodiments of the present disclosure, the driving device is an electric motor, and each electric motor drives a transmission mechanism. However, the cooperation method between the electric motor and the transmission mechanism is not limited thereto. In another embodiment not shown, other structures are the same as some embodiments of the present disclosure. The difference lies in that one electric motor drives two transmission mechanisms, thereby lessening the number of electric motors and reducing the cost. Similarly, in some embodiments, one electric motor drives four lifting transmission mechanisms at the same time, thereby further saving the manufacturing cost.

[0896] According to an eighth embodiment shown in Figs. 83 and 84, a ceiling recessed fan is disclosed, the structure of which is substantially the same as the seventh embodiment, and the differences lie in that: the air outlet assembly 20h is provided with at least one second air outlet 32h communicating with the air outlet duct 11h; when the air outlet assembly 20h descends to an operation position, the first windshield 40h and the second windshield form cooperation to block the flow of the airflow between the air return gate and the first air outlet 31h and between the air return gate and the second air outlet 32h.

[0897] The ceiling recessed fan provided by some embodiments of the present disclosure is provided with a first windshield 40h and a second windshield 50h. The first windshield 40h is provided with an accommodating groove 41h, and the second end of the second windshield 50h is movably arranged in the accommodating groove 41h. When the air outlet assembly 20h descends to an operation position, the first windshield 40h cooperates with the second windshield 50h so as to block the flow of the airflow between the air return gate and the first air outlet 31h and between the air return gate and the second air outlet 32h, thereby preventing the air output from entering the air return gate through the movement gap and reducing the generation of condensation.

[0898] With the first air outlet 31h, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not blow downward to directly blow the skin. At the same time, the second air outlet 32h is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 31h with the second air outlet 32h, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0899] It is to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0900] When the air outlet assembly 20h descends so that a first air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h, a gap which is formed between the air outlet assembly 20h and the main body frame 10h, forms an air supply duct 12h. One end of the air supply duct 12h communicates with the air outlet duct 11h, and the other end of the air supply duct 12h forms a first air outlet 31h. The airflow in the air outlet duct 11h is blown out by the first air outlet 31h after air deflection by the air supply duct 12h, and the vertically downward airflow in the air outlet duct 11h is deflected

by the air supply duct 12h to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0901] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflection. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 10h of the present disclosure further includes a side frame 13h. When the air outlet assembly 20h descends so that an air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h, an air supply duct 12h is formed between the air outlet assembly 20h and the side frame 13h, and on the mounting planar face of the main body frame 10h (for example, the ceiling), the projection of the air outlet assembly 20h at least partially coincides with the projection of the side frame 13h. When the projection of the air outlet assembly 20h coincides with the projection of the side frame 13h, the air outlet assembly 20h is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet 31h, the air outlet assembly 20h gradually goes away from the main body frame 10h to form an air supply duct 12h. At this time, a corresponding portion of the air outlet assembly 20h forms a lower side surface of the air supply duct 12h. When the airflow flows through the air supply duct 12h, under the air deflection effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0902] As another embodiment, the projection of the air outlet assembly 20h completely coincides with the projection of the side frame 13h. In this case, compared with the case where the projection of the air outlet assembly 20h partially coincides with the projection of the side frame 13h, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 20h is attached to the main body frame 10h, and a corresponding portion of the air outlet assembly 20h is attached to the side frame 13h, so that a person can only see the air outlet assembly 20h instead of the main body frame 10h when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan. It is to be noted that, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

When the ceiling recessed fan is in the first air output mode, the first air outlet 31h is open and the second air outlet 32h is closed. At this time, all the airflow in the air outlet duct is blown out through the first air outlet 31h, that is, a horizontal air output or even a tilting air output is formed.

[0903] When the ceiling recessed fan is in the second air output mode, the first air outlet 31h is open and the second air outlet 32h is open. At this time, part of the airflow in the air outlet duct is blown out through the first air outlet 31h, and the remaining is blown out through the second air outlet 32h, so as to realize circumferential air supply and improve the uniformity of room temperature.

[0904] When the ceiling recessed fan is in the third air output mode, the first air outlet 31h is closed and the second air outlet 32h is open. At this time, all the air in the air outlet duct is blown out through the second air outlet 32h, that is, a tiltingly downward air output or even a vertically downward air output is formed.

[0905] The ceiling recessed fan resumes planning the heating mode and the cooling mode according to the above-described air output mode. When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode. When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0906] Since the structure of the air outlet assembly located on one side of the air outlet duct is unreasonably provided, when the air in the air outlet duct flows through the air outlet assembly, it is likely to generate vortex, which will produce resistance to the air flow in the air outlet duct, thereby causing the air volume loss.

[0907] Therefore, according to a ninth embodiment of the present disclosure as shown in Figs. 85 and 86, a ceiling recessed fan is disclosed, which includes a main body frame 10h, an air outlet assembly 20h, a lifting mechanism and a vent cover plate 40h, wherein the main body frame 10h is internally formed with an air outlet duct 13h. The air outlet assembly 20h is connected to the main body frame 10h through a lifting mechanism, and the air outlet assembly 20h descends so that a first air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h. The vent cover plate 40h is arranged on the air outlet assembly 20h and located between the air outlet duct 13h and the air return gate. The vent cover plate 40h has an arc-shaped air deflecting surface 41h for deflecting the airflow to the first air outlet 31h.

[0908] The ceiling recessed fan provided by some embodiments of the present disclosure is provided with the vent cover plate 40h, and the vent cover plate 40h is provided with the air deflecting surface 41h. When the ceiling recessed fan outputs air, and the airflow inside the ceiling recessed fan passes through the air deflecting surface 41h, the airflow is deflected to the first air outlet 31h through the air deflecting surface 41h, which reduces the generation of vortex and allows a more smooth air output, thereby reducing the air volume loss and improving the air output efficiency of the air conditioner.

[0909] It is to be noted that, in the related art, the structure of the air duct also changes accordingly during the lifting process of the air outlet assembly 20h, and many irregular structures (for example, C-shaped, L-shaped and inverted T-shaped) are added inside the air duct, so that vortex may be generated after the air output flows through the groove structure, thereby causing the air volume loss. Moreover, the airflow flowing through these irregular structures will generate vortex, thereby causing the air volume loss.

[0910] In a ninth embodiment as shown in Figs. 85 and 86, the vent cover plate 40h is provided to be an arc-shaped plate, and the vent cover plate 40h covers some irregular structures of the air outlet assembly 20h which are shielded by the vent cover plate 40h, thereby reducing the generation of vortex and the air volume loss of the air output.

[0911] It is also to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0912] In the related art, in order to allow a smooth lifting movement of the air outlet assembly and the main body frame, it is necessary that a movement gap is retained between the lifting assembly and the main body frame. With the presence of the movement gap, the first air outlet communicates with the air return gate through the movement gap, which leads to air output entering the air return gate through the movement gap so that it is likely to cause condensation. Therefore, the inventors believe that, how to allow a smooth lifting movement and reduce or even avoid the air output from entering the air return gate is an urgent problem to be solved.

[0913] Therefore, in some embodiments of the present disclosure, the following technical solution is provided: there is a movement gap 50h between the main body frame 10h and the air outlet assembly 20h, and the movement gap 50h communicates with the air return gate of the ceiling recessed fan. The main body frame 10h is provided with a first windshield 11h located at the position of the movement gap 50h. When the air outlet assembly 20h descends to an operation position, the first windshield 11h and the vent cover plate 40h form cooperation to block the movement gap 50h. By arranging the first windshield 11h at the movement gap 50h, when the air outlet assembly 20h descends to an operation position, the first windshield 11h forms cooperation with the vent cover plate 40h to block the movement gap 50h and prevent the air output from entering the air return gate through the movement gap 50h, thereby reducing the generation of condensation. Also that is, the vent cover plate 40h not only produces the air deflection effect, but also produces the effect of blocking the movement gap 50h, which is typically multi-functional.

[0914] It is to be noted that, as shown in Figure 85, the right end of the vent cover plate 40h in Figure 85 is the free end protruding out of the air outlet assembly 20h. At the same time, the free end is also the position where the vent cover plate 40h cooperates with the first windshield 11h, and the free end is located at the position of the movement gap 50h. When the air outlet assembly 20h descends to an operation position, the free end of the vent cover plate 40h is in lapped joint with the first windshield 11h so as to block the movement gap 50h. The free end of the vent cover plate 40h is in lapped joint with the first windshield 11h, and a lapped joint sealing fit is formed between the vent cover plate 40h and the first windshield 11h, thereby blocking the movement gap 50h and reducing condensation formed by air leakage.

[0915] In some embodiments, the main body frame 10h is provided with a second windshield 12h located above the first windshield 11h. When the air outlet assembly 20h ascends to a retracted position, the vent cover plate 40h and the second windshield 12h form cooperation so as to block the movement gap 50h. By providing a second baffle, when the air outlet assembly 20h ascends to a retracted position, the vent cover plate 40h and the second windshield 12h form cooperation to block the movement gap 50h, which makes it difficult for dust and mosquitoes to enter the air duct, thereby allowing a clean air duct inside.

[0916] It is to be noted that, when the air outlet assembly 20h ascends to a retracted position, the free end of the vent cover plate 40h also cooperates with the second windshield 12 so as to realize a lapped joint sealing.

[0917] In some embodiments, the first windshield 11h is a reinforcement rib on the main body frame 10h. By providing the first windshield 11h to be a reinforcement rib, the first windshield 11h protrudes from the surface of the main body frame 10h, and the vent cover plate 40h is in lapped joint with the reinforcement rib so as to realize a lapped joint sealing. In addition to this function, the reinforcement rib has two additional functions: on the one hand, the reinforcement rib enhances the overall strength of the main body frame 10h and improves the reliability of the main body frame; and on the other hand, when the vent cover plate 40h is lapped joint with the first windshield 11h, the first windshield 11h, which is a reinforcement rib, also serves as a support structure to support the air outlet assembly 20h, thereby producing a certain load-bearing effect. By providing the first windshield 11h to be a reinforcement rib, it is possible to not only achieve the lapped joint sealing effect, but also produce the reinforcing and load-bearing effect, which is typically multi-functional.

[0918] In some embodiments not shown, the second windshield 12h is also provided to be a reinforcement rib, which also produces the sealing and reinforcing effect. Alternatively, it is also feasible to only provide the second windshield 12h to be a reinforcement rib.

[0919] The distance between the first windshield 11h and the second windshield 12h is a descending height of the air outlet assembly 20h. By setting the distance between the first windshield 11h and the second windshield 12h to be a descending height of the air outlet assembly 20h, the air outlet assembly 20h will only cooperate with the first windshield

11h when the air outlet assembly 20h descends to an operation position, and the air outlet assembly 20h will only cooperate with the second windshield 12h when the air outlet assembly 20h ascends to a retracted position, so as to realize the function of blocking the movement gap 50h.

[0920] In some embodiments, the air outlet assembly 20h is provided with an air deflector 21h arranged at the position of the first air outlet 31h, and the air deflector 21h has an air deflecting surface in smooth transition with the air deflecting surface 41h. The air deflecting surface of the air deflector 21h is in smooth transition with the air deflecting surface 41h, and the airflow directly flows to the air deflecting surface of the air deflector 21h after passing through the air deflecting surface 41h, so as to allow a more smooth air output and air deflection and reduce the air volume loss.

[0921] It is to be noted that, the smooth transition between the air deflecting surface and the air deflecting surface 41h is that the heights of the air deflecting surface 41h and the air deflecting surface are substantially the same, and vortex may not be generated when the airflow flows therebetween, thereby reducing the air volume loss.

[0922] In some embodiments not shown, one end of the air deflector 21h proximate to the vent cover plate has a lapped joint portion, which is a lapped joint plate connected with the vent cover plate through a flexible material. The lapped joint plate is in lapped joint with the vent cover plate 40h, so that the air deflecting surface of the air deflector 21h is connected with the air deflecting surface 41h through the lapped joint portion, thereby forming a complete air deflecting camber. When the air deflector 21h swings, the lapped joint plate is always in lapped joint with the vent cover plate so as to realize air deflection. It is to be noted that, the flexible material is one or more of the following: corrugated board, waterproof cloth, windproof fabric, and the like. Of course, it is also feasible that the air deflector 21h is directly connected with the vent cover plate through a flexible material.

[0923] It is to be noted that, in a ninth embodiment, the air outlet assembly 20h includes an air outlet frame, wherein a first air outlet 31h is formed between the air outlet frame and the main body frame 10h, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 20h includes an air outlet frame and an air return panel, wherein a first air outlet 31h is formed between the air outlet frame and the main body frame 10h, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0924] According to a tenth embodiment shown in Figs. 87 and 88, a ceiling recessed fan is disclosed, the structure of which is substantially the same as the ninth embodiment, and the differences lie in that: the air outlet assembly 20h is provided with at least one second air outlet 32h communicating with the air outlet duct 13h. The vent cover plate 40h has an arc-shaped air deflecting surface 41h for deflecting the airflow to at least one of the first outlet 31h and the second outlet 32h. That is, the air deflecting surface 41h deflects the airflow to the first air outlet 31h, or the air deflecting surface 41h deflects the airflow to the second air outlet 32h, or the air deflecting surface 41h deflects the airflow to the first air outlet 31h and the second air outlet 32h.

[0925] The ceiling recessed fan provided by some embodiments of the present disclosure is provided with the vent cover plate 40h, and the vent cover plate 40h is provided with the air deflecting surface 41h. When the ceiling recessed fan outputs air, and the airflow inside the ceiling recessed fan passes through the air deflecting surface 41h, the airflow is deflected to the first air outlet 31h through the air deflecting surface 41h, which reduces the generation of vortex and allows a more smooth air output, thereby reducing the air volume loss and improving the air output efficiency of the air conditioner.

[0926] With the first air outlet 31h, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not blow downward to directly blow the skin. At the same time, the second air outlet 32h is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 31h with the second air outlet 32h, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0927] It is to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0928] When the air outlet assembly 20h descends so that a first air outlet 31h is formed between the air outlet assembly 20h and the main body frame 10h, a gap which is formed between the air outlet assembly 20h and the main body frame 10h, forms an air supply duct 14h. One end of the air supply duct 14h communicates with the air outlet duct 11h, and the other end of the air supply duct 14h forms a first air outlet 31h. The airflow in the air outlet duct 11h is blown out by the first air outlet 31h after air deflection by the air supply duct 14h, and the vertically downward airflow in the air outlet duct 11h is deflected by the air supply duct 14h to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0929] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflection. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 10h of the present disclosure further includes a side frame 15h. When the air outlet assembly 20h descends so that a first air outlet

31h is formed between the air outlet assembly 20h and the main body frame 10h, an air supply duct 14h is formed between the air outlet assembly 20h and the side frame 15h, and on the mounting planar face of the main body frame 10h (for example, the ceiling), the projection of the air outlet assembly 20h at least partially coincides with the projection of the side frame 15h. When the projection of the air outlet assembly 20h coincides with the projection of the side frame 15h, the air outlet assembly 20h is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet 31h, the air outlet assembly 20h gradually goes away from the main body frame 10h to form an air supply duct 14h. At this time, a corresponding portion of the air outlet assembly 20h forms a lower side surface of the air supply duct 14h. When the airflow flows through the air supply duct 14h, under the air deflection effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0930] As another embodiment, the projection of the air outlet assembly 20h completely coincides with the projection of the side frame 15h. In this case, compared with the case where the projection of the air outlet assembly 20h partially coincides with the projection of the side frame 15h, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 20h is attached to the main body frame 10h, and a corresponding portion of the air outlet assembly 20h is attached to the side frame 15h, so that a person can only see the air outlet assembly 20h instead of the main body frame 10h when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0931] It is to be noted that, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

When the ceiling recessed fan is in the first air output mode, the first air outlet 31h is open and the second air outlet 32h is closed. At this time, all the airflow in the air outlet duct is blown out through the first air outlet 31h, that is, a horizontal air output or even a tilting air output is formed.

[0932] When the ceiling recessed fan is in the second air output mode, the first air outlet 31h is open and the second air outlet 32h is open. At this time, part of the airflow in the air outlet duct is blown out through the first air outlet 31h, and the remaining is blown out through the second air outlet 32h, so as to realize circumferential air supply and improve the uniformity of room temperature.

[0933] When the ceiling recessed fan is in the third air output mode, the first air outlet 31h is closed and the second air outlet 32h is open. At this time, all the air in the air outlet duct is blown out through the second air outlet 32h, that is, a tiltingly downward air output or even a vertically downward air output is formed.

[0934] The ceiling recessed fan resumes planning the heating mode and the cooling mode according to the above-described air output mode. When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode. When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0935] The inventors have found through studies that, the ceiling recessed fan in the related art uses an electric motor as a lifting mechanism to drive the entire air outlet assembly to move. Since the electric motor has a limited load-bearing capacity, those of ordinary skills in the art can only improve the lifting reliability of the air outlet assembly by reducing the weight of the air outlet assembly or increasing the number of electric motors. However, when the number of electric motors is increased, it is necessarily possible to increase the manufacturing cost of the ceiling recessed fan and the manufacturing difficulty of the ceiling recessed fan. When the weight of the air outlet assembly is reduced, it is necessarily possible to reduce the function of the air outlet assembly, which results in a poor effect of the ceiling recessed fan.

[0936] Therefore, according to an eleventh embodiment of the present disclosure as shown in Figs. 89 and 90, a ceiling recessed fan is disclosed, which includes: a main body frame 1h; a lifting mechanism 2h arranged in the main body frame 1h; an air outlet assembly 3h arranged on the lifting mechanism 2h capable of driving the air outlet assembly 3h to ascend and descend; a support assembly 4h arranged in the main body frame 1h, and capable of providing a support force for the air outlet assembly 3h, wherein the direction of the support force is opposite to the direction of the gravity.

[0937] Part of the gravity of the air outlet assembly 3h is transferred to the main body frame 1h through the support assembly 4h, so as to overcome the problem that it is difficult to manufacture the lifting mechanism 2h due to the fact that the gravity of the air outlet assembly 3h is borne by the lifting mechanism 2h that has been found by the inventors. In the case of lifting the air outlet assembly 3h with the same mass as in the related art, the support assembly 4h can apparently reduce the structural requirements of the lifting mechanism 2h. Taking the lifting mechanism 2h which is an electric motor as an example, the torque of the electric motor selected in the present disclosure can be apparently less than the torque of the electric motor in the related art, and the torque of the electric motor is related to the dimension of the electric motor (the electric motor with a low velocity has a large torque, the electric motor with a large torque has a large current density, the electric motor with a large current density has a thick copper wire, and the electric motor with a thick copper wire has a large volume. Similarly, the electric motor with a high velocity has a small torque, the electric motor with a small torque has a small current density, the electric motor with a small current density has a thin copper wire, and the electric motor with a thin

copper wire has a small volume). Therefore, the support assembly 4h in the present disclosure can effectively reduce the volume of the electric motor selected in use, and effectively reduce the volumes of the lifting mechanism 2h and the ceiling recessed fan on the premise of achieving the same air output effect.

[0938] It is to be noted that, the main body frame 1h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 1h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 1h and fixed to the ceiling through the main body frame 1h.

[0939] The air outlet assembly 3h has an operation position that descends to a predetermined height and forms a first air outlet 10h with the main body frame 1h. The air outlet assembly 3h has a first windshield 32h at the position of the first air outlet 10h, and the main body frame 1h has a second windshield 11h at the position of the first air outlet 10h. When the air outlet assembly 3h descends to an operation position, the first windshield 32h cooperates with the second windshield 11h to block the air return gate and the first air outlet 10h. The support assembly 4h is arranged between the first windshield 32h and the second windshield 11h. By providing the first windshield 32h and the second windshield 11h, an airflow passage is generated between the first air outlet 10h and the air return gate of the ceiling recessed fan, which affects the normal operation of the ceiling recessed fan. At the same time, the support assembly 4h is fixed by using the first windshield 32h and the second windshield 11h without additionally machining other structures on the ceiling recessed fan, thereby saving the internal space of the ceiling recessed fan. At the same time, the support assembly 4h can also support the gravity of the first windshield 32h or the second windshield 11h to a certain extent, which further improves the operation reliability of the ceiling recessed fan.

[0940] The upper edge of the first windshield 32h is bent towards the second windshield 11h to form a first bent portion, and the upper edge of the second windshield 11h is bent towards the first windshield 32h to form a second bent portion, and the support assembly 4h is arranged between the first bent portion and the second bent portion. Also that is, at this time, the first windshield 32h and the second windshield 11h are both L-shaped, and the two L-shapes are arranged in mirror symmetry to achieve the sealing effect. At this time, the support assembly 4h is wrapped in the first windshield 32h and located outside the second windshield 11h or wrapped in the second windshield 11h and located outside the first windshield 32h, and the horizontal section of the L-shape provides a mounting position for the support assembly 4h.

[0941] As another embodiment, the upper edge of the first windshield 32h is bent towards the second windshield 11h to form a first bent portion, and the lower edge of the second windshield 11h is bent towards the first windshield 32h to form a third bent portion, and the support assembly 4h is arranged between the first bent portion and the third bent portion. Also that is, at this time, the first windshield 32h and the second windshield 11h are both L-shaped, and the two L-shapes are locked with each other to achieve the sealing effect. At this time, the support assembly 4h is wrapped in the first windshield 32h and the second windshield 11h, and the horizontal section of the L-shape provides a mounting position for the support assembly 4h.

[0942] In order to prevent the support assembly 4h from interfering with the first windshield 32h and the second windshield 11h, the structure of a twelfth embodiment of the present disclosure as shown in Figure 91 is substantially the same as the eleventh embodiment, and the differences lie in that: in some embodiments of the present disclosure, the air outlet assembly 3h is provided with a first boss 31h, the main body frame 1h includes a first mounting structure 12h above the first boss 31h, the first end 41h of the support assembly 4h is arranged on the first mounting structure 12h, and the second end 42h of the support assembly 4h is arranged on the first boss 31h, also that is, at this time, the support assembly 4h generates an upward pulling force on the first boss 31h (the air outlet assembly 3h). Wherein, the first mounting structure 12h is a corresponding surface of the main body frame 1h, or a structure arranged in the main body frame 1h to fix the support assembly 4h. Taking the support assembly 4h which is a spring as an example, the first mounting structure 12h is a fixing column projecting out of the surface of the main body frame 1h, and one end of the spring is sleeved on the fixing column to complete fixed installation.

[0943] In order to allow that the support assembly 4h may not interfere with the first windshield 32h and the second windshield 11h, the structure of a thirteenth embodiment of the present disclosure as shown in Figure 92 is substantially the same as the eleventh embodiment, and the differences lie in that: the air outlet assembly 3h is provided with a first boss 31h, the main body frame 1h includes a second mounting structure 13h below the first boss 31h, the first end 41h of the support assembly 4h is arranged on the second mounting structure 13h, and the second end 42h of the support assembly 4h is arranged on the first boss 31h. At this time, the support assembly 4h generates an upward support force on the first boss 31h (the air outlet assembly 3h). Wherein, the second mounting structure 13h is a corresponding surface of the main body frame 1h, or a structure arranged in the main body frame 1h to fix the support assembly 4h. Taking the support assembly 4h which is a spring as an example, the second mounting structure 13h is a fixing column projecting out of the surface of the main body frame 1h, and one end of the spring is sleeved on the fixing column to complete fixed installation.

[0944] In other embodiments not shown, the air outlet assembly 3h is only provided with the first boss 31h to fix the support assembly 4h.

[0945] The main body frame 1h is provided with a connector, the upper end of which is arranged in the main body frame 1h, and the lower end of which is bent in a direction away from the center of the main body frame 1h to form the second mounting structure 13h.

[0946] The air outlet assembly 3h has an operation position that descends to a predetermined height and forms a first air outlet 10h with the main body frame 1h. The air outlet assembly 3h has a first windshield 32h at the position of the first air outlet 10h, and the main body frame 1h has a second windshield 11h at the position of the first air outlet. When the air outlet assembly 3h descends to an operation position, the first windshield 32h cooperates with the second windshield 11h to block the air return gate and the first air outlet 10h, and the second windshield 11h forms a connector.

[0947] In the vertical direction, the support assembly 4h has a first end 41h and a second end 42h opposite to each other, wherein the first end 41h is arranged in the main body frame 1h, and the second end 42h is arranged on the air outlet assembly 3h, and the second end 42h can be remote from or proximate to the first end 41h. Also that is, as the air outlet assembly 3h moves, the second end 42h and the first end 41h move relative to each other, so as to implement supporting the air outlet assembly 3h.

[0948] The support assembly 4h includes a deformation member, which is deformed during the lifting process of the air outlet assembly 3h. The energy generated during the movement process of the air outlet assembly 3h is accumulated by the deformation of the deformation member, and the accumulated energy further enhances the support effect of the air outlet assembly 3h and provides an auxiliary force for the movement of the air outlet assembly 3h.

[0949] In some embodiments, the deformation member includes a spring, which is compressed or stretched during the lifting process of the air outlet assembly 3h.

[0950] In some embodiments, the deformation member includes a balloon, which is compressed or stretched in the vertical direction when the air outlet assembly 3h descends.

[0951] The air outlet assembly 3h includes an air outlet frame, wherein a first air outlet 10h is formed between the air outlet frame and the main body frame 1h, and the air outlet frame is lifted independently. In other embodiments not shown, the air outlet assembly 3h includes an air outlet frame and an air return panel, wherein a first air outlet 10h is formed between the air outlet frame and the main body frame 1h, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[0952] According to a fourteenth embodiment of the present disclosure as shown in Figs. 93 and 94, a ceiling recessed fan is disclosed, the structure of which is substantially the same as the eleventh embodiment, and the differences only lie in that: in some embodiments of the present disclosure, the main body frame 1h is internally formed with an air outlet duct 14h; the air outlet assembly 3h is arranged in the main body frame 1h in a way so as to be able to be raised and lowered, and the air outlet assembly 3h descends so that a first air outlet 10h is formed between the air outlet assembly 3h and the main body frame 1h3; and the air outlet assembly 3h is provided with at least one second air outlet 33h communicating with the air outlet duct 14h. With the first air outlet 10h, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not blow downward to directly blow the skin. At the same time, the second air outlet 33h is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 10h with the second air outlet 33h, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0953] When the air outlet assembly descends so that a first air outlet 10h is formed between the air outlet assembly and the main body frame 1h, a gap which is formed between the air outlet assembly 3h and the main body frame 1h, forms an air supply duct 15h. One end of the air supply duct 15h communicates with the air outlet duct 14h, and the other end of the air supply duct 15h forms a first air outlet 10h. The airflow in the air outlet duct 14h is blown out by the first air outlet 31h after air deflection by the air supply duct 15h, and the vertically downward airflow in the air outlet duct 14h is deflected by the air supply duct 15h to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0954] According to a fifteenth embodiment of the present disclosure as shown in Figure 95, a ceiling recessed fan is disclosed, the structure of which is substantially the same as the twelfth embodiment, and the differences only lie in that: in some embodiments of the present disclosure, the main body frame 1h is internally formed with an air outlet duct 14h; the air outlet assembly 3h is arranged in the main body frame 1h in a way so as to be able to be raised and lowered, and the air outlet assembly 3h descends so that a first air outlet 10h is formed between the air outlet assembly 3h and the main body frame 1h3; and the air outlet assembly 3h is provided with at least one second air outlet 33h communicating with the air outlet duct 14h. With the first air outlet 10h, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not blow downward to directly blow the skin. At the same time, the second air outlet 33h is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 10h with the second air outlet 33h, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0955] When the air outlet assembly descends so that a first air outlet 10h is formed between the air outlet assembly and the main body frame 1h, a gap which is formed between the air outlet assembly 3h and the main body frame 1h, forms an air supply duct 15h. One end of the air supply duct 15h communicates with the air outlet duct 14h, and the other end of the air supply duct 15h forms a first air outlet 10h. The airflow in the air outlet duct 14h is blown out by the first air outlet 31h after air

deflection by the air supply duct 15h, and the vertically downward airflow in the air outlet duct 14h is deflected by the air supply duct 15h to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0956] According to a sixteenth embodiment of the present disclosure as shown in Figure 96, a ceiling recessed fan is disclosed, the structure of which is substantially the same as the thirteenth embodiment, and the differences only lie in that: in some embodiments of the present disclosure, the main body frame 1h is internally formed with an air outlet duct 14h; the air outlet assembly 3h is arranged in the main body frame 1h in a way so as to be able to be raised and lowered, and the air outlet assembly 3h descends so that a first air outlet 10h is formed between the air outlet assembly 3h and the main body frame 1h3; and the air outlet assembly 3h is provided with at least one second air outlet 33h communicating with the air outlet duct 14h. With the first air outlet 10h, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not blow downward to directly blow the skin. At the same time, the second air outlet 33h is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 10h with the second air outlet 33h, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0957] When the air outlet assembly descends so that a first air outlet 10h is formed between the air outlet assembly and the main body frame 1h, a gap which is formed between the air outlet assembly 3h and the main body frame 1h, forms an air supply duct 15h. One end of the air supply duct 15h communicates with the air outlet duct 14h, and the other end of the air supply duct 15h forms a first air outlet 10h. The airflow in the air outlet duct 14h is blown out by the first air outlet 31h after air deflection by the air supply duct 15h, and the vertically downward airflow in the air outlet duct 14h is deflected by the air supply duct 15h to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0958] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflection. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 1h of the present disclosure further includes a side frame 16h. When the air outlet assembly 3h descends so that a first air outlet 10h is formed between the air outlet assembly 3h and the main body frame 1h, an air supply duct 15h is formed between the air outlet assembly 3h and the side frame 16h, and on the mounting planar face of the main body frame 1h (for example, the ceiling), the projection of the air outlet assembly 3h at least coincides with the projection of the side frame 16h. When the projection of the air outlet assembly 3h coincides with the projection of the side frame 16h, the air outlet assembly is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet 10h, the air outlet assembly 3h gradually goes away from the main body frame 1h to form an air supply duct 15h. At this time, a corresponding portion of the air outlet assembly 3h forms a lower side surface of the air supply duct 15h. When the airflow flows through the air supply duct 15h, under the air deflection effect of a lower side surface of the air supply duct 15h, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0959] As another embodiment, the projection of the air outlet assembly 3h completely coincides with the projection of the side frame 16h. In this case, compared with the case where the projection of the air outlet assembly 3h partially coincides with the projection of the side frame 16h, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 3h is attached to the main body frame 1h, and a corresponding portion of the air outlet assembly 3h is attached to the side frame 16h, so that a person can only see the air outlet assembly 3h instead of the main body frame 1h when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0960] As another embodiment, the projection of the air outlet assembly 3h exceeds the projection of the side frame 16h. In this case, compared with the case where the projection of the air outlet assembly 3h completely coincides with the projection of the side frame 16h, the air outlet assembly 3h can be further extended, thereby further increasing a horizontal blow effect and an air supply distance of the ceiling recessed fan.

[0961] In some embodiments, the projection of the air outlet assembly 3h exceeds the projection of the main body frame 1h, so that the air outlet assembly 3h effectively increases the air deflection dimension relative to the related art, so as to increase the air supply distance of the ceiling recessed fan.

[0962] It is to be noted that, the ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

[0963] When the ceiling recessed fan is in the first air output mode, the first air outlet 31h is open and the second air outlet 32h is closed. At this time, all the airflow in the air outlet duct 14h is blown out through the first air outlet 31h, that is, a

horizontal air output or even a tilting air output is formed.

[0964] When the ceiling recessed fan is in the second air output mode, the first air outlet 10h is open and the second air outlet 33h is open. At this time, part of the airflow in the air outlet duct 14h is blown out through the first air outlet 10h, and the remaining is blown out through the second air outlet 33h, so as to realize circumferential air supply and improve the uniformity of room temperature.

[0965] When the ceiling recessed fan is in the third air output mode, the first air outlet 10h is closed and the second air outlet 33h is open. At this time, all the air in the air outlet duct 14h is blown out through the second air outlet 33h, that is, a tiltingly downward air output or even a vertically downward air output is formed.

[0966] The ceiling recessed fan resumes planning the heating mode and the cooling mode according to the above-described air output mode. When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode. When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[0967] The inventors have found that, in the ceiling recessed fan in the related art, restricted by the position of its air outlet, it is only possible to perform air output according to a set direction, rather than performing horizontal blow during cooling. Especially for business occasions, skin blow by cold air during downdraft airflow cooling will make people uncomfortable, and skin blow by cold air for a long time is likely to lead to colds and other diseases. The main reason lies in that: the existing ceiling recessed fan has a panel facing towards the ground, and the panel is provided with an air return gate and an air outlet surrounding the air return gate. Also that is, the air output direction of the air outlet of the ceiling recessed fan is generally tiltingly downward air output or even vertically downward air output. However, during cooling, the air output of the air outlet is cold air, and cold air may directly blow the skin at this time, which results in less comfort.

[0968] Therefore, according to a seventeenth embodiment of the present disclosure as shown in Figs. 97 to 107, a ceiling recessed fan with an air outlet duct is disclosed, which includes: a main body frame 10h internally formed with an air outlet duct 11h; and an air outlet assembly 20h arranged in the main body frame 10h in a way so as to be able to be raised and lowered, wherein the air outlet assembly 20h descends so that a first air outlet 12h is formed between the air outlet assembly 20h and the main body frame 10h. The air outlet assembly 20h is provided with at least one second air outlet 13h communicating with the air outlet duct 11h. With the first air outlet 12h, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not blow downward to directly blow the skin. At the same time, the second air outlet 13h is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 12h with the second air outlet 13h, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[0969] It is to be noted that, the main body frame 10h is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10h is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10h and fixed to the ceiling through the main body frame 10h.

[0970] As shown in Figs. 99 and 100, when the air outlet assembly 20h descends so that a first air outlet 12h is formed between the air outlet assembly 20h and the main body frame 10h, a gap which is formed between the air outlet assembly 20h and the main body frame 10h, forms an air supply duct 14h. One end of the air supply duct 14h communicates with the air outlet duct 11h, and the other end of the air supply duct 14h forms a first air outlet 12h. The airflow in the air outlet duct 11h is blown out by the first air outlet 12h after air deflection by the air supply duct 14h, and the vertically downward airflow in the air outlet duct 11h is deflected by the air supply duct 14h to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[0971] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflection. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 10h of the present disclosure further includes a side frame 15h. When the air outlet assembly 20h descends so that a first air outlet 12h is formed between the air outlet assembly 20h and the main body frame 10h, an air supply duct 14h is formed between the air outlet assembly 20h and the side frame 15h, and on the mounting planar face of the main body frame 10h (for example, the ceiling), the projection of the air outlet assembly 20h at least partially coincides with the projection of the side frame 15h. When the projection of the air outlet assembly 20h coincides with the projection of the side frame 15h, the air outlet assembly is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet 12h, the air outlet assembly 20h gradually goes away from the main body frame 10h to form an air supply duct 14h. At this time, a corresponding portion of the air outlet assembly 20h forms a lower side surface of the air supply duct 14h. When the airflow flows through the air supply duct 14h, under the air deflection effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the

air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[0972] As another embodiment, the projection of the air outlet assembly 20h completely coincides with the projection of the side frame 15h. In this case, compared with the case where the projection of the air outlet assembly 20h partially coincides with the projection of the side frame 15h, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 20h is attached to the main body frame 10h, and a corresponding portion of the air outlet assembly 20h is attached to the side frame 15h, so that a person can only see the air outlet assembly 20h instead of the main body frame 10h when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[0973] As another embodiment, the projection of the air outlet assembly 20h exceeds the projection of the side frame 15h. In this case, compared with the case where the projection of the air outlet assembly 20h completely coincides with the projection of the side frame 15h, the air outlet assembly can be further extended, thereby further increasing a horizontal blow effect and an air supply distance of the ceiling recessed fan.

[0974] In some embodiments, the projection of the air outlet assembly 20h exceeds the projection of the main body frame 10h, so that the air outlet assembly 20h effectively increases the air deflection dimension relative to the related art, so as to increase the air supply distance of the ceiling recessed fan.

[0975] The air outlet assembly 20h is also provided with an air deflector 22h. The air deflector 22h can form part of the air outlet duct 11h to allow a more smooth inner surface of the air outlet duct 11h, or the deflector 22h is located at the corner of the air outlet duct 11h and the air supply duct 14h to better deflect the airflow in the air outlet duct 11h to the air supply duct 14h.

[0976] The ceiling recessed fan further includes an air deflector 4h which is rotatably arranged at the second air outlet 13h and capable of closing or opening the second air outlet 13h. When the second air outlet 13h needs to be opened, the air deflector 4h rotates gradually, so that the second air outlet 13h communicates with the air outlet duct 11h to allow that the airflow in the air outlet duct 11h is blown out by the second air outlet 13h, and the air deflector 4h adjusts its tilting angle according to actual needs to adjust the air output direction and/or the air output volume of the second air outlet 13h. When the second air outlet 13h needs to be closed, the air deflector 4h returns to the state of sealing fit with the air outlet assembly 20h so as to close the second air outlet 13h. At this time, the airflow in the air outlet duct 11h can only be blown out from the first air outlet 12h under the joint deflection effect of the air outlet assembly 20h and the air deflector 4h.

[0977] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly 20h and the air deflector 4h is arranged on the rotating mechanism capable of driving the air deflector 4h to rotate.

[0978] As shown in Figure 101, the rotating mechanism includes a rotary arm 5h, one end of which is hinged to the air outlet assembly 20h, and the air deflector 4h is arranged on the other end of the rotary arm 5h.

[0979] Wherein, the rotary arm 5h is U-shaped. With the U-shaped structure, the rotary arm 5h may not interfere with the air outlet assembly 20h during the rotation process, thereby improving the rotation reliability of the air deflector 4h.

[0980] The rotating mechanism also includes a power source arranged on the air outlet assembly 20h, and the end of the rotary arm 5h is arranged on the power source. In some embodiments, the power source is an electric motor, and the output shaft of the electric motor drives one end of the rotary arm 5h to rotate, so as to realize the rotation of the air deflector 4h.

[0981] The air deflector 4h is provided with a plurality of partition plates 6h. All the partition plates 6h are arranged in parallel along the length direction of the air deflector 4h, and a flow channel is formed between two adjacent partition plates 6h. With the partition plate 6h, the airflow flowing through the air deflector 4h is divided into a plurality of streams, and each stream of airflow can be partially deflected through a corresponding air deflector 4h, thereby enhancing the deflecting effect of the air deflector 4h on the airflow. At the same time, the partition plate 6h is mounted along the width direction of the air deflector 4h, which can effectively enhance the rigidity of the air deflector 4h and improve the structural reliability of the air deflector 4h.

[0982] As another embodiment, the ceiling recessed fan also includes at least two partition plates 6h. All the partition plates are arranged in the air outlet duct 11h, and a flow channel is formed between two adjacent partition plates 6h. With the partition plate 6h, the airflow in the air outlet duct 11h is divided into a plurality of streams, so that the airflow in the air outlet duct 11h is not too turbulent, and the first air outlet 12h and the second air outlet 13h have a favorable air output effect.

[0983] A step sealing structure is provided between the edge of the air deflector 4h and the edge of the second air outlet 13h. With a sealing structure, when the second air outlet 13h is closed, the airflow will not flow out through a slit between the air deflector 4h and the second air outlet 13h (in order to prevent locking due to a manufacturing tolerance, it is necessary to design an avoidance gap between the air deflector 4h and the second air outlet 13h) so as to reduce the air output effect. Wherein, the air deflector 4h has a plurality of edges connected sequentially, the edge of the second air outlet 13h is an annular edge matched with the air deflector 4h, and a step sealing structure is provided between each edge of the air deflector 4h and a portion of a corresponding annular edge to improve the sealing effect of the air deflector 4h on the second air outlet 13h. In some embodiments, along the airflow direction, the air deflector 4h has a first edge and a second edge, and the second air outlet 13h has a third edge and a fourth edge. When the air deflector 4h closes the second air outlet 13h, the first edge is sealingly fit with the third edge, and the second edge is sealingly fit with the fourth edge.

[0984] The edge of the air deflector 4h is provided with a first step structure, and the edge of the second air outlet 13h is provided with a second step structure, so that the first step structure and the second step structure are fit to form a step sealing structure. By providing the first step structure and the second step structure, a fold-shaped slit is formed between the edge of the air deflector 4h and the edge of the second air outlet 13h so as to further enhance the sealing effect.

[0985] The first step structure includes an elastic sealing material. Wherein, the first step structure is made from an elastic sealing material to improve the sealing effect of the step sealing structure, or the first step structure is provided with a seal of an elastic sealing material such as sponge.

[0986] The second step structure includes an elastic sealing material. Wherein, the second step structure is made from an elastic sealing material to improve the sealing effect of the step sealing structure. In some embodiments, the second step structure is provided with a seal of an elastic sealing material such as sponge.

[0987] In order to prevent that it is likely to have condensation at the second air outlet 13h when the first air outlet 12h outputs air, the air deflector 4h is made from a thermal insulation material, or is jointly composed of a high-strength material and a thermal insulation material. Wherein, the air deflector 4h is made from a high-strength material as a main body and a thermal insulation material at the edge of the high-strength material, or the material for making the air deflector 4h satisfies the strength requirements and the thermal insulation requirements at the same time.

[0988] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 10h, and the air outlet assembly 20h is arranged on the lifting mechanism. The lifting mechanism can drive the air outlet assembly 20h to ascend or descend.

[0989] Since the projection of the air outlet assembly 20h at least partially coincides with the side frame 15h, with the portion of the air outlet assembly 20h required to be extended below the side frame 15h relative to the related art, the width of the air outlet assembly 20h becomes larger so that it is likely to deform, and it is also likely to vibrate during the lifting process, which affects a cooperation degree between the air outlet assembly 20h and the main body frame 10h. Therefore, in order to allow the air outlet assembly 20h to ascend and descend reliably, the lifting mechanism is connected to one side of the air outlet assembly 20h away from the air return gate of the ceiling recessed fan. Wherein, the air return gate of the ceiling recessed fan is located in the middle of the ceiling recessed fan, and the air outlet assembly 20h is arranged around the periphery of the air return gate of the ceiling recessed fan.

[0990] The cross section of the air outlet assembly 20h is square or polygonal, and a first air outlet can be formed between the main body frame 10h and the air outlet assembly 20h on a side of the rectangle or the polygon. In order to reduce or even avoid the influence of the lifting mechanism on the first air outlet 12h and/or the second air outlet 13h, the lifting mechanism is connected to the corner of the air outlet assembly 20h, and the lifting mechanism is located between two adjacent first air outlets 12h.

[0991] As shown in Figs. 102 and 36, the lifting mechanism includes a driving device 30h, a transmission mechanism and a guiding mechanism 60h, wherein the transmission mechanism is connected with the air outlet assembly 20h and the transmission mechanism is drivingly connected with the driving device 30h which drives the air outlet assembly 20h to ascend and descend through the transmission mechanism. The transmission mechanism has a guiding portion 52h. The guiding mechanism 60h and the guiding portion 52h may move relative to each other in the lifting direction of the air outlet assembly 20h. At the same time, the guiding mechanism 60h is in limiting fit with the guiding portion 52h in the horizontal direction.

[0992] In the ceiling recessed fan provided by some embodiments of the present disclosure, the transmission mechanism is provided with the guiding portion 52h, so that the transmission mechanism cooperates with the guiding mechanism 60h through the guiding portion 52h, and the guiding mechanism 60h restricts the movement direction of the transmission mechanism, so that the transmission mechanism moves in the lifting direction of the air outlet assembly 20h without shaking in the horizontal direction, which allows that the transmission mechanism and the driving mechanism cooperate with each other more closely and stably, thereby reducing the generation of noise without vibrating the transmission mechanism during the driving process.

[0993] The guiding mechanism 60h includes a guiding unit 61h, and the guiding unit 61h has two guiding members 611h arranged oppositely. A guiding channel is formed between the two guiding members 611h, and the guiding portion 52h is located in the guiding channel. By providing the two opposite guiding members 611h, a guiding channel formed between the two guiding members 611h restricts the movement direction of the guiding portion 52h, so that the guiding portion 52h can only move along the guiding channel, and the movement direction of the transmission structure is also restricted, thereby reducing the generation of noise without vibrating the transmission mechanism during the movement process.

[0994] In some embodiments, there are a plurality of guiding units 61h arranged at intervals along the lifting direction of the air outlet assembly 20h. By providing the plurality of guiding units 61h, a plurality of guiding channels are formed in the lifting direction of the air outlet assembly 20h, and the plurality of guiding channels are in limiting fit with the guiding portion 52h at a plurality of positions in the lifting direction of the air outlet assembly 20h, thereby further improving the stability of the transmission mechanism during the movement process.

[0995] The transmission mechanism includes a gear 40h and a rack 50h, and the gear 40h is mounted on the output shaft of the driving device 30h. The rack 50h is fixedly connected with the air outlet assembly 20h and meshes with the gear

40h, and the driving device 30h drives the air outlet assembly 20h to ascend and descend by cooperation between the gear 40h and the rack 50h. The guiding portion 52h is located on the rack 50h. During the lifting process, the output shaft of the driving device 30h drives the gear 40h to rotate, so that the rotating gear 40h drives the rack 50h to ascend or descend, and the rack 50h drives the air outlet assembly 20h to ascend or descend. During the moving process, the guiding portion 52h cooperates with the guiding member 611h and moves in the guiding channel. Under the guidance of the guiding channel, the rack 50h can only move upwards or downwards, thereby reducing the occurrence of a horizontal vibration phenomenon.

[0996] In some embodiments, the guiding portion 52h is a guiding column on the rack 50h, and two opposite guiding members 611h are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members 611h through the guiding grooves. Since there is a fit gap between the gear 40h and the rack 50h, the rack 50h may still vibrate in the vertical direction during the ascending and descending process. By arranging the guiding column on the rack 50h and the guiding groove on the guiding member 611h, the guiding member 611h clamps the guiding column through the guiding groove, so that the guiding column descends slowly, which allows that the entire air outlet assembly 20h ascends or descends stably without vibration in the vertical direction.

[0997] The first side of the rack 50h is provided with a meshing tooth 51, and the second side is provided with a guiding portion 52h. The rack 50h is provided with a mounting groove 55h located between the meshing tooth 51 and the guiding portion 52h. Two guiding members 611h of the guiding unit 61h are located on both sides of the guiding portion 52h respectively, and one of the guiding members 611h of the guiding unit 61h is located in the mounting groove 55h. By arranging the guiding portion 52h on the rack 50h, the structure is more compact when the rack 50h produces a transmission effect at the same time. The rack 50h is provided with the mounting groove 55h, which reduces the weight of the rack 50h, and saves the material. Moreover, some guiding members 611h are arranged in the mounting groove 55h, which greatly saves the assembling space. Further, the mounting groove 55h itself also limits the guiding member 611h, thereby achieving a multi-functional solution.

[0998] Specifically, the extension direction of the mounting groove 55h is the lifting direction of the air outlet assembly 20h, and the mounting groove 55h has a first end wall 53h located above and a second end wall 54h located below along the lifting direction of the air outlet assembly 20h, and the maximum distance between the first end wall 53h and the guiding unit 61h is equal to a maximum descending height of the air outlet assembly 20h. When the air outlet assembly 20h descends, the first end wall 53h of the mounting groove 55h moves toward the guiding unit 61h, and when the first end wall 53h moves to the position of the guiding unit 61h, a limiting fit is formed so as to prevent that the rack 50h is disengaged from the gear 40h.

[0999] In some embodiments, the guiding member 611h in some embodiments of the present disclosure includes a roller in rolling fit with the guiding portion 52h. With the rolling fit between the roller and the guiding portion 52h, the frictional resistance is reduced when the guiding portion 52h is clamped at the same time.

[1000] It is to be noted that, the guiding members 611h also uses other structures. For example, the guiding members 611h is a slider in sliding fit with the guiding portion 52h, or the guiding member 611h includes both a slider and a roller, so that both of them are in hybrid use.

[1001] During the assembling process, the spacing between the guiding units 61h may affect the stability when the transmission mechanism descends. In some embodiments as shown in Figure 103, the guiding mechanism 60h includes two guiding units 61h arranged at intervals along the lifting direction of the air outlet assembly 20h, and the guiding unit 61h and the guiding portion 52h are in sliding fit in the lifting direction of the air outlet assembly 20h. At the same time, the guiding mechanism 60h and the guiding portion 52h are in limiting fit in the horizontal direction. For the maximum descending height B of the air outlet assembly 20h and the spacing distance C between the two guiding units 61h, the ratio of B/C is in the range of 2:1 to 4:1. When B/C is 2:1, the spacing between the guiding units 61h is large, and the descending process of the transmission mechanism is the most stable. When B/C is 4:1, the descending stroke of the transmission mechanism is the largest, that is, the maximum descending height of the air outlet assembly 20h is the largest. In this way, the transmission mechanism is made in a relatively small dimension, which saves the space. When B/C is 3:1, the spacing of the guiding unit 61h is moderate, and the maximum descending height of the air outlet assembly 20h also satisfies the design requirements without enlarging the dimension of the transmission mechanism. Therefore, when B/C is 3:1, it is possible to improve the stability during the lifting process of the air outlet assembly 20h, with a relatively compact and small structure, which saves the cost and the mounting space.

[1002] In the above-described embodiments, the transmission mechanism includes a gear 40h and a rack 50h, and the gear 40h is mounted on the output shaft of the driving device 30h. The rack 50h is fixedly connected with the air outlet assembly 20h and meshes with the gear 40h, and the driving device 30h drives the air outlet assembly 20h to ascend and descend by cooperation between the gear 40h and the rack 50h. The guiding portion 52h is located on the rack 50h. For the length A of the rack 50h along the lifting direction of the air outlet assembly 20h, the ratio of A/C is in the range of 3:1 to 5:1.

[1003] The length A of the rack 50h is related to the maximum descending height of the air outlet assembly 20h and the spacing between the guiding units 61h. When A/C is 3:1, the spacing between the guiding units 61h is large, and the descending process of the transmission mechanism is the most stable. When A/C is 5:1, the spacing of the guiding unit 61h

is small, and correspondingly, the descending stroke of the transmission mechanism is the largest, that is, the maximum descending height of the air outlet assembly 20h is the largest. In this way, the transmission mechanism is made in a relatively small dimension, which saves the space. When A/C is 4:1, the spacing of the guiding unit 61h is moderate, and the maximum descending height of the air outlet assembly 20h also satisfies the design requirements without enlarging the dimension of the transmission mechanism. Therefore, when A/C is 3:1, it is possible to improve the stability during the lifting process of the air outlet assembly 20h, with a relatively compact and small structure, which saves the cost and the mounting space.

[1004] The lifting mechanism also includes a mounting box 70h arranged in the main body frame 10h, and the transmission mechanism and the guiding mechanism 60h are mounted in the mounting box 70h. The driving device 30h is an electric motor arranged outside the mounting box 70h, and the output shaft of the electric motor passes through the inside of the mounting box 70h.

[1005] In some embodiments, the mounting box 70h includes a box body 71h and a box cover, wherein the box body 71h is fixedly connected with the main body frame 10h; and the box cover is detachably arranged on the box body 71h. With the above-described structure, the entire lifting mechanism is integrated so that its occupied mounting space is minimized. Moreover, the mounting box 70h is detachable so as to facilitate the installation and removal and save the assembling and subsequent maintenance cost.

[1006] It is to be noted that, in the lifting mechanism, a transmission mechanism, a guiding mechanism 60h and a mounting box 70h form a lifting unit, and there are a plurality of lifting units. In some embodiments of the present disclosure, there are four lifting units connected to four corners of the air outlet assembly 20h respectively so as to allow a uniform stress.

[1007] It is also to be noted that, in some embodiments of the present disclosure, there is one electric motor, and each lifting unit is provided with one electric motor through which the lifting unit is in driving connection with the transmission mechanism directly. However, the cooperation method between the electric motor and the transmission mechanism is not limited thereto. In another embodiment not shown, other structures are the same as in some embodiments of the present disclosure. The differences lie in that: one electric motor drives two lifting units, and the electric motor is in driving connection with different transmission mechanisms at the same time through a belt or a gear, thereby lessening the number of electric motors and reducing the cost. Similarly, as an alternative, one electric motor drives four lifting units to ascend and descend at the same time.

[1008] As shown in Figs. 104 to 107, the air outlet assembly 20h is provided with a first windshield 8h, and the air outlet duct 11h is internally provided with a second windshield 9h. The first windshield 8h cooperates with the second windshield 9h to block the air return gate and the air outlet duct 11h, and the first windshield 8h can move relative to the second windshield 9h. By cooperation between the first windshield 8h and the second windshield 9h, when the air outlet assembly 20h descends to a predetermined height or ascends to close the first air outlet 12h but only open the second air outlet 13h, the airflow in the air outlet duct 11h may not flow back to the air return gate to cause airflow short-circuit, thereby effectively improving the air output efficiency of the ceiling recessed fan.

[1009] A sealing member is provided between the contact surfaces of the first windshield 8h and the second windshield 9h. The sealing effect between the first windshield 8h and the second windshield 9h is further improved by the sealing member.

[1010] The first windshield 8h has a first contact member 81h, and the second windshield 9h is provided with a second contact member 92h and a third contact member 93h with a height difference. The first contact member 81h is located between the second contact member 92h and the third contact member 93h, and the first contact member 81h has a first position that descends to be in sealing contact with the third contact member 93h and a second position that ascends to be in sealing contact with the second contact member 92h.

[1011] Specifically, the first windshield 8h is T-shaped, and the horizontal section of the T shape constitutes a first contact member 81h. The second windshield 9h is C-shaped, and the upper horizontal section of the C shape constitutes a second contact member 92h, and the lower horizontal section of row C constitutes a third contact member 93h. The first contact member 81h projects between the second contact member 92h and the third contact member 93h. During the lifting process of the air outlet assembly 20h, the first contact member 81h moves between the second contact member 92h and the third contact member 93h, and when the air outlet assembly 20h is lifted at two set positions, the first contact member 81h is in sealing contact with the second contact member 92h and the third contact member 93h respectively.

[1012] In the first position, the upper surface of the first contact member 81h is in sealing contact with the lower surface of the second contact member 92h, and in the second position, the lower surface of the first contact member 81h is in sealing contact with the upper surface of the third contact member 93h.

[1013] The first contact member 81h is made from an elastic material; and/or, the second contact member 92h is made from an elastic material; and/or the third contact member 93h is made from an elastic material. With an elastic material, it is possible to enhance the sealing strength between the first contact member 81h and the second contact member 92h or between the first contact member 81h and the third contact member 93h, and reduce or even eliminate the phenomenon that it is difficult to achieve surface-to-surface contact due to the manufacturing and assembling tolerances. In some

embodiments, when the first contact member 81h is in contact with the second contact member 92h, the first contact member 81h and the second contact member 92h are in such a state as to be pressed against each other. When the first contact member 81h is in contact with the second contact member 92h, the first contact member 81h and the third contact member 93h are in such a state as to be pressed against each other.

[1014] Wherein, the deflector 22h is arranged on the second windshield 9h.

[1015] In order to achieve the aim that the cold airflow blows distally without skin blow, considering the settlement characteristics of the cold airflow and the general state of the art that the hoisting height of the air-conditioning unit is higher than the height of a person, the included angle β between the air output direction of the first air outlet 12h and the horizontal plane is in the angle range of $-20^\circ \leq \beta \leq 45^\circ$. When $\beta = 0^\circ$, the air output direction of the first air outlet 12h is parallel to the horizontal direction, and when $\beta > 0^\circ$, the air output direction of the first air outlet 12h tilts upwards relative to the horizontal direction. Wherein, the air output direction of the first air outlet 12h refers to the main flow direction of the airflow when flowing out of the first air outlet. When the parts of the main body frame 10h and/or the air outlet assembly 20h for forming the air supply duct 14h are both a plane, the air output direction of the first air outlet 12h is parallel to the plane. When the parts of the main body frame 10h and/or the air outlet assembly 20h for forming the air supply duct 14h are a camber, the air output direction of the first air outlet 12h refers to a tangential direction at the position where the camber has the greatest influence on the airflow.

[1016] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, simulation is performed by adjusting the value of β , and the simulation results are as follows:

$\beta (^\circ)$	Horizontal air supply distance (m)	Whether there is a phenomenon of skin blow by cold air within an effective operation range
-21	4.8	YES
-20	4.9	NO
0	5.2	NO
30	4.7	NO
45	4	NO
46	3.9	NO

[1017] From the simulation results, when β is 0° , the horizontal air supply distance reaches a maximum value, and a phenomenon of skin blow by cold air is not present within an operation range at this time. When β increases to 30° (that is, the air output direction of the first air outlet 12h tilts upward relative to the horizontal plane at this time), the air supply distance begins to decrease, and a phenomenon of skin blow by cold air is not present. When β continues to increase to 45° , the air supply distance further decreases, and when β continues to increase to 46° , the air supply distance further decreases, which substantially cannot satisfy the requirements of the air supply distance of the ceiling recessed fan, especially for the scene where large-area heat exchange is required in business buildings (for example, shopping malls), and the air supply distance is too small to satisfy the requirements of large-area heat exchange. When β decreases to -20° (the air output direction of the first air outlet 12h tilts downward relative to the horizontal plane at this time), the air supply distance also begins to decrease, but with a small tilting angle of the air output direction relative to the horizontal plane, the component of the airflow in the horizontal direction is far greater than the component in the vertical direction during the flowing process. Finally, when the airflow reaches to the air supply distance of 4.9m, there is still a certain distance between the airflow and the ground ($4.9\text{m} \cdot \tan 20^\circ = 1.78\text{m}$, and taking a store as an example, the height of the store is 3.9m, $3.9\text{m} - 1.78\text{m} = 2.12\text{m}$, that is, when β is -20° , the height of the airflow reaching the ground is substantially maintained above 2.12m), and the distance allows that the air outlet of the ceiling recessed fan is not present with a phenomenon of skin blow by cold air. When β continues to decrease to -21° , the air supply distance is further reduced, ($4.8\text{m} \cdot \tan 21^\circ = 1.84\text{m}$, and $3.9\text{m} - 1.84\text{m} = 2.06\text{m}$), and the spacing between the airflow and the bottom surface is reduced synchronously, so that a phenomenon of skin blow by cold air is present. Also that is, only when β is in the range of -20° to 45° , the air supply distance of the ceiling recessed fan is appropriate, and a phenomenon of skin blow by cold air is not present.

[1018] Furthermore, in some embodiments, the included angle β between the air output direction of the first air outlet 12h and the horizontal plane is in the angle range of $0^\circ \leq \beta \leq 30^\circ$, and when $\beta > 0^\circ$, the air output direction of the first air outlet 12h tilts upward relative to the horizontal plane.

[1019] The air outlet assembly has a first descending height L1, and the value of the predetermined height L1 is in the range of $15\text{mm} \leq L1 \leq 60\text{mm}$.

[1020] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, under the premise that the air output direction of the first air outlet 12h is unchanged, simulation is performed by adjusting the

value of L1, and the simulation results are as follows:

L1 (mm)	Air volume (m ³ /h)	Refrigerating capacity (kw)	Air supply distance (m)
14	1175	11.2	6.5
15	1260	11.4	6.4
20	1416	11.8	6.1
30	1800	12.0	5.2
50	1921	12.2	4.3
60	1937	12.3	4.0
61	1938	12.3	3.9

[1021] From the simulation results, when L1 is 30mm, although the air volume does not reach a maximum value, the refrigerating capacity and the air supply distance are at a favorable level. When L1 increases to 50mm, the air volume and the refrigerating capacity begin to increase, but the air supply distance begins to decrease. When L1 continues to increase to 60mm, the air volume and the refrigerating capacity continue to increase, and the air supply distance continues to decrease. When L1 continues to increase to 61mm, although the air volume increases, the increasing ratio begins to decrease, and the refrigerating capacity is unchanged compared with that when L1 is 60mm, but the air supply distance continues to decrease, so that the air supply distance is too small as it is impossible to satisfy the comfort requirements of the ceiling recessed fan when the air velocity is below 3m/s. When L1 decreases 20mm, the air volume and the refrigerating capacity begin to decrease, and the air supply distance begins to increase. When L1 continues to decrease to 15mm, the air volume and the refrigerating capacity further decrease, and the air supply distance further increases. When L1 continues to decrease to 14mm, the air volume and the refrigerating capacity are still further reduced, and the air supply distance increases. At this time, the air volume attenuation is more than 20%, and the refrigerating capacity cannot satisfy that the ceiling recessed fan reaches a required heat exchange efficiency, which does not conform with the energy saving principles. Also that is, when L1 is in the range of 15mm to 60mm, the air volume, the refrigerating capacity and the air supply distance of the ceiling recessed fan can be matched to a reasonable state.

[1022] The air outlet assembly has a first descending height L1, and the value of the predetermined height L1 is in the range of $20\text{mm} \leq L1 \leq 50\text{mm}$.

[1023] The ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

[1024] When the ceiling recessed fan is in the first air output mode, the first air outlet 12h is open and the second air outlet 13h is closed. At this time, all the airflow in the air outlet duct 11h is blown out through the first air outlet 12h, that is, a horizontal air output or even a tilting air output is formed.

[1025] When the ceiling recessed fan is in the second air output mode, the first air outlet 12h is open and some or all the second air outlets 13h are open. At this time, part of the airflow in the air outlet duct 11h is blown out through the first air outlet 12h, and the remaining is blown out through the second air outlet 13h, so as to realize circumferential air supply and improve the uniformity of room temperature. Wherein, all the second air outlets 13h are selectively opened according to the required air output direction and the air volume of the air output.

[1026] When the ceiling recessed fan is in the third air output mode, the first air outlet 12h is closed and some or all the second air outlets 13h are open. At this time, all the air in the air outlet duct 11h is blown out through the second air outlet 13h, that is, a tilting downward air output or even a vertically downward air output is formed.

[1027] When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode.

[1028] When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[1029] The main body frame 10h includes a side frame 15h. When the air outlet assembly 20h descends to form a first air outlet 12h with the main body frame 10h, an air supply duct 14h is formed between the air outlet assembly 20h and the side frame 15h. The part of the side frame 15h for forming the air supply duct 14h is arranged obliquely relative to the horizontal plane, and an upper layer portion of the airflow in the air supply duct 14h is deflected by the obliquely arranged side frame 15h, so that the air output direction of the first air outlet 12h meets the requirements.

[1030] The tilting angle α formed between the part of the side frame 15h for forming the air supply duct 14h and the horizontal plane is in the angle range of $-20^\circ \leq \alpha \leq 45^\circ$. When $\alpha = 0^\circ$, the part of the side frame 15h for forming the air supply duct 14h is parallel to the horizontal direction, and when $\alpha > 0^\circ$, the part of the side frame 15h for forming the air supply duct 14h tilts upward relative to the horizontal plane. The side frame 15h tilts to change the airflow direction in the air supply duct 14h, and finally change the air output direction of the first air outlet 12h. When $\alpha \geq 0^\circ$, the air output of the ceiling recessed fan

flows along a horizontal direction as much as possible, and when a is between 0° and -20° , although the airflow flows obliquely downwards, it is still possible to allow that the ceiling recessed fan is not present with a phenomenon of skin blow.

[1031] In some embodiments, the part of the side frame 15h for forming the air supply duct tilts upward relative to the horizontal plane, that is, $a > 0^\circ$. The air output direction of the air supply duct 14h tilts upward relative to the horizontal plane.

The side frame 15h tilts to allow that air supply duct can tilt upward relative to the horizontal plane, so that the airflow in the air supply duct 14h flows towards the ceiling direction as much as possible, thereby increasing the horizontal air output distance of the ceiling recessed fan, and effectively enhancing the waterfall refrigeration effect.

[1032] The part of the air outlet assembly 20h for forming the air supply duct 14h is arranged obliquely relative to the horizontal plane, and a lower layer portion of the airflow in the air supply duct 14h is deflected by the obliquely arranged air outlet assembly 20h, so that the direction of the first air outlet 12h meets the requirements.

[1033] The tilting angle a formed between the part of the air outlet assembly 20h for forming the air supply duct 14h and the horizontal plane is in the angle range of $-20^\circ \leq b \leq 45^\circ$. When $b = 0^\circ$, the part of the air outlet assembly 20h for forming the air supply duct 14h is parallel to the horizontal direction, and when $b > 0^\circ$, the part of the air outlet assembly 20h for forming the air supply duct 14h tilts upward relative to the horizontal plane. Also that is, along the airflow direction, the part of the air outlet assembly 20h for forming the air supply duct 14h forms a tiltingly deflecting surface, so that the air output direction of the air supply duct 14h can tilt upward relative to the horizontal plane. When $b \geq 0^\circ$, the air outlet assembly 20h can make the air output direction of the air supply duct 14h tilt upward relative to the horizontal plane, so that the air output of the ceiling recessed fan flows along a horizontal direction as much as possible, and when b is between 0° and -20° , although the airflow flows obliquely downwards, it is possible to allow that the ceiling recessed fan is not present with a phenomenon of skin blow.

[1034] In some embodiments, the part of the side frame 15h for forming the air supply duct and the part of the air outlet assembly 20h for forming the air supply duct 14h are parallel to each other.

[1035] The air outlet assembly 20h includes an air outlet frame, which is lifted independently. In other embodiments not shown, the air outlet assembly 20h includes an air outlet frame and an air return panel, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[1036] According to a first embodiment of the present disclosure as shown in Figs. 108 to 110, a recessed air conditioner with a transmission mechanism is disclosed, which includes a main body frame 10i, an air outlet assembly 20i and a lifting mechanism, wherein the air outlet assembly 20i is connected to the main body frame 10i through the lifting mechanism. The lifting mechanism includes a driving device 30i, a transmission mechanism and a guiding mechanism 60i, wherein the transmission mechanism is connected with the air outlet assembly 20i and the transmission mechanism is drivingly connected with the driving device 30i which drives the air outlet assembly 20i to ascend and descend through the transmission mechanism. The transmission mechanism has a guiding portion 52i. The guiding mechanism 60i and the guiding portion 52i may move relative to each other in the lifting direction of the air outlet assembly 20i. At the same time, the guiding mechanism 60i is in limiting fit with the guiding portion 52i in the horizontal direction.

[1037] In the recessed air conditioner provided by some embodiments of the present disclosure, the transmission mechanism is provided with the guiding portion 52i, so that the transmission mechanism cooperates with the guiding mechanism 60i through the guiding portion 52i, and the guiding mechanism 60i restricts the movement direction of the transmission mechanism, so that the transmission mechanism moves in the lifting direction of the air outlet assembly 20i without shaking in the horizontal direction, which allows that the transmission mechanism and the driving mechanism cooperate with each other more closely and stably, thereby lessening the vibration of the transmission mechanism during the driving process and reducing the generation of noise.

[1038] It is to be noted that, the main body frame 10i is a main load-bearing structure of the recessed air conditioner. When the recessed air conditioner is installed, the main body frame 10i is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10i and fixed to the ceiling through the main body frame 10i. The recessed air conditioner has an indoor unit installed in the ceiling, the main body frame 10i is connected with the indoor unit, the air outlet assembly 20i is connected with the main body frame 10i, and the indoor unit has an indoor unit air exhaust. The air outlet duct of the main body frame 10i communicates with the indoor unit air exhaust, and the air flow path is: air return gate-evaporator-indoor unit air exhaust-air outlet duct-air outlet (blowing out).

[1039] The guiding mechanism 60i includes a guiding unit 61i, and the guiding unit 61i has two guiding members 611i arranged oppositely. A guiding channel is formed between the two guiding members 611i, and the guiding portion 52i is located in the guiding channel. By providing the two opposite guiding members 611i, a guiding channel formed between the two guiding members 611i restricts the movement direction of the guiding portion 52i, so that the guiding portion 52i can only move along the guiding channel, and the movement direction of the transmission structure is also restricted, thereby lessening the vibration of the transmission mechanism during the movement process and reducing the generation of noise.

[1040] In some embodiments, there are a plurality of guiding units 61i arranged at intervals along the lifting direction of the air outlet assembly 20i. By providing the plurality of guiding units 61i, a plurality of guiding channels are formed in the lifting direction of the air outlet assembly 20i, and the plurality of guiding channels are in limiting fit with the guiding portion

52i at a plurality of positions in the lifting direction of the air outlet assembly 20i, thereby further improving the stability of the transmission mechanism during the movement process.

[1041] The transmission mechanism includes a gear 40i and a rack 50i, and the gear 40i is mounted on the output shaft of the driving device 30i. The rack 50i is fixedly connected with the air outlet assembly 20i and meshes with the gear 40i, and the driving device 30i drives the air outlet assembly 20i to ascend and descend by cooperation between the gear 40i and the rack 50i. The guiding portion 52i is located on the rack 50i. During the lifting process, the output shaft of the driving device 30i drives the gear 40i to rotate, so that the rotating gear 40i drives the rack 50i to ascend or descend, and the rack 50i drives the air outlet assembly 20i to ascend or descend. During the moving process, the guiding portion 52i cooperates with the guiding member 611i and moves in the guiding channel. Under the guidance of the guiding channel, the rack 50i can only move upwards or downwards, thereby reducing the occurrence of horizontal vibration.

[1042] In some embodiments, the guiding portion 52i is a guiding column on the rack 50i, and two opposite guiding members 611i are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members 611i through the guiding grooves. Since there is a fit gap between the gear 40i and the rack 50i, the rack 50i may still vibrate in the vertical direction during the ascending and descending process. By arranging the guiding column on the rack 50i and the guiding groove on the guiding member 611i, the guiding member 611i clamps the guiding column through the guiding groove, so that the guiding column descends slowly, which reduces the vibration in the vertical direction and allows that the entire air outlet assembly 20i ascends or descends stably.

[1043] The first side of the rack 50i is provided with a meshing tooth 51i, and the second side is provided with a guiding portion 52i. The rack 50i is provided with a mounting groove 55i located between the meshing tooth 51i and the guiding portion 52i. Two guiding members 611i of the guiding unit 61i are located on both sides of the guiding portion 52i respectively, and one of the guiding members 611i of the guiding unit 61i is located in the mounting groove 55i. By arranging the guiding portion 52i on the rack 50i, the structure is more compact when the rack 50i produces a transmission effect at the same time. The rack 50i is provided with the mounting groove 55i, which reduces the weight of the rack 50i, and saves the material. Moreover, some guiding members 611i are arranged in the mounting groove 55i, which greatly saves the assembling space. Further, the mounting groove 55i itself also limits the guiding member 611i, thereby achieving a multi-functional solution.

[1044] Specifically, the extension direction of the mounting groove 55i is the lifting direction of the air outlet assembly 20i, and the mounting groove 55i has a first end wall 53i located above and a second end wall 54i located below along the lifting direction of the air outlet assembly 20i, and the maximum distance between the first end wall 53i and the guiding unit 61i is equal to a maximum descending height of the air outlet assembly 20i. When the air outlet assembly 20i descends, the first end wall 53i of the mounting groove 55i moves toward the guiding unit 61i, and when the first end wall 53i moves to the position of the guiding unit 61i, a limiting fit is formed so as to prevent that the rack 50i is disengaged from the gear 40i.

[1045] In some embodiments, the guiding member 611i in some embodiments of the present disclosure includes a roller in rolling fit with the guiding portion 52i. With the rolling fit between the roller and the guiding portion 52i, the frictional resistance is reduced when the guiding portion 52i is clamped at the same time.

[1046] It is to be noted that, the guiding members 611i also uses other structures. For example, the guiding members 611i is a slider in sliding fit with the guiding portion 52i, or the guiding member 611i includes both a slider and a roller, so that both of them are in hybrid use.

[1047] During the assembling process, the spacing between the guiding units 61i may affect the stability when the transmission mechanism descends. In some embodiments as shown in Figure 108, the guiding mechanism 60i includes two guiding units 61i arranged at intervals along the lifting direction of the air outlet assembly 20i, and the guiding unit 61i and the guiding portion 52i are in sliding fit in the lifting direction of the air outlet assembly 20i. At the same time, the guiding mechanism 60i and the guiding portion 52i are in limiting fit in the horizontal direction. For the maximum descending height B of the air outlet assembly 20i and the spacing distance C between the two guiding units 61i, the ratio of B/C is in the range of 1:1 to 4:1. When B/C is 1:1, the spacing between the guiding units 61i is large, and the descending process of the transmission mechanism is the most stable. When B/C is 4:1, the descending stroke of the transmission mechanism is the largest, that is, the maximum descending height of the air outlet assembly 20i is the largest. In this way, the transmission mechanism is made in a relatively small dimension, which saves the space. When B/C is 3:2, the spacing of the guiding unit 61i is moderate, and the maximum descending height of the air outlet assembly 20i also satisfies the design requirements without enlarging the dimension of the transmission mechanism. Therefore, when B/C is 3:2, it is possible to improve the stability during the lifting process of the air outlet assembly 20i, with a relatively compact and small structure, which saves the cost and the mounting space.

[1048] In the above-described embodiments, the transmission mechanism includes a gear 40i and a rack 50i, and the gear 40i is mounted on the output shaft of the driving device 30i. The rack 50i is fixedly connected with the air outlet assembly 20i and meshes with the gear 40i, and the driving device 30i drives the air outlet assembly 20i to ascend and descend by cooperation between the gear 40i and the rack 50i. The guiding portion 52i is located on the rack 50i. For the length A of the rack 50i along the lifting direction of the air outlet assembly 20i, the ratio of A/C is in the range of 3:1 to 5:1.

[1049] The length A of the rack 50i is related to the maximum descending height of the air outlet assembly 20i and the

spacing between the guiding units 61i. When A/C is 2:1, the spacing between the guiding units 61i is large, and the descending process of the transmission mechanism is the most stable. When A/C is 5:1, the spacing of the guiding unit 61i is small, and correspondingly, the descending stroke of the transmission mechanism is the largest, that is, the maximum descending height of the air outlet assembly 20i is the largest. In this way, the transmission mechanism is made in a relatively small dimension, which saves the space. When A/C is 5:2, the spacing of the guiding unit 61i is moderate, and the maximum descending height of the air outlet assembly 20i also satisfies the design requirements without enlarging the dimension of the transmission mechanism. Therefore, when A/C is 5:2, it is possible to improve the stability during the lifting process of the air outlet assembly 20i, with a relatively compact and small structure, which saves the cost and the mounting space.

[1050] In some embodiments of the present disclosure, the air outlet assembly 20i includes an air outlet frame, wherein an air outlet is formed between the air outlet frame and the main body frame 10i, and the air outlet frame is lifted independently.

[1051] In another embodiment not shown, the air outlet assembly 20i includes an air outlet frame and an air return panel, wherein an air outlet is formed between the air outlet frame and the main body frame 10i, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[1052] The lifting mechanism also includes a mounting box 70i arranged in the main body frame 10i, and the transmission mechanism and the guiding mechanism 60i are mounted in the mounting box 70i. The driving device 30i is an electric motor arranged outside the mounting box 70i, and the output shaft of the electric motor passes through the inside of the mounting box 70i.

[1053] In some embodiments, the mounting box 70i includes a box body 71i and a box cover, wherein the box body 71i is fixedly connected with the main body frame 10i; and the box cover is detachably arranged on the box body 71i. With the above-described structure, the entire lifting mechanism is integrated so that its occupied mounting space is minimized. Moreover, the mounting box 70i is detachable so as to facilitate the installation and removal and save the assembling and subsequent maintenance cost.

[1054] It is to be noted that, in the lifting mechanism, a transmission mechanism, a guiding mechanism 60i and a mounting box 70i form a lifting unit, and there are a plurality of lifting units. In some embodiments of the present disclosure, there are four lifting units located at four corners of the recessed air condition respectively so as to improve a uniform stress.

[1055] It is also to be noted that, in some embodiments of the present disclosure, there is one electric motor, and each lifting unit is provided with one electric motor through which the lifting unit is in driving connection with the transmission mechanism directly. However, the cooperation method between the electric motor and the transmission mechanism is not limited thereto. In another embodiment not shown, other structures are the same as in some embodiments of the present disclosure. The differences lie in that: one electric motor drives two lifting units, and the electric motor is in driving connection with different transmission mechanisms at the same time through a belt or a gear, thereby lessening the number of electric motors and reducing the cost. Similarly, as an alternative, one electric motor drives four lifting units to ascend and descend at the same time.

[1056] In a second embodiment shown in Figs. 111 and 112, the structure of the recessed air conditioner is substantially the same as the above-described embodiments, and the differences only lie in that, in some embodiments of the present disclosure, the air outlet assembly 20i descends so that an air supply duct 11i is formed between the air outlet assembly 20i and the main body frame 10i, and one end of the air supply duct 11i forms a first air outlet 81i, and the other end of the air supply duct 11i communicates with the air outlet duct of the recessed air conditioner. With the first air outlet 81i, it is possible to realize the horizontal air output of the recessed air conditioner, so that cold air may be selectively blown out horizontally, thereby reducing a phenomenon that cold air outputs air obliquely downwards or even vertically downwards to directly blow the skin that has been found by the inventors.

[1057] The air outlet assembly 20i is also provided with at least one second air outlet 82i communicating with the air outlet duct of the recessed air conditioner. The air outlet assembly 20i is provided with an air deflector 21i located at the position of the first air outlet 81i and/or the second air outlet 82i. The second air outlet 82i is provided so that it is possible to allow the recessed air conditioner to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 81i with the second air outlet 82i, it is possible to increase an air output method of the recessed air conditioner, thereby increasing the air output range of the recessed air conditioner and the accuracy and rate of temperature adjustment. The airflow in the air outlet duct is blown out by the first air outlet 81i after air deflection by the air supply duct 11i, and the vertically downward airflow in the air outlet duct is deflected by the air supply duct 11i to output air horizontally or even output air in a tiltingly upward direction relative to a horizontal plane.

[1058] It is to be noted that, the main body frame 10i is a main load-bearing structure of the recessed air conditioner. When the recessed air conditioner is installed, the main body frame 10i is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10i and fixed to the ceiling through the main body frame 10i.

[1059] In the related art, the recessed air conditioner uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector 21i is provided at the air

outlet for air deflection. However, on the mounting planar face of the recessed air conditioner, the projection of the air deflector 21i does not coincide with the projection of the panel of the recessed air conditioner, so that the air deflector 21i has a poor deflection effect, which finally results in a reduced air supply distance of the recessed air conditioner. Therefore, the main body frame 10i of the present disclosure further includes a side frame 12i. When the air outlet assembly 20i descends so that a first air outlet 81i is formed between the air outlet assembly 20i and the main body frame 10i, an air supply duct 11i is formed between the air outlet assembly 20i and the side frame 12i, and on the mounting planar face of the main body frame 10i (for example, the ceiling), the projection of the air outlet assembly 20i at least partially coincides with the projection of the side frame 12i. When the projection of the air outlet assembly 20i coincides with the projection of the side frame 12i, the air outlet assembly 20i is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the recessed air conditioner and an increased air supply distance. When the recessed air conditioner opens the first air outlet 81i, the air outlet assembly 20i gradually goes away from the main body frame 10i to form an air supply duct 11i. At this time, a corresponding portion of the air outlet assembly 20i forms a lower side surface of the air supply duct 11i. When the airflow flows through the air supply duct 11i, under the air deflection effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the recessed air conditioner, thereby realizing a horizontal air output effect.

[1060] As another embodiment, the projection of the air outlet assembly 20i completely coincides with the projection of the side frame 12i. In this case, compared with the case where the projection of the air outlet assembly 20i partially coincides with the projection of the side frame 12i, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the recessed air conditioner and a further increased air supply distance. At the same time, when the recessed air conditioner is in a shutdown state, the air outlet assembly 20i is attached to the main body frame 10i, and a corresponding portion of the air outlet assembly 20i is attached to the side frame 12i, so that a person can only see the air outlet assembly 20i instead of the main body frame 10i when observing the recessed air conditioner from the ground, which effectively increases the aesthetic feeling of the recessed air conditioner.

[1061] It is to be noted that, the recessed air conditioner has a first air output mode, a second air output mode and a third air output mode:

[1062] When the recessed air conditioner is in the first air output mode, the first air outlet 81i is open and the second air outlet 82i is closed. At this time, all the air in the air outlet duct is blown out through the first air outlet 81i, that is, a horizontal air output or even a tilting air output is formed.

[1063] When the recessed air conditioner is in the second air output mode, the first air outlet 81i is open and the second air outlet 82i is open. At this time, part of the airflow in the air outlet duct is blown out through the first air outlet 81i, and the remaining is blown out through the second air outlet 82i, so as to realize circumferential air supply and improve the uniformity of room temperature.

[1064] When the recessed air conditioner is in the third air output mode, the first air outlet 81i is closed and the second air outlet 82i is open. At this time, all the air in the air outlet duct is blown out through the second air outlet 82i, that is, a tiltingly downward air output or even a vertically downward air output is formed.

[1065] The recessed air conditioner resumes planning the heating mode and the cooling mode according to the above-described air output mode. When the recessed air conditioner is in a cooling mode, the recessed air conditioner is in the first air output mode or the second air output mode. When the recessed air conditioner is in a heating mode, the recessed air conditioner is in the third air output mode or the second air output mode.

[1066] The air outlet assembly 20i which faces towards the ground, forms a surface where the recessed air conditioner is observed. The projection of the air outlet assembly 20i on the ground coincides with the projection of the main body frame 10i on the ground. When the recessed air conditioner is in a shutdown state, the air outlet assembly 20i is attached to the main body frame 10i at this time, and a person can only see the air outlet assembly 20i instead of the main body frame 10i when observing the recessed air conditioner from the ground. When the recessed air conditioner opens the first air outlet 81i, the air outlet assembly 20i gradually goes away from the main body frame 10i to form an air supply duct 11i, and a corresponding portion of the air outlet assembly 20i forms a lower side surface of the air supply duct 11i. Under the air deflection effect of a lower side surface of the air supply duct 11i, the airflow flows along the horizontal direction or even blows out along an upwardly tilting direction, so as to realize a horizontal air output effect.

[1067] The existing ceiling recessed fan has a panel facing towards the ground, and the panel is provided with an air return gate and an air outlet surrounding the air return gate. Also that is, the air output direction of the air outlet of the ceiling recessed fan is generally tiltingly downward air output or even vertically downward air output. However, during cooling, the air output of the air outlet is cold air, and cold air may directly blow the skin at this time, which results in less comfort.

[1068] Therefore, a ceiling recessed fan with an air outlet duct as shown in Figs. 113 to 124 is provided in the present disclosure, which includes: a main body frame 10j internally formed with an air outlet duct 11j; and an air outlet assembly 20j arranged in the main body frame 10j in a way so as to be able to be raised and lowered, wherein the air outlet assembly 20j descends so that a first air outlet 12j is formed between the air outlet assembly 20j and the main body frame 10j. The air outlet assembly 20j is provided with at least one second air outlet 13j communicating with the air outlet duct 11j. With the

first air outlet 12j, the ceiling recessed fan performs air output distally or even realizes horizontal air output or tiltingly upward air output, so that cold air will not blow downward to directly blow the skin. At the same time, the second air outlet 13j is provided so that it is possible to allow the ceiling recessed fan to satisfy the requirements of tiltingly downward air output or even vertically downward air output. Moreover, by cooperating the first air outlet 12j with the second air outlet 13j, it is possible to increase an air output method of the ceiling recessed fan, thereby increasing the air output effect of the ceiling recessed fan and the accuracy and rate of temperature adjustment.

[1069] It is to be noted that, the main body frame 10j is a main load-bearing structure of the ceiling recessed fan. When the ceiling recessed fan is installed, the main body frame 10j is used to be mounted on the ceiling, and other structures are directly or indirectly mounted on the main body frame 10j and fixed to the ceiling through the main body frame 10j. The ceiling recessed fan has an indoor unit installed in the ceiling, the main body frame 10j is connected with the indoor unit, the air outlet assembly 20j is connected with the main body frame 10j, and the indoor unit has an indoor unit air exhaust. The first end of the air outlet duct 11j of the main body frame 10j communicates with the indoor unit air exhaust, and the air flow path is: air return gate-evaporator-indoor unit air exhaust-first end of the air outlet duct 11j-second end of the air outlet duct-air outlet (blowing out from the first air outlet 12j and/or the second air outlet 13j).

[1070] When the air outlet assembly 20j descends so that a first air outlet 12j is formed between the air outlet assembly 20j and the main body frame 10j, a gap which is formed between the air outlet assembly 20j and the main body frame 10j, forms an air supply duct 14j. One end of the air supply duct 14j communicates with the air outlet duct 11j, and the other end of the air supply duct 14j forms a first air outlet 12j. The airflow in the air outlet duct 11j is blown out by the first air outlet 12j after air deflection by the air supply duct 14j, and the vertically downward airflow in the air outlet duct 11j is deflected by the air supply duct 14j to output air away from the ceiling recessed fan substantially along a horizontal direction, or even in a direction of upwardly tilting relative to a horizontal plane, so as to realize horizontal air output to the ceiling recessed fan.

[1071] In the related art, the ceiling recessed fan uses a solution of providing an air vent on the surface facing towards the ground for air output, and in order to change the air output direction, an air deflector is provided at the air outlet for air deflection. However, on the mounting planar face of the ceiling recessed fan, the projection of the air deflector does not coincide with the projection of the panel of the ceiling recessed fan, so that the air deflector has a poor deflection effect, which finally results in a reduced air supply distance of the ceiling recessed fan. Therefore, the main body frame 10j of the present disclosure further includes a side frame 15j. When the air outlet assembly 20j descends so that a first air outlet 12j is formed between the air outlet assembly 20j and the main body frame 10j, an air supply duct 14j is formed between the air outlet assembly 20j and the side frame 15j, and on the mounting planar face of the main body frame 10j (for example, the ceiling), the projection of the air outlet assembly 20j at least partially coincides with the projection of the side frame 15j. When the projection of the air outlet assembly 20j coincides with the projection of the side frame 15j, the air outlet assembly is substantively extended compared with the related art, so that it is possible to allow a favorable horizontal blow effect of the ceiling recessed fan and an increased air supply distance. When the ceiling recessed fan opens the first air outlet 12j, the air outlet assembly 20j gradually goes away from the main body frame 10j to form an air supply duct 14j. At this time, a corresponding portion of the air outlet assembly 20j forms a lower side surface of the air supply duct 14j. When the airflow flows through the air supply duct 14j, under the air deflection effect of a lower side surface of the air supply duct, the airflow flows along a horizontal direction or even blows out along an upwardly tilting direction, which increases the air supply distance of the ceiling recessed fan, thereby realizing a horizontal air output effect.

[1072] As another embodiment, the projection of the air outlet assembly 20j completely coincides with the projection of the side frame 15j. In this case, compared with the case where the projection of the air outlet assembly 20j partially coincides with the projection of the side frame 15j, the air outlet assembly can be further extended, so as to allow a horizontal blow effect of the ceiling recessed fan and a further increased air supply distance. At the same time, when the ceiling recessed fan is in a shutdown state, the air outlet assembly 20j is attached to the main body frame 10j, and a corresponding portion of the air outlet assembly 20j is attached to the side frame 15j, so that a person can only see the air outlet assembly 20j instead of the main body frame 10j when observing the ceiling recessed fan from the ground, which effectively increases the aesthetic feeling of the ceiling recessed fan.

[1073] As another embodiment, the projection of the air outlet assembly 20j exceeds the projection of the side frame 15j. In this case, compared with the case where the projection of the air outlet assembly 20j completely coincides with the projection of the side frame 15j, the air outlet assembly can be further extended, thereby further increasing a horizontal blow effect and an air supply distance of the ceiling recessed fan.

[1074] In some embodiments, the projection of the air outlet assembly 20j exceeds the projection of the main body frame 10j, so that the air outlet assembly 20j effectively increases the air deflection dimension relative to the related art, so as to increase the air supply distance of the ceiling recessed fan.

[1075] The air outlet assembly 20j is also provided with an air deflector 22j. The air deflector 22j can form part of the air outlet duct 11j to allow a more smooth inner surface of the air outlet duct 11j, or the deflector 22j is located at the corner of the air outlet duct 11j and the air supply duct 14j to better deflect the airflow in the air outlet duct 11j to the air supply duct 14j.

[1076] The ceiling recessed fan further includes an air deflector 4j which is rotatably arranged at the second air outlet 13j and capable of closing or opening the second air outlet 13j. When the second air outlet 13j needs to be opened, the air

deflector 4j rotates gradually, so that the second air outlet 13j communicates with the air outlet duct 11j to allow that the airflow in the air outlet duct 11j is blown out by the second air outlet 13j, and the air deflector 4j adjusts its tilting angle according to actual needs to adjust the air output direction and/or the air output volume of the second air outlet 13j. When the second air outlet 13j needs to be closed, the air deflector 4j returns to the state of sealing fit with the air outlet assembly 20j so as to close the second air outlet 13j. At this time, the airflow in the air outlet duct 11j can only be blown out from the first air outlet 12j under the joint deflection effect of the air outlet assembly 20j and the air deflector 4j.

[1077] The ceiling recessed fan also includes a rotating mechanism arranged on the air outlet assembly 20j and the air deflector 4j is arranged on the rotating mechanism capable of driving the air deflector 4j to rotate.

[1078] The rotating mechanism includes a rotary arm 5j, one end of which is hinged to the air outlet assembly 20j, and the air deflector 4j is arranged on the other end of the rotary arm 5j.

[1079] Wherein, the rotary arm 5j is U-shaped. With the U-shaped structure, the rotary arm 5j may not interfere with the air outlet assembly 20j during the rotation process, thereby improving the rotation reliability of the air deflector 4j.

[1080] The rotating mechanism also includes a power source arranged on the air outlet assembly 20j, and the end of the rotary arm 5j is arranged on the power source. In some embodiments, the power source is an electric motor, and the output shaft of the electric motor drives one end of the rotary arm 5j to rotate, so as to realize the rotation of the air deflector 4j.

[1081] The air deflector 4j is provided with a plurality of partition plates 6j. All the partition plates 6j are arranged in parallel along the length direction of the air deflector 4j, and a flow channel is formed between two adjacent partition plates 6j. With the partition plate 6j, the airflow flowing through the air deflector 4j is divided into a plurality of streams, and each stream of airflow can be partially deflected through a corresponding air deflector 4j, thereby enhancing the deflecting effect of the air deflector 4j on the airflow. At the same time, the partition plate 6j is mounted along the width direction of the air deflector 4j, which can effectively enhance the rigidity of the air deflector 4j and improve the reliability of the air deflector 4j.

[1082] As another embodiment, the ceiling recessed fan also includes at least two partition plates 6j. All the partition plates are arranged in the air outlet duct 11j, and a flow channel is formed between two adjacent partition plates 6j. With the partition plate 6j, the airflow in the air outlet duct 11j is divided into a plurality of streams, so that the airflow in the air outlet duct 11j is not too turbulent, and the first air outlet 12j so as to improve an air output effect of the second air outlet 13j.

[1083] A step sealing structure is provided between the edge of the air deflector 4j and the edge of the second air outlet 13j. With a sealing structure, when the second air outlet 13j is closed, the airflow will not flow out through a slit between the air deflector 4j and the second air outlet 13j (in order to prevent locking due to a manufacturing tolerance, it is necessary to design an avoidance gap between the air deflector 4j and the second air outlet 13j) so as to reduce the air output effect.

Wherein, the air deflector 4j has a plurality of edges connected sequentially, the edge of the second air outlet 13j is an annular edge matched with the air deflector 4j, and a step sealing structure is provided between each edge of the air deflector 4j and a portion of a corresponding annular edge to improve the sealing effect of the air deflector 4j on the second air outlet 13j. In some embodiments, along the airflow direction, the air deflector 4j has a first edge and a second edge, and the second air outlet 13j has a third edge and a fourth edge. When the air deflector 4j closes the second air outlet 13j, the first edge is sealingly fit with the third edge, and the second edge is sealingly fit with the fourth edge.

[1084] The edge of the air deflector 4j is provided with a first step structure, and the edge of the second air outlet 13j is provided with a second step structure, so that the first step structure and the second step structure are fit to form a step sealing structure. By providing the first step structure and the second step structure, a fold-shaped slit is formed between the edge of the air deflector 4j and the edge of the second air outlet 13j so as to further enhance the sealing effect.

[1085] The first step structure includes an elastic sealing material. Wherein, the first step structure is made from an elastic sealing material to improve the sealing effect of the step sealing structure, or the first step structure is provided with a seal of an elastic sealing material such as sponge.

[1086] The second step structure includes an elastic sealing material. Wherein, the second step structure is made from an elastic sealing material to improve the sealing effect of the step sealing structure, or the second step structure is provided with a seal of an elastic sealing material such as sponge.

[1087] In order to prevent that it is likely to have condensation at the second air outlet 13j when the first air outlet 12j outputs air, the air deflector 4j is made from a thermal insulation material, or is jointly composed of a high-strength material and a thermal insulation material. Wherein, the air deflector 4j is made from a high-strength material as a main body and a thermal insulation material at the edge of the high-strength material, or the material for making the air deflector 4j satisfies the strength requirements and the thermal insulation requirements at the same time.

[1088] The ceiling recessed fan also includes a lifting mechanism arranged in the main body frame 10j, and the air outlet assembly 20j is arranged on the lifting mechanism. The lifting mechanism can drive the air outlet assembly 20j to ascend or descend.

[1089] Since the projection of the air outlet assembly 20j at least partially coincides with the side frame 15j, with the portion of the air outlet assembly 20j required to be extended below the side frame 15j relative to the related art, the width of the air outlet assembly 20j becomes larger so that it is likely to deform, and it is also likely to vibrate during the lifting process, which affects a cooperation degree between the air outlet assembly 20j and the main body frame 10j. Therefore, in order to improve the lifting reliability of the air outlet assembly 20j, the lifting mechanism is connected to one side of the air outlet

assembly 20j away from the air return gate of the ceiling recessed fan. Wherein, the air return gate of the ceiling recessed fan is located in the middle of the ceiling recessed fan, and the air outlet assembly 20j is arranged around the periphery of the air return gate of the ceiling recessed fan.

[1090] The cross section of the air outlet assembly 20j is square or polygonal, and a first air outlet can be formed between the main body frame 10j and the air outlet assembly 20j on a side of the rectangle or the polygon. In order to reduce or even avoid the influence of the lifting mechanism on the first air outlet 12j and/or the second air outlet 13j, the lifting mechanism is connected to the corner of the air outlet assembly 20j, that is, the lifting mechanism is located between two adjacent first air outlets 12j.

[1091] The lifting mechanism includes a driving device 30j, a transmission mechanism and a guiding mechanism 60j, wherein the transmission mechanism is connected with the air outlet assembly 20j and the transmission mechanism is drivingly connected with the driving device 30j which drives the air outlet assembly 20j to ascend and descend through the transmission mechanism. The transmission mechanism has a guiding portion 52j. The guiding mechanism 60j and the guiding portion 52j may move relative to each other in the lifting direction of the air outlet assembly 20j. At the same time, the guiding mechanism 60j is in limiting fit with the guiding portion 52j in the horizontal direction.

[1092] In the ceiling recessed fan provided by some embodiments of the present disclosure, the transmission mechanism is provided with the guiding portion 52j, so that the transmission mechanism cooperates with the guiding mechanism 60j through the guiding portion 52j, and the guiding mechanism 60j restricts the movement direction of the transmission mechanism, so that the transmission mechanism moves in the lifting direction of the air outlet assembly 20j without shaking in the horizontal direction, which allows that the transmission mechanism and the driving mechanism cooperate with each other more closely and stably, thereby lessening the vibration of the transmission mechanism during the driving process and reducing the generation of noise.

[1093] The guiding mechanism 60j includes a guiding unit 61j, and the guiding unit 61j has two guiding members 611j arranged oppositely. A guiding channel is formed between the two guiding members 611j, and the guiding portion 52j is located in the guiding channel. By providing the two opposite guiding members 611j, a guiding channel formed between the two guiding members 611j restricts the movement direction of the guiding portion 52j, so that the guiding portion 52j can only move along the guiding channel, and the movement direction of the transmission structure is also restricted, thereby lessening the vibration of the transmission mechanism during the movement process and reducing the generation of noise.

[1094] In some embodiments, there are a plurality of guiding units 61j arranged at intervals along the lifting direction of the air outlet assembly 20j. By providing the plurality of guiding units 61j, a plurality of guiding channels are formed in the lifting direction of the air outlet assembly 20j, and the plurality of guiding channels are in limiting fit with the guiding portion 52j at a plurality of positions in the lifting direction of the air outlet assembly 20j, thereby further improving the stability of the transmission mechanism during the movement process.

[1095] The transmission mechanism includes a gear 40j and a rack 50j, and the gear 40j is mounted on the output shaft of the driving device 30j. The rack 50j is fixedly connected with the air outlet assembly 20j and meshes with the gear 40j, and the driving device 30j drives the air outlet assembly 20j to ascend and descend by cooperation between the gear 40j and the rack 50j. The guiding portion 52j is located on the rack 50j. During the lifting process, the output shaft of the driving device 30j drives the gear 40j to rotate, so that the rotating gear 40j drives the rack 50j to ascend or descend, and the rack 50j drives the air outlet assembly 20j to ascend or descend. During the moving process, the guiding portion 52j cooperates with the guiding member 611j and moves in the guiding channel. Under the guidance of the guiding channel, the rack 50j can only move upwards or down wards, thereby reducing the occurrence of horizontal vibration.

[1096] In some embodiments, the guiding portion 52j is a guiding column on the rack 50j, and two opposite guiding members 611j are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members 611j through the guiding grooves. Since there is a fit gap between the gear 40j and the rack 50j, the rack 50j may still vibrate in the vertical direction during the ascending and descending process. By arranging the guiding column on the rack 50j and the guiding groove on the guiding member 611j, the guiding member 611j clamps the guiding column through the guiding groove, so that the guiding column descends slowly, which reduces the vibration in the vertical direction and allows that the entire air outlet assembly 20j ascends or descends stably.

[1097] The first side of the rack 50j is provided with a meshing tooth 51j, and the second side is provided with a guiding portion 52j. The rack 50j is provided with a mounting groove 55j located between the meshing tooth 51j and the guiding portion 52j. Two guiding members 611j of the guiding unit 61j are located on both sides of the guiding portion 52j respectively, and one of the guiding members 611j of the guiding unit 61j is located in the mounting groove 55j. By arranging the guiding portion 52j on the rack 50j, the structure is more compact when the rack 50j produces a transmission effect at the same time. The rack 50j is provided with the mounting groove 55j, which reduces the weight of the rack 50j, and saves the material. Moreover, some guiding members 611j are arranged in the mounting groove 55j, which greatly saves the assembling space. Further, the mounting groove 55j itself also limits the guiding member 611j, thereby achieving a multi-functional solution.

[1098] Specifically, the extension direction of the mounting groove 55j is the lifting direction of the air outlet assembly 20j,

and the mounting groove 55j has a first end wall 53j located above and a second end wall 54j located below along the lifting direction of the air outlet assembly 20j, and the maximum distance between the first end wall 53j and the guiding unit 61j is equal to a maximum descending height of the air outlet assembly 20j. When the air outlet assembly 20j descends, the first end wall 53j of the mounting groove 55j moves toward the guiding unit 61j, and when the first end wall 53j moves to the position of the guiding unit 61j, a limiting fit is formed so as to prevent that the rack 50j is disengaged from the gear 40j.

[1099] In some embodiments, the guiding member 611j in some embodiments of the present disclosure includes a roller in rolling fit with the guiding portion 52j. With the rolling fit between the roller and the guiding portion 52j, the frictional resistance is reduced when the guiding portion 52j is clamped at the same time.

[1100] It is to be noted that, alternatively, the guiding members 611j uses other structures. For example, the guiding members 611j is a slider in sliding fit with the guiding portion 52j, or the guiding member 611j includes both a slider and a roller, so that both of them are in hybrid use.

[1101] During the assembling process, the spacing between the guiding units 61j may affect the stability when the transmission mechanism descends. In some embodiments as shown in Figure 113, the guiding mechanism 60j includes two guiding units 61j arranged at intervals along the lifting direction of the air outlet assembly 20j, and the guiding unit 61j and the guiding portion 52j are in sliding fit in the lifting direction of the air outlet assembly 20j. At the same time, the guiding mechanism 60j and the guiding portion 52j are in limiting fit in the horizontal direction. For the maximum descending height B of the air outlet assembly 20j and the spacing distance C between the two guiding units 61j, the ratio of B/C is in the range of 2:1 to 4:1. When B/C is 2:1, the spacing between the guiding units 61j is large, and the descending process of the transmission mechanism is the most stable. When B/C is 4:1, the descending stroke of the transmission mechanism is the largest, that is, the maximum descending height of the air outlet assembly 20j is the largest. In this way, the transmission mechanism is made in a relatively small dimension, which saves the space. When B/C is 3:1, the spacing of the guiding unit 61j is moderate, and the maximum descending height of the air outlet assembly 20j also satisfies the design requirements without enlarging the dimension of the transmission mechanism. Therefore, when B/C is 3:1, it is possible to improve the stability during the lifting process of the air outlet assembly 20j, with a relatively compact and small structure, which saves the cost and the mounting space.

[1102] In the above-described embodiments, the transmission mechanism includes a gear 40j and a rack 50j, and the gear 40j is mounted on the output shaft of the driving device 30j. The rack 50j is fixedly connected with the air outlet assembly 20j and meshes with the gear 40j, and the driving device 30j drives the air outlet assembly 20j to ascend and descend by cooperation between the gear 40j and the rack 50j. The guiding portion 52j is located on the rack 50j. For the length A of the rack 50j along the lifting direction of the air outlet assembly 20j, the ratio of A/C is in the range of 3:1 to 5:1.

[1103] The length A of the rack 50j is related to the maximum descending height of the air outlet assembly 20j and the spacing between the guiding units 61j. When A/C is 3:1, the spacing between the guiding units 61j is large, and the descending process of the transmission mechanism is the most stable. When A/C is 5:1, the spacing of the guiding unit 61j is small, and correspondingly, the descending stroke of the transmission mechanism is the largest, that is, the maximum descending height of the air outlet assembly 20j is the largest. In this way, the transmission mechanism is made in a relatively small dimension, which saves the space. When A/C is 3:1, the spacing of the guiding unit 61j is moderate, and the maximum descending height of the air outlet assembly 20j also satisfies the design requirements without enlarging the dimension of the transmission mechanism. Therefore, when A/C is 3:1, it is possible to improve the stability during the lifting process of the air outlet assembly 20j, with a relatively compact and small structure, which saves the cost and the mounting space.

[1104] The lifting mechanism also includes a mounting box 70j arranged in the main body frame 10j, and the transmission mechanism and the guiding mechanism 60j are mounted in the mounting box 70j. The driving device 30j is an electric motor arranged outside the mounting box 70j, and the output shaft of the electric motor passes through the inside of the mounting box 70j.

[1105] In some embodiments, the mounting box 70j includes a box body 71j and a box cover, wherein the box body 71j is fixedly connected with the main body frame 10j; and the box cover is detachably arranged on the box body 71j. With the above-described structure, the entire lifting mechanism is integrated so that its occupied mounting space is minimized. Moreover, the mounting box 70j is detachable so as to facilitate the installation and removal and save the assembling and subsequent maintenance cost.

[1106] It is to be noted that, in the lifting mechanism, a transmission mechanism, a guiding mechanism 60j and a mounting box 70j form a lifting unit, and there are a plurality of lifting units. In some embodiments of the present disclosure, there are four lifting units connected to four corners of the air outlet assembly 20j respectively so as to improve a uniform stress.

[1107] It is also to be noted that, in some embodiments of the present disclosure, there is one electric motor, and each lifting unit is provided with one electric motor through which the lifting unit is in driving connection with the transmission mechanism directly. However, the cooperation method between the electric motor and the transmission mechanism is not limited thereto. In another embodiment not shown, other structures are the same as in some embodiments of the present disclosure. The differences lie in that: one electric motor drives two lifting units, and the electric motor is in driving

connection with different transmission mechanisms at the same time through a belt or a gear, thereby lessening the number of electric motors and reducing the cost. Similarly, it is also possible that, one electric motor drives four lifting units to ascend and descend at the same time.

[1108] The air outlet assembly 20j is provided with a first windshield 8j, and the air outlet duct 11j is internally provided with a second windshield 9j. The first windshield 8j cooperates with the second windshield 9j to block the air return gate and the air outlet duct 11j, and the first windshield 8j can move relative to the second windshield 9j. By cooperation between the first windshield 8j and the second windshield 9j, when the air outlet assembly 20j descends to a predetermined height or ascends to close the first air outlet 12j but only open the second air outlet 13j, the airflow in the air outlet duct 11j may not flow back to the air return gate to cause airflow short-circuit, thereby effectively improving the air output efficiency of the ceiling recessed fan.

[1109] A sealing member is provided between the contact surfaces of the first windshield 8j and the second windshield 9j. The sealing effect between the first windshield 8j and the second windshield 9j is further improved by the sealing member.

[1110] The first windshield 8j has a first contact member 81j, and the second windshield 9j is provided with a second contact member 92j and a third contact member 93j with a height difference. The first contact member 81j is located between the second contact member 92j and the third contact member 93j, and the first contact member 81j has a first position that descends to be in sealing contact with the third contact member 93j and a second position that ascends to be in sealing contact with the second contact member 92j.

[1111] Specifically, the first windshield 8j is T-shaped, and the horizontal section of the T shape constitutes a first contact member 81j. The second windshield 9j is C-shaped, and the upper horizontal section of the C shape constitutes a second contact member 92j, and the lower horizontal section of row C constitutes a third contact member 93j. The first contact member 81j projects between the second contact member 92j and the third contact member 93j. During the lifting process of the air outlet assembly 20j, the first contact member 81j moves between the second contact member 92j and the third contact member 93j, and when the air outlet assembly 20j is lifted at two set positions, the first contact member 81j is in sealing contact with the second contact member 92j and the third contact member 93j respectively.

[1112] In the first position, the upper surface of the first contact member 81j is in sealing contact with the lower surface of the second contact member 92j, and in the second position, the lower surface of the first contact member 81j is in sealing contact with the upper surface of the third contact member 93j.

[1113] The first contact member 81j is made from an elastic material; and/or, the second contact member 92j is made from an elastic material; and/or the third contact member 93j is made from an elastic material. With an elastic material, it is possible to enhance the sealing strength between the first contact member 81j and the second contact member 92j or between the first contact member 81j and the third contact member 93j, without a phenomenon that it is difficult to achieve surface-to-surface contact due to the manufacturing and assembling tolerances. In some embodiments, when the first contact member 81j is in contact with the second contact member 92j, the first contact member 81j and the second contact member 92j are in such a state as to be pressed against each other. When the first contact member 81j is in contact with the second contact member 92j, the first contact member 81j and the third contact member 93j are in such a state as to be pressed against each other.

[1114] Wherein, the deflector 22j is arranged on the second windshield 9j.

[1115] In order to achieve the aim that the cold airflow blows distally without skin blow, considering the settlement characteristics of the cold airflow and the general state of the art that the hoisting height of the air-conditioning unit is higher than the height of a person, the included angle β between the air output direction of the first air outlet 12j and the horizontal plane is in the angle range of $-20^\circ \leq \beta \leq 45^\circ$. When $\beta = 0^\circ$, the air output direction of the first air outlet 12j is parallel to the horizontal direction, and when $\beta > 0^\circ$, the air output direction of the first air outlet 12j tilts upwards relative to the horizontal direction. Wherein, the air output direction of the first air outlet 12j refers to the main flow direction of the airflow when flowing out of the first air outlet. When the parts of the main body frame 10j and/or the air outlet assembly 20j for forming the air supply duct 14j are both a plane, the air output direction of the first air outlet 12j is parallel to the plane. When the parts of the main body frame 10j and/or the air outlet assembly 20j for forming the air supply duct 14j are a camber, the air output direction of the first air outlet 12j refers to a tangential direction at the position where the camber has the greatest influence on the airflow.

[1116] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, simulation is performed by adjusting the value of β , and the simulation results are as follows:

$\beta(^{\circ})$	Horizontal air supply distance (m)	Whether there is a phenomenon of skin blow by cold air within an effective operation range
-21	4.8	YES
-20	4.9	NO

(continued)

$\beta(^{\circ})$	Horizontal air supply distance (m)	Whether there is a phenomenon of skin blow by cold air within an effective operation range
0	5.2	NO
30	4.7	NO
45	4	NO
46	3.9	NO

[1117] From the simulation results, when β is 0° , the horizontal air supply distance reaches a maximum value, and a phenomenon of skin blow by cold air is not present within an operation range at this time. When β increases to 30° (that is, the air output direction of the first air outlet 12j tilts upward relative to the horizontal plane at this time), the air supply distance begins to decrease, and a phenomenon of skin blow by cold air is not present. When β continues to increase to 45° , the air supply distance further decreases, and when β continues to increase to 46° , the air supply distance further decreases, which substantially cannot satisfy the requirements of the air supply distance of the ceiling recessed fan, especially for the scene where large-area heat exchange is required in business buildings (for example, shopping malls), and the air supply distance is too small to satisfy the requirements of large-area heat exchange. When β decreases to -20° (the air output direction of the first air outlet 12j tilts downward relative to the horizontal plane at this time), the air supply distance also begins to decrease, but with a small tilting angle of the air output direction relative to the horizontal plane, the component of the airflow in the horizontal direction is far greater than the component in the vertical direction during the flowing process. Finally, when the airflow reaches to the air supply distance of 4.9m, there is still a certain distance between the airflow and the ground ($4.9\text{m} \times \tan 20^{\circ} = 1.78\text{m}$, and taking a store as an example, the height of the store is 3.9m, $3.9\text{m} - 1.78\text{m} = 2.12\text{m}$, that is, when β is -20° , the height of the airflow reaching the ground is substantially maintained above 2.12m), and the distance allows that the air outlet of the ceiling recessed fan is not present with a phenomenon of skin blow by cold air. When β continues to decrease to -21° , the air supply distance is further reduced, ($4.8\text{m} \times \tan 21^{\circ} = 1.84\text{m}$, and $3.9\text{m} - 1.84\text{m} = 2.06\text{m}$), and the spacing between the airflow and the bottom surface is reduced synchronously, so that a phenomenon of skin blow by cold air is present. Also that is, only when β is in the range of -20° to 45° , it is possible that the air supply distance of the ceiling recessed fan meets the requirements, and a phenomenon of skin blow by cold air is not present.

[1118] Furthermore, in some embodiments, the included angle β between the air output direction of the first air outlet 12j and the horizontal plane is in the angle range of $0^{\circ} \leq \beta \leq 30^{\circ}$, and when $\beta > 0^{\circ}$, the air output direction of the first air outlet 12j tilts upward relative to the horizontal plane.

[1119] The air outlet assembly has a first descending height L1, and the value of the predetermined height L1 is in the range of $15\text{mm} \leq L1 \leq 60\text{mm}$.

[1120] Taking the ceiling recessed fan provided by some embodiments of the present disclosure as an example, under the premise that the air output direction of the first air outlet 12j is unchanged, simulation is performed by adjusting the value of L1, and the simulation results are as follows:

L1 (mm)	Air volume (m^3/h)	Refrigerating capacity (kw)	Air supply distance (m)
14	1175	11.2	6.5
15	1260	11.4	6.4
20	1416	11.8	6.1
30	1800	12.0	5.2
50	1921	12.2	4.3
60	1937	12.3	4.0
61	1938	12.3	3.9

[1121] From the simulation results, when L1 is 30mm, although the air volume does not reach a maximum value, the refrigerating capacity and the air supply distance are at a favorable level. When L1 increases to 50mm, the air volume and the refrigerating capacity begin to increase, but the air supply distance begins to decrease. When L1 continues to increase to 60mm, the air volume and the refrigerating capacity continue to increase, and the air supply distance continues to decrease. When L1 continues to increase to 61mm, although the air volume increases, the increasing ratio begins to

decrease, and the refrigerating capacity is unchanged compared with that when L1 is 60mm, but the air supply distance continues to decrease, so that the air supply distance is too small as it is impossible to satisfy the comfort requirements of the ceiling recessed fan when the air velocity is below 3m/s. When L1 decreases 20mm, the air volume and the refrigerating capacity begin to decrease, and the air supply distance begins to increase. When L1 continues to decrease to 15mm, the air volume and the refrigerating capacity further decrease, and the air supply distance further increases. When L1 continues to decrease to 14mm, the air volume and the refrigerating capacity are still further reduced, and the air supply distance increases. At this time, the air volume attenuation is more than 20%, and the refrigerating capacity cannot satisfy that the ceiling recessed fan reaches a required heat exchange efficiency, which does not conform with the energy saving principles. Also that is, only when L1 is in the range of 15mm to 60mm, the air volume, the refrigerating capacity and the air supply distance of the ceiling recessed fan can be matched to a reasonable state.

[1122] The air outlet assembly has a first descending height L1, and the value of the predetermined height L1 is in the range of $20\text{mm} \leq L1 \leq 50\text{mm}$.

[1123] The ceiling recessed fan has a first air output mode, a second air output mode and a third air output mode:

[1124] When the ceiling recessed fan is in the first air output mode, the first air outlet 12j is open and the second air outlet 13j is closed. At this time, all the airflow in the air outlet duct 11j is blown out through the first air outlet 12j, that is, a horizontal air output or even a tilting air output is formed.

[1125] When the ceiling recessed fan is in the second air output mode, the first air outlet 12j is open and some or all the second air outlets 13j are open. At this time, part of the airflow in the air outlet duct 11j is blown out through the first air outlet 12j, and the remaining is blown out through the second air outlet 13j, so as to realize circumferential air supply and improve the uniformity of room temperature. Wherein, all the second air outlets 13j are selectively opened according to the required air output direction and the air volume of the air output.

[1126] When the ceiling recessed fan is in the third air output mode, the first air outlet 12j is closed and some or all the second air outlets 13j are open. At this time, all the air in the air outlet duct 11j is blown out through the second air outlet 13j, that is, a tiltingly downward air output or even a vertically downward air output is formed.

[1127] When the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in the first air output mode or the second air output mode.

[1128] When the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in the third air output mode or the second air output mode.

[1129] The main body frame 10j includes a side frame 15j. When the air outlet assembly 20j descends to form a first air outlet 12j with the main body frame 10j, an air supply duct 14j is formed between the air outlet assembly 20j and the side frame 15j. The part of the side frame 15j for forming the air supply duct 14j is arranged obliquely relative to the horizontal plane, and an upper layer portion of the airflow in the air supply duct 14j is deflected by the obliquely arranged side frame 15j, so that the air output direction of the first air outlet 12j meets the requirements.

[1130] The tilting angle α formed between the part of the side frame 15j for forming the air supply duct 14j and the horizontal plane is in the angle range of $-20^\circ \leq \alpha \leq 45^\circ$. When $\alpha = 0^\circ$, the part of the side frame 15h for forming the air supply duct 14j is parallel to the horizontal direction, and when $\alpha > 0^\circ$, the part of the side frame 15j for forming the air supply duct 14j tilts upward relative to the horizontal plane. The side frame 15j tilts to change the airflow direction in the air supply duct 14j, and finally change the air output direction of the first air outlet 12j. When $\alpha \geq 0^\circ$, the air output of the ceiling recessed fan flows along a horizontal direction as much as possible, and when α is between 0° and -20° , although the airflow flows obliquely downwards, it is still possible to allow that the ceiling recessed fan is not present with a phenomenon of skin blow.

[1131] In some embodiments, the part of the side frame 15j for forming the air supply duct tilts upward relative to the horizontal plane, that is, $\alpha > 0^\circ$. The air output direction of the air supply duct 14j tilts upward relative to the horizontal plane. The side frame 15j tilts to allow that air supply duct can tilt upward relative to the horizontal plane, so that the airflow in the air supply duct 14j flows towards the ceiling direction as much as possible, thereby increasing the horizontal air output distance of the ceiling recessed fan, and effectively enhancing the waterfall refrigeration effect.

[1132] The part of the air outlet assembly 20j for forming the air supply duct 14j is arranged obliquely relative to the horizontal plane, and a lower layer portion of the airflow in the air supply duct 14j is deflected by the obliquely arranged air outlet assembly 20j, so that the direction of the first air outlet 12j meets the requirements.

[1133] The tilting angle β formed between the part of the air outlet assembly 20j for forming the air supply duct 14j and the horizontal plane is in the angle range of $-20^\circ \leq \beta \leq 45^\circ$. When $\beta = 0^\circ$, the part of the air outlet assembly 20j for forming the air supply duct 14j is parallel to the horizontal direction, and when $\beta > 0^\circ$, the part of the air outlet assembly 20j for forming the air supply duct 14j tilts upward relative to the horizontal plane. Also that is, along the airflow direction, the part of the air outlet assembly 20j for forming the air supply duct 14j forms a tiltingly deflecting surface, so that the air output direction of the air supply duct 14j can tilt upward relative to the horizontal plane. When $\beta \geq 0^\circ$, the air outlet assembly 20j can make the air output direction of the air supply duct 14j tilt upward relative to the horizontal plane, so that the air output of the ceiling recessed fan flows along a horizontal direction as much as possible, and when β is between 0° and -20° , although the airflow flows obliquely downwards, it is still possible to allow that the ceiling recessed fan is not present with a phenomenon of skin blow.

[1134] In some embodiments, the part of the side frame 15j for forming the air supply duct and the part of the air outlet assembly 20j for forming the air supply duct 14j are parallel to each other.

[1135] The air outlet duct 11j has a first end 111j and a second end 112j along the airflow direction. The first air outlet 12j and the second air outlet 13j both communicate with the second end 112j, and the ratio of the width D1 of the first end 111j to the width D2 of the second air outlet 13j is in the range of $0.75 \leq D2/D1 \leq 0.85$.

[1136] When the ceiling recessed fan is in a heating condition, taking a 5 horse power indoor unit as an example, the width D1 of the first end 111j is set to be a fixed value of 60mm, and the opening angle of the air deflector is set to be a fixed value of 50° , and simulation is performed by adjusting the width D2 of the second air outlet.

D2/D1	Air volume (m ³ /h)	Air supply distance
0.7	1586	1.0m
0.75	1596	1.0m
0.8	1607	0.8m
0.85	1615	0.3m
0.9	1621	/ (the airflow is entrained by the air return gate without falling off)

[1137] From the experiment results, when D2/D1 is 0.8, the air volume is attenuated less, and the air supply distance is also far enough, which is the most desirable. When D2/D1 increases to 0.85, although the air volume begins to increase, the air supply distance is apparently shortened. When D2/D1 continues to increase to 0.9, the air supply distance is seriously shortened, which cannot be accepted. When D2/D1 decreases to 0.75, the air volume begins to decrease, and the air supply distance reaches a maximum value. When D2/D1 continues to decrease to 0.7, the air volume is seriously attenuated, which cannot be accepted. Also that is, in the case where other conditions are unchanged, the greater the width D2 of the second air outlet 13j is, the lower the air velocity of the air output will be, and the more likely to be entrained by the air return gate of the ceiling recessed fan it will be. On the contrary, the smaller the width D2 of the second air outlet 13j is, the faster the air velocity will be, so that the airflow lands easily, which has a minor influence on the air supply distance. However, the smaller the airflow is, the worse the heating effect will be.

[1138] The air outlet assembly 20j includes an air outlet frame, which is lifted independently. In other embodiments not shown, the air outlet assembly 20j includes an air outlet frame and an air return panel, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

[1139] In the description of the present disclosure, it is necessary to understand that, the azimuth or positional relations indicated by the terms "center", "transverse", "longitudinal", "front", "rear", "left", "right", "up", "down", "vertical", "horizontal", "top", "bottom", "within", "outside", which are based on the azimuth or positional relations illustrated by the drawings, are only for facilitating description of the present disclosure and simplifying the description, rather than indicating or implying that the device or element referred thereto has to present a particular azimuth, and be constructed and operated in a particular azimuth, so that it cannot be understood as limiting the protection scope of the present disclosure.

[1140] Finally, it should be noted that: the above embodiments are only intended to explain the technical solution of the present disclosure rather than limiting the same; although detailed explanations are made to the present disclosure with reference to preferred embodiments, those of ordinary skill in the art should understand that: it is still possible to make amendments to the embodiments of the present disclosure or equivalent replacements to some of the technical features, which shall all be encompassed in the scope of the technical solution for which protection is sought in the present disclosure without departing from the spirit of the technical solution of the present disclosure.

Claims

1. A ceiling recessed fan, comprising:

a main body frame internally provided with an air outlet duct, wherein the air outlet duct comprises a first end and a second end along an airflow direction;

an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, there is a height difference between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame, and the air outlet communicates with a second end of the air outlet duct;

a ratio of a height h1 of the air outlet to a width h2 of a first end of the air outlet duct is in a range of $1/3 \leq h1/h2 \leq 3/5$.

2. The ceiling recessed fan according to claim 1, wherein the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form the height difference, and when the air outlet assembly is in the operation position, the ratio of the height h_1 of the air outlet to the width h_2 of the first end of the air outlet duct is in a range of $1/3 \leq h_1/h_2 \leq 3/5$.
3. The ceiling recessed fan according to claim 1 or 2, wherein the air outlet assembly comprises an air deflector and an air outlet frame, the air outlet frame is arranged in the main body frame; the air deflector is rotatably arranged on the air outlet frame; and when the air outlet assembly is in an operation position, the air deflector is capable of adjusting a height of the air outlet.
4. The ceiling recessed fan according to claim 3, wherein the air deflector has a first position to allow the height h_1 of the air outlet to reach a minimum value, and the ratio of a minimum height h_1 of the air outlet to the width of a first end of the air outlet duct is in the range of $1/3 \leq h_1/h_2 \leq 3/5$.
5. The ceiling recessed fan according to claim 3 or 4, wherein when the ceiling recessed fan is in a cooling mode, the included angle a between the plane where the air deflector is located and the horizontal plane is in the angle range of $-10^\circ \leq a \leq 10^\circ$, and when $a = 0^\circ$, the plane where the air deflector is located is parallel to the horizontal plane.
6. The ceiling recessed fan according to claim 5, wherein when the ceiling recessed fan is in the cooling mode, the included angle a in the angle range of $10^\circ \geq a > 0^\circ$, and when $a > 0^\circ$, the air deflector tilts upwards relative to the horizontal plane.
7. The ceiling recessed fan according to any of claims 3 to 6, wherein the air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge; and when the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.
8. The ceiling recessed fan according to claim 7, wherein when the air outlet assembly is in the closed position, the air outlet frame and the air deflector jointly cooperate with the main body frame to form a seal.
9. The ceiling recessed fan according to any of claims 2 to 8, wherein the air outlet assembly comprises an air outlet frame, the air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.
10. The ceiling recessed fan according to any of claims 2 to 9, wherein the air outlet assembly comprises an air outlet frame and an air return panel, the air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.
11. A ceiling recessed fan, comprising:
 - a main body frame internally provided with an air outlet duct, wherein the air outlet duct has a first end and a second end along an airflow direction;
 - an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, and having an operation position which descends to a predetermined height and forms an air outlet with the main body frame, wherein the air outlet communicates with a second end of the air outlet duct;
 - when the air outlet assembly is in the operation position, the angle b between the air output direction of the air outlet and the air output direction of the air outlet duct is in the angle value of $130^\circ \leq b \leq 150^\circ$.
12. The ceiling recessed fan according to claim 11, wherein the air outlet assembly comprises an air deflector and an air outlet frame, the air outlet frame is arranged in the main body frame; the air deflector is swingably arranged on the air outlet frame; and when the air outlet assembly is in the operation position, the air deflector is capable of adjusting a height of the air outlet.
13. The ceiling recessed fan according to claim 12, wherein the ceiling recessed fan has a cooling mode, and when the ceiling recessed fan is in the cooling mode, the angle c between the plane where the air deflector is located and the air output direction of the air outlet duct is in the angle range of $120^\circ \leq c \leq 140^\circ$.

14. The ceiling recessed fan according to claim 12, wherein the ceiling recessed fan has a heating mode, and when the ceiling recessed fan is in the heating mode, the angle c between the plane where the air deflector is located and the air output direction of the air outlet duct is in the angle range of $180^{\circ} \leq c \leq 190^{\circ}$.
- 5 15. The ceiling recessed fan according to any of claims 12 to 14, wherein the air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge; and when the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.
- 10 16. The ceiling recessed fan according to claim 15, wherein the second edge is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the step structure, so that the first step structure can be sealingly fit with the second step structure.
- 15 17. The ceiling recessed fan according to claim 16, wherein the first step structure is provided with a seal, and when the first step structure is sealingly fit with the second step structure, the seal is located between the first step structure and the second step structure.
- 20 18. The ceiling recessed fan according to any of claims 12 to 17, wherein the ceiling recessed fan also comprises a swinging mechanism arranged on the air outlet assembly, and the air deflector is arranged on the swinging mechanism.
- 25 19. The ceiling recessed fan according to claim 18, wherein the swinging mechanism comprises a rotary arm, one end of which is hinged to the air outlet frame, and the other end of which is arranged on the air deflector.
- 30 20. The ceiling recessed fan according to claim 19, wherein the swinging mechanism also comprises a driving member arranged on the air outlet frame and directly or indirectly driving the rotary arm to rotate.
- 35 21. The ceiling recessed fan according to any of claims 11 to 20, wherein the air outlet assembly comprises an air outlet frame, an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.
22. The ceiling recessed fan according to any of claims 11 to 21, wherein the air outlet assembly comprises an air outlet frame and an air return panel, an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.
23. The ceiling recessed fan according to any of claims 11 to 22, wherein the air outlet assembly is provided with at least one second air outlet communicating with a second end of the air outlet duct.
- 40 24. The ceiling recessed fan according to claim 23, wherein the ceiling recessed fan further comprises an air deflector rotatably arranged at the second air outlet and configured to close or open the second air outlet.
25. A ceiling recessed fan, comprising:
45 a main body frame;
 an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, and having an operation position which descends to a set height and forms an air outlet with the main body frame; the height h_1 of the air outlet is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$.
- 50 26. The ceiling recessed fan according to claim 25, wherein when the height h_1 of the air outlet is in the range of $20\text{mm} \leq h_1 \leq 36\text{mm}$, the air output volume of the ceiling recessed fan is greater than or equal to 75% of a rated air output volume of the ceiling recessed fan.
- 55 27. The ceiling recessed fan according to claim 25 or 26, wherein the air outlet assembly comprises a rotatable air deflector, and the air deflector and the main body frame form the air outlet.
28. The ceiling recessed fan according to claim 27, wherein when the ceiling recessed fan is in a cooling mode, the comprised angle a between the plane where the air deflector is located and the horizontal plane is in the angle range of

$-10^{\circ} \leq \alpha \leq 10^{\circ}$, and when $\alpha = 0^{\circ}$, the plane where the air deflector is located is parallel to the horizontal plane.

29. The ceiling recessed fan according to claim 27 or 28, wherein the ceiling recessed fan also comprises a rotating mechanism arranged on the air outlet assembly, and the air deflector is arranged on the rotating mechanism.

30. The ceiling recessed fan according to claim 29, wherein the rotating mechanism comprises a rotary arm, one end of which is hinged to the air outlet assembly, and the other end of which is arranged on the air deflector.

31. The ceiling recessed fan according to claim 30, wherein the rotating mechanism also comprises a driving member arranged on the air outlet assembly and drivingly connected with the rotary arm.

32. The ceiling recessed fan according to any of claims 27 to 31, wherein the air outlet assembly comprises an air outlet frame, the air deflector is rotatably arranged on the air outlet frame, and a step sealing structure is provided between an edge of the air deflector and the air outlet frame.

33. The ceiling recessed fan according to claim 32, wherein the edge of the air deflector is provided with a first step structure, and the air outlet frame is provided with a second step structure, so that the first step structure and the second step structure are fit to form the step sealing structure.

34. The ceiling recessed fan according to claim 33, wherein a sealing member is provided between the first step structure and the second step structure.

35. The ceiling recessed fan according to any of claims 25 to 34, wherein the air outlet assembly comprises an air outlet frame, an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

36. The ceiling recessed fan according to any of claims 25 to 35, wherein the air outlet assembly comprises an air outlet frame and an air return panel, an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

37. A ceiling recessed fan, comprising:

a main body frame;

an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame;

a first air deflector arranged at a swinging mechanism, and swingably arranged at the air outlet;

the angle c between the plane where the first air deflector is located and a mounting planar face of the main body frame is in the range of $-10^{\circ} \leq c \leq 10^{\circ}$, and when the angle c is 0° , the plane where the first air deflector is located is parallel to the mounting planar face;

the air outlet assembly has a first descending height h , and when the ceiling recessed fan is in a cooling mode, the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$.

38. The ceiling recessed fan according to claim 37, wherein when the angle c is in the range of $-10^{\circ} \leq c < 0^{\circ}$, the plane where the first air deflector is located tilts upward relative to the mounting planar face, and the first descending height h is in the range of $20\text{mm} \leq h \leq 28\text{mm}$; or when the angle c is in the range of $0^{\circ} \leq c < 10^{\circ}$, the first descending height h is in the range of $20\text{mm} \leq h \leq 36\text{mm}$.

39. The ceiling recessed fan according to claim 37 or 38, wherein the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form the height difference.

40. The ceiling recessed fan according to any of claims 37 to 39, wherein the mounting planar face of the main body frame is parallel to the horizontal plane.

41. The ceiling recessed fan according to claim 39 or 40, wherein the first air deflector is provided with an extension plate projecting out of the first air deflector when the air outlet assembly is in the operation position.

42. The ceiling recessed fan according to any of claims 37 to 40, wherein the ceiling recessed fan also comprises an air deflection structure arranged in the main body frame, and capable of deflecting the air output of the air outlet when the ceiling recessed fan is in a cooling mode.

43. The ceiling recessed fan according to claim 42, wherein the main body frame comprises a side frame, at least part of the air output of the air outlet passes through the side frame, and the air deflecting structure comprises a second air deflector swingably arranged on the side frame; or the main body frame comprises a side frame, at least part of the air output of the air outlet passes through the side frame, and the side frame is formed with an air deflecting channel which constitutes the air deflecting structure.

44. The ceiling recessed fan according to any of claims 37 to 43, wherein the air outlet assembly comprises an air outlet frame, an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

45. The ceiling recessed fan according to any of claims 37 to 44, wherein the air outlet assembly comprises an air outlet frame and an air return panel, an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

46. A ceiling recessed fan, comprising:

a main body frame;
an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, a height difference is formed between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame; and
a first air deflector arranged at a swinging mechanism, and swingably arranged at the air outlet;
wherein the plane where the first air deflector is located tilts upward relative to a mounting planar face of the main body frame, and the angle c between the plane where the first air deflector is located and the mounting planar face is in the range of $-10^\circ \leq c < 0^\circ$.

47. The ceiling recessed fan according to claim 46, wherein the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly has an operation position descending to a set height to form the height difference.

48. A ceiling recessed fan with a cooling mode, comprising:

a main body frame internally provided with an air outlet duct, wherein the air outlet duct has a first end and a second end along an airflow direction;
an air outlet assembly arranged in the main body frame, wherein when the ceiling recessed fan is in a cooling mode, there is a height difference between the air outlet assembly and the main body frame, and an air outlet is formed between the air outlet assembly and the main body frame, and the air outlet communicates with a second end of the air outlet duct;
the ratio of the height h_1 of the air outlet to the width h_2 of a first end of the air outlet duct is in the range of $1/3 \leq h_1/h_2 \leq 3/5$.

49. The ceiling recessed fan according to claim 48, wherein the air outlet assembly is arranged in the main body frame in a way so as to be able to be raised and lowered, and the air outlet assembly comprises an operation position descending to a set height to form the height difference; and when the air outlet assembly is in the operation position, the range of the height h_1 of the air outlet to the width h_2 of a first end of the air outlet duct is in the range of $1/3 \leq h_1/h_2 \leq 3/5$.

50. The ceiling recessed fan according to claim 48 or 49, wherein the air outlet assembly comprises an air deflector and an air outlet frame, the air outlet frame is arranged in the main body frame; the air deflector is rotatably arranged on the air outlet frame; and when the air outlet assembly is in the operation position, the air deflector is capable of adjusting a height of the air outlet.

51. The ceiling recessed fan according to claim 50, wherein the air deflector has a first position to allow the height h_1 of the air outlet to reach a minimum value, and the ratio of the minimum height h_1 of the air outlet to the width of a first end of the air outlet duct is in the range of $1/3 \leq h_1/h_2 \leq 3/5$.

52. The ceiling recessed fan according to claim 50, wherein when the ceiling recessed fan is in a cooling mode, the comprised angle α between the plane where the air deflector is located and the horizontal plane is in the angle range of $-10^\circ \leq \alpha \leq 10^\circ$, and when $\alpha = 0^\circ$, the plane where the air deflector is located is parallel to the horizontal plane.

53. The ceiling recessed fan according to claim 52, wherein when the ceiling recessed fan is in a cooling mode, the comprised angle α is in the angle range of $10^\circ \geq \alpha > 0^\circ$, and when $\alpha > 0^\circ$, the air deflector tilts upwards relative to the horizontal plane.

54. The ceiling recessed fan according to any of claims 50 to 53, wherein the air outlet assembly comprises a closed position to close the air outlet in cooperation with the main body frame, and the air deflector has a first edge and a second edge; and when the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet frame.

55. The ceiling recessed fan according to claim 54, wherein when the air outlet assembly is in the closed position, the air outlet frame and the air deflector jointly cooperate with the main body frame to form a seal.

56. The ceiling recessed fan according to claim 54 or 55, wherein the second edge is provided with a first step structure, and the air outlet frame is provided with a second step structure fit with the first step structure, so that the first step structure is sealingly fit with the second step structure when the air outlet assembly is in the closed position.

57. The ceiling recessed fan according to claim 56, wherein the first step structure is provided with a seal, and when the air outlet assembly is in the closed position, the seal is arranged between the first step structure and the second step structure.

58. The ceiling recessed fan according to any of claims 49 to 57, wherein the ceiling recessed fan also comprises a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.

59. The ceiling recessed fan according to any of claims 49 to 58, wherein the air outlet assembly comprises an air outlet frame, an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

60. The ceiling recessed fan according to any of claims 49 to 59, wherein the air outlet assembly comprises an air outlet frame and an air return panel; an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

61. The ceiling recessed fan according to any of claims 48 to 60, wherein the air outlet assembly comprises at least one second air outlet communicating with a second end of the air outlet duct.

62. The ceiling recessed fan according to claim 61, wherein the ceiling recessed fan further comprises an air deflector rotatably arranged at the second air outlet and configured to close or open the second air outlet.

63. A ceiling recessed fan with an air outlet, comprising:

a main body frame internally provided with an air outlet duct, wherein the air outlet duct comprises a first end and a second end; and

an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, and descending to form an air outlet with the main body frame, wherein the air outlet communicates with a second end of the air outlet duct;

the ratio of the circulation area S_1 of the air outlet to the circulation area S_2 of the first end is in the range of $0.7 \leq S_1/S_2 \leq 1.27$.

64. The ceiling recessed fan according to claim 63, wherein the air outlet assembly comprises a rotatable air deflector, and the air deflector and the main body frame form the air outlet.

65. The ceiling recessed fan according to claim 64, wherein the ceiling recessed fan also comprises a rotating mechanism arranged on the air outlet assembly, and the air deflector is arranged on the rotating mechanism.

66. The ceiling recessed fan according to claim 65, wherein the rotating mechanism comprises a rotary arm, one end of which is hinged to the air outlet assembly, and the other end of which is arranged on the air deflector.
- 5 67. The ceiling recessed fan according to claim 64, wherein the air outlet assembly has a closed position to close the air outlet in cooperation with the main body frame, and the air deflector comprises a first edge and a second edge; and when the air outlet assembly is in the closed position, the first edge is sealed with a corresponding position of the main body frame, and the second edge is sealed with a corresponding edge of the air outlet assembly.
- 10 68. The ceiling recessed fan according to claim 67, wherein a sealing structure is provided between the second edge and the air outlet assembly.
69. The ceiling recessed fan according to any of claims 63 to 68, wherein the ceiling recessed fan also comprises a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism.
- 15 70. The ceiling recessed fan according to any of claims 63 to 69, wherein the air outlet assembly comprises an air outlet frame, an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.
- 20 71. The ceiling recessed fan according to any of claims 63 to 70, wherein the air outlet assembly comprises an air outlet frame and an air return panel, an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.
- 25 72. The ceiling recessed fan according to any of claims 63 to 71, wherein the air outlet assembly is provided with at least one second air outlet communicating with a second end of the air outlet duct.
73. The ceiling recessed fan according to claim 72, wherein the ceiling recessed fan further comprises an air deflector rotatably arranged at the second air outlet and configured to close or open the second air outlet.
- 30 74. A control method of a ceiling recessed fan, wherein the ceiling recessed fan comprises a main body frame and an air outlet assembly, the air outlet assembly is mounted on the main body frame, and a height difference is formed between the air outlet assembly and the main body frame to form a first air outlet; the air outlet assembly is also provided with a second air outlet, the control method comprising the steps of:
- 35 judging whether a fast cooling condition is met; and
 controlling the first air outlet and the second air outlet to be opened at the same time when the judgment result is YES.
- 40 75. The control method according to claim 74, wherein the ceiling recessed fan further comprises:
- a lifting mechanism through which the air outlet assembly is mounted on the main body frame;
 the step of controlling the opening of the first air outlet comprises: controlling the lifting mechanism to drive the air outlet assembly to descend so as to open the first air outlet.
- 45 76. The control method according to claim 74 or 75, wherein a first air deflecting portion is provided between the air outlet assembly and the main body frame; the air outlet assembly is provided with a second air deflecting portion,
- controlling the opening of the first air outlet by controlling the opening of the first air deflecting portion;
 controlling the opening of the second air outlet by controlling the opening of the second air deflecting portion.
- 50 77. The control method according to any of claims 74 to 76, wherein the step of judging whether a fast cooling condition is met comprises:
- 55 judging whether a fast cooling instruction is received or whether an indoor temperature is higher than a first preset temperature;
 judging that a fast cooling condition is satisfied if YES.
78. The control method according to any of claims 74 to 77, wherein after the step of controlling the first air outlet and the

second air outlet to be opened at the same time, the control method further comprises:

judging whether a fast cooling exit condition is met;
controlling the second air outlet to be closed when the first air outlet remains opened if YES.

79. The control method according to claim 78, wherein the step of judging whether a fast cooling exit condition is met comprises:

judging whether a fast cooling exit instruction is received, or judging whether an opening duration of the second air outlet reaches a first preset duration, or judging whether an indoor temperature is lower than a second preset temperature;
judging that a fast cooling exit condition is met if YES.

80. The control method according to claim 79, wherein after the step of judging that a fast cooling exit condition is met and before controlling the second air outlet to be closed, the control method further comprises:

controlling the second air outlet to be intermittently opened;
controlling the second air outlet to be closed after a second preset duration.

81. A control apparatus of a ceiling recessed fan, for realizing the control method according to any of claims 74 to 80, wherein the control apparatus comprises:

a first judging module configured to judge whether a fast cooling condition is met; and
a first control module configured to control a first air outlet and a second air outlet to be opened at the same time when the judgment result is YES.

82. A ceiling recessed fan, comprising a main body frame and an air outlet assembly, wherein the air outlet assembly is mounted on the main body frame, and a height difference is formed between the air outlet assembly and the main body frame to form a first air outlet which outputs air horizontally; the air outlet assembly is also provided with a second air outlet which outputs air downwards, and the ceiling recessed fan further comprises the control apparatus according to claim 8.

83. A computer readable storage medium having a computer program stored thereon that, when executed by a processor, implements the control method according to any of claims 74 to 80.

84. A ceiling recessed fan, comprising a main body frame, an air outlet assembly and a lifting mechanism, wherein the air outlet assembly is connected to the main body frame through the lifting mechanism;

wherein the main body frame is provided with a load-bearing member, and the air outlet assembly is provided with a lapped joint member configured to be movable relative to the load-bearing member;
during the ascending process of the air outlet assembly, the load-bearing member is separated from the lapped joint member;
when the air outlet assembly descends to an operation position, the lapped joint member is in lapped joint with the load-bearing member which bears at least part of the gravity of the air outlet assembly.

85. The ceiling recessed fan according to claim 84, wherein a movement stroke A of the lapped joint member is equal to a maximum descending height of the air outlet assembly.

86. The ceiling recessed fan according to claim 85, wherein a maximum lifting distance of the lifting mechanism is greater than a movement stroke of the lapped joint member.

87. The ceiling recessed fan according to claim 86, wherein the lifting mechanism comprises:

a driving device arranged in the main body frame;
a gear mounted on an output shaft of the driving device; and
a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack;
a meshing length of the rack is equal to a maximum lifting distance of the lifting mechanism.

88. The ceiling recessed fan according to claim 87, wherein the lifting mechanism is mounted on the load-bearing member.

89. The ceiling recessed fan according to any of claims 84 to 88, wherein the load-bearing member comprises a load-bearing plate and a load-bearing step, wherein the load-bearing plate is connected with the main body frame, and the load-bearing step is connected with the load-bearing plate;

the lapped joint member comprises a lapped joint plate and a lapped joint step, wherein the lapped joint plate is connected with the air outlet assembly, and the lapped joint step is connected with the lapped joint plate; during the ascending process of the air outlet assembly, the lap jointed step ascends away from the load-bearing step; when the air outlet assembly descends to an operation position, the lap jointed step descends and is in lapped joint with the load-bearing step.

90. The ceiling recessed fan according to claim 89, wherein the bearing plate has a first side surface and a second side surface that are oppositely arranged; the load-bearing step is formed on the first side surface, and the lifting mechanism is mounted on the second side surface.

91. The ceiling recessed fan according to claim 89 or 90, wherein the cross-sectional shape of the load-bearing member is C-shaped, and the cross-sectional shape of the lapped joint member is L-shaped or T-shaped.

92. The ceiling recessed fan according to any of claims 84 to 91, wherein the air outlet assembly comprises an air outlet frame, an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

93. The ceiling recessed fan according to any of claims 84 to 92, wherein the air outlet assembly comprises an air outlet frame and an air return panel, a first air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

94. A recessed air conditioner with a transmission mechanism, comprising a main body frame, an air outlet assembly and a lifting mechanism, wherein the air outlet assembly is connected to the main body frame through the lifting mechanism, wherein the lifting mechanism comprises:

a driving device;
a transmission mechanism connected with the air outlet assembly and drivingly connected with the driving device, wherein the drive device drives the air outlet assembly to ascend and descend through the transmission mechanism; the transmission mechanism comprises a guiding portion; and
a guiding mechanism, wherein the guiding mechanism and the guiding portion are movable relative to each other in a lifting direction of the air outlet assembly, and at the same time, the guiding mechanism is in limiting fit with the guiding portion in a horizontal direction.

95. The recessed air conditioner according to claim 94, wherein the guiding mechanism comprises a guiding unit having two guiding members arranged oppositely, a guiding channel is formed between the two guiding members, and the guiding portion is located in the guiding channel.

96. The recessed air conditioner according to claim 95, wherein there are a plurality of the guiding units arranged at intervals along a lifting direction of the air outlet assembly.

97. The recessed air conditioner according to claim 95 or 96, wherein the transmission mechanism comprises:

a gear mounted on an output shaft of the driving device; and
a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack; and the guiding portion is located on the rack.

98. The recessed air conditioner according to claim 97, wherein the guiding portion is a guiding column on the rack, and the two opposite guiding members are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members

through the guiding grooves.

99. The recessed air conditioner according to claim 97 or 98, wherein the first side of the rack is provided with a meshing tooth, the second side is provided with a guiding portion, and the rack is provided with a mounting groove located between the meshing tooth and the guiding portion;
the two guiding members of the guiding unit are located on both sides of the guiding portion respectively, and one of the guiding members of the guiding unit is located in the mounting groove.

100.

The recessed air conditioner according to claim 99, wherein the extension direction of the mounting groove is the lifting direction of the air outlet assembly, and the mounting groove has a first end wall located above and a second end wall located below along a lifting direction of the air outlet assembly, and the maximum distance between the first end wall and the guiding unit is equal to a maximum descending height of the air outlet assembly.

101.

The recessed air conditioner according to any of claims 95 to 100, wherein the guiding member comprises a slider in sliding fit with the guiding portion and/or a roller in rolling fit with the guiding portion.

102.

The recessed air conditioner according to any of claims 94 to 100, wherein the guiding mechanism comprises:

two guiding units arranged at intervals along a lifting direction of the air outlet assembly, wherein the guiding unit and the guiding portion are in sliding fit in a lifting direction of the air outlet assembly, and at the same time, the guiding mechanism and the guiding portion are in limiting fit in a horizontal direction;
for a maximum descending height B of the air outlet assembly and a spacing distance C between the two guiding units 61i, the ratio of B/C is in the range of 1:1 to 4:1.

103.

The recessed air conditioner according to claim 102, wherein the transmission mechanism comprises:

a gear mounted on an output shaft of the driving device;
a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack; and the guiding portion is located on the rack;
for a length A of the rack along a lifting direction of the air outlet assembly, the ratio of A/C is in the range of 2:1 to 5:1.

104.

The recessed air conditioner according to any of claims 94 to 103, wherein the air outlet assembly comprises an air outlet frame, an air outlet is formed between the air outlet frame and the main body frame, and the air outlet frame is lifted independently.

105.

The recessed air conditioner according to any of claims 94 to 104, wherein the air outlet assembly comprises an air outlet frame and an air return panel, an air outlet is formed between the air outlet frame and the main body frame, the air return panel is provided with an air return gate, and the air outlet frame and the air return panel are connected and lifted together.

106.

The recessed air conditioner according to any of claims 94 to 105, wherein the lifting mechanism further comprises:
a mounting box arranged in the main body frame, wherein the transmission mechanism and the guiding mechanism are mounted in the mounting box.

107.

The recessed air conditioner according to claim 106, wherein the mounting box comprises:

a box body fixedly connected with the main body frame; and
a box cover detachably arranged on the box body.

108.

The recessed air conditioner according to claim 107, wherein the driving device is arranged outside the mounting box, and the output shaft of the electric motor passes through the inside of the mounting box.

109.

The recessed air conditioner according to any of claims 94 to 108, wherein the air outlet assembly descends to form an air supply duct with the main body frame, so that one end of the air supply duct forms a first air outlet, and the other end of the air supply duct communicates with an air outlet duct of the recessed air conditioner.

110.

The recessed air conditioner according to claim 109, wherein the air outlet assembly is also provided with at least one second air outlet communicating with an air outlet duct of the recessed air conditioner.

111. The recessed air conditioner according to claim 110, wherein the air outlet assembly is provided with an air deflector located at the position of the first air outlet and/or the second air outlet.

112.

The recessed air conditioner according to any of claims 109 to 111, wherein the main body frame further comprises a side frame, and when the air outlet assembly descends to form a first air outlet with the main body frame, the air supply duct is formed between the air outlet assembly and the side frame, and the projection of the air outlet assembly at least partially coincides with the projection of the side frame on a mounting planar face of the main body frame.

113.

A ceiling recessed fan with an air supply duct, comprising:

- a main body frame internally formed with an air outlet duct; and
- an air outlet assembly arranged in the main body frame in a way so as to be able to be raised and lowered, and descending to form a first air outlet with the main body frame;
- the air outlet assembly comprises at least one second air outlet communicating with the air outlet duct.

114.

The ceiling recessed fan according to claim 113, wherein when the air outlet assembly descends to form a first air outlet with the main body frame, a gap is formed between the air outlet assembly and the main body frame, so that the gap forms an air supply duct, one end of which communicates with the air outlet duct, and the other end of which forms the first air outlet.

115.

The recessed air conditioner according to claim 114, wherein the main body frame further comprises a side frame; and when the air outlet assembly descends to form a first air outlet with the main body frame, the air supply duct is formed between the air outlet assembly and the side frame, and the projection of the air outlet assembly at least partially coincides with the projection of the side frame on a mounting planar face of the main body frame.

116.

The ceiling recessed fan according to any of claims 113 to 115, wherein the ceiling recessed fan further comprises an air deflector rotatably arranged at the second air outlet and configured to close or open the second air outlet.

117.

The ceiling recessed fan according to any of claims 113 to 116, wherein the ceiling recessed fan also comprises at least two partition plates, all the partition plates are arranged in the air outlet duct, and a flow channel is formed between the two adjacent partition plates.

118.

The ceiling recessed fan according to any of claims 113 to 117, wherein the ceiling recessed fan also comprises a lifting mechanism arranged in the main body frame, and the air outlet assembly is arranged on the lifting mechanism; the lifting mechanism comprises:

- a driving device;
- a transmission mechanism connected with the air outlet assembly and drivingly connected with the driving device,

wherein the drive device drives the air outlet assembly to ascend and descend through the transmission mechanism; the transmission mechanism comprises a guiding portion; and a guiding mechanism, wherein the guiding mechanism and the guiding portion are movable relative to each other in a lifting direction of the air outlet assembly, and the guiding mechanism is in limiting fit with the guiding portion in a horizontal direction.

119.

The ceiling recessed fan according to claim 118, wherein the guiding mechanism comprises a guiding unit having two guiding members arranged oppositely, a guiding channel is formed between the two guiding members, and the guiding portion is located in the guiding channel.

120.

The ceiling recessed fan according to claim 119, wherein the transmission mechanism comprises:

a gear mounted on an output shaft of the driving device; and a rack fixedly connected with the air outlet assembly and meshed with the gear, wherein the driving device drives the air outlet assembly to ascend and descend by cooperation between the gear and the rack;

and the guiding portion is located on the rack.

121.

The ceiling recessed fan according to claim 120, wherein the guiding portion is a guiding column on the rack, and the two opposite guiding members are provided with guiding grooves matched with the guiding columns, and the guiding columns are clamped between the two guiding members through the guiding grooves.

122.

The ceiling recessed fan according to claim 121, wherein

the first side of the rack is provided with a meshing tooth, the second side is provided with a guiding portion, and the rack is provided with a mounting groove located between the meshing tooth and the guiding portion; the two guiding members of the guiding unit are located on both sides of the guiding portion respectively, and one of the guiding members of the guiding unit is located in the mounting groove.

123.

The ceiling recessed fan according to claim 122, wherein the extension direction of the mounting groove is the lifting direction of the air outlet assembly, and the mounting groove has a first end wall located above and a second end wall located below along a lifting direction of the air outlet assembly, and the maximum distance between the first end wall and the guiding unit is equal to a maximum descending height of the air outlet assembly.

124.

The ceiling recessed fan according to any of claims 113 to 123, wherein the comprised angle β between the air output direction of the first air outlet and the horizontal plane is in the angle range of $-20^\circ \leq \beta \leq 45^\circ$; when $\beta = 0^\circ$, the air output direction of the first air outlet is parallel to the horizontal direction; and when $\beta > 0^\circ$, the air output direction of the first air outlet tilts upwards relative to the horizontal direction.

125.

The ceiling recessed fan according to claim 124, wherein the comprised angle β between the air output direction of the first air outlet and the horizontal plane is in the angle range of $0^\circ \leq \beta \leq 30^\circ$; and when $\beta > 0^\circ$, the air output direction of the first air outlet tilts upwards relative to the horizontal direction.

126.

The ceiling recessed fan according to any of claims 113 to 125, wherein the air outlet assembly has a first descending height L_1 in the value range of $15\text{mm} \leq L_1 \leq 60\text{mm}$.

127.

The ceiling recessed fan according to claim 126, wherein the air outlet assembly comprises a first descending height L_1 in the value range of $20\text{mm} \leq L_1 \leq 50\text{mm}$.

128.

The ceiling recessed fan according to any of claims 113 to 127, wherein the ceiling recessed fan comprises a first air output mode, a second air output mode and a third air output mode;

when the ceiling recessed fan is in the first air output mode, the first air outlet is open, and the second air outlet is closed;
 when the ceiling recessed fan is in the second air output mode, the first air outlet is open, and some or all the second air outlets are open;
 when the ceiling recessed fan is in the third air output mode, the first air outlet is closed, and some or all the second air outlets are open.

129.

The ceiling recessed fan according to claim 128, wherein

when the ceiling recessed fan is in a cooling mode, the ceiling recessed fan is in a first air output mode or the second air output mode;
 when the ceiling recessed fan is in a heating mode, the ceiling recessed fan is in a third air output mode or the second air output mode.

130.

The recessed air conditioner according to any of claims 114 to 129, wherein the main body frame comprises a side frame; and when the air outlet assembly descends to form a first air outlet with the main body frame, the air supply duct is formed between the air outlet assembly and the side frame, the part of the side frame for forming the air supply duct is arranged obliquely relative to a horizontal plane; and/or, the part of the air outlet assembly for forming the air supply duct is arranged obliquely relative to a horizontal plane.

131.

The ceiling recessed fan according to claim 130, wherein the tilting angle α formed between the part of the side frame for forming the air supply duct and a horizontal plane is in the angle range of $-20^\circ \leq \alpha \leq 45^\circ$, and when $\alpha = 0^\circ$, the part of the side frame for forming the air supply duct is parallel to a horizontal direction, and when $\alpha > 0^\circ$, the part of the side frame for forming the air supply duct tilts upward relative to the horizontal plane; and/or, the tilting angle β formed between the part of the air outlet assembly for forming the air supply duct and a horizontal plane is in the angle range of $-20^\circ \leq \beta \leq 45^\circ$, and when $\beta = 0^\circ$, the part of the air outlet assembly for forming the air supply duct is parallel to a horizontal direction, and when $\beta > 0^\circ$, the part of the air outlet assembly for forming the air supply duct tilts upward relative to a horizontal plane.

132.

The recessed air conditioner according to any of claims 113 to 131, wherein the air outlet duct has a first end and a second end along an airflow direction, the first air outlet and the second air outlet both communicate with the second end, and the ratio of the width D_1 of the first end to the width D_2 of the second air outlet is in the range of $0.75 \leq D_2/D_1 \leq 0.85$.

133.

The ceiling recessed fan according to any of claims 113 to 132, wherein the air outlet assembly comprises an air outlet frame, which is lifted independently.

134.

The ceiling recessed fan according to any of claims 113 to 133, wherein the air outlet assembly comprises an air outlet frame and an air return panel, the air return panel comprises an air return gate, and the air outlet frame and the air return panel are connected and lifted synchronously.

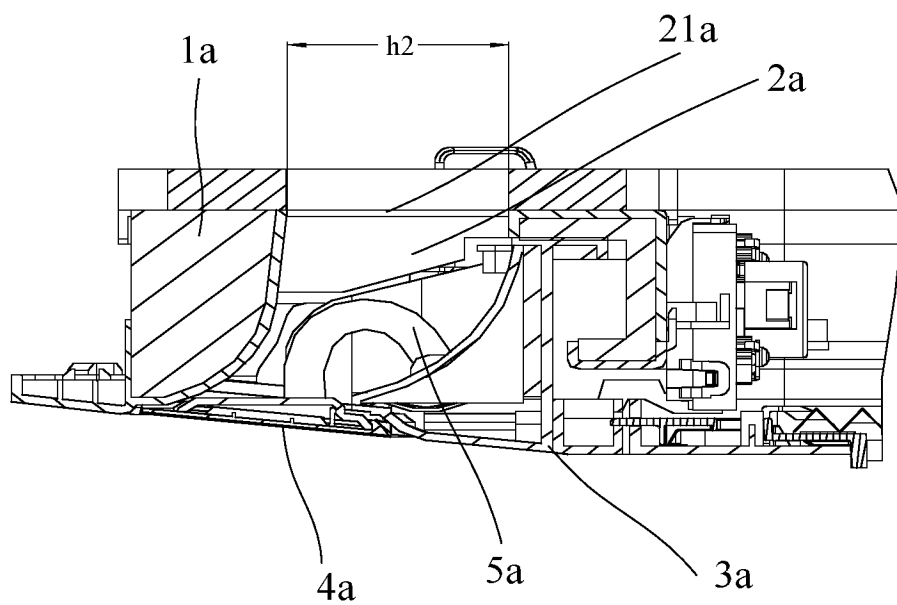


Figure 1

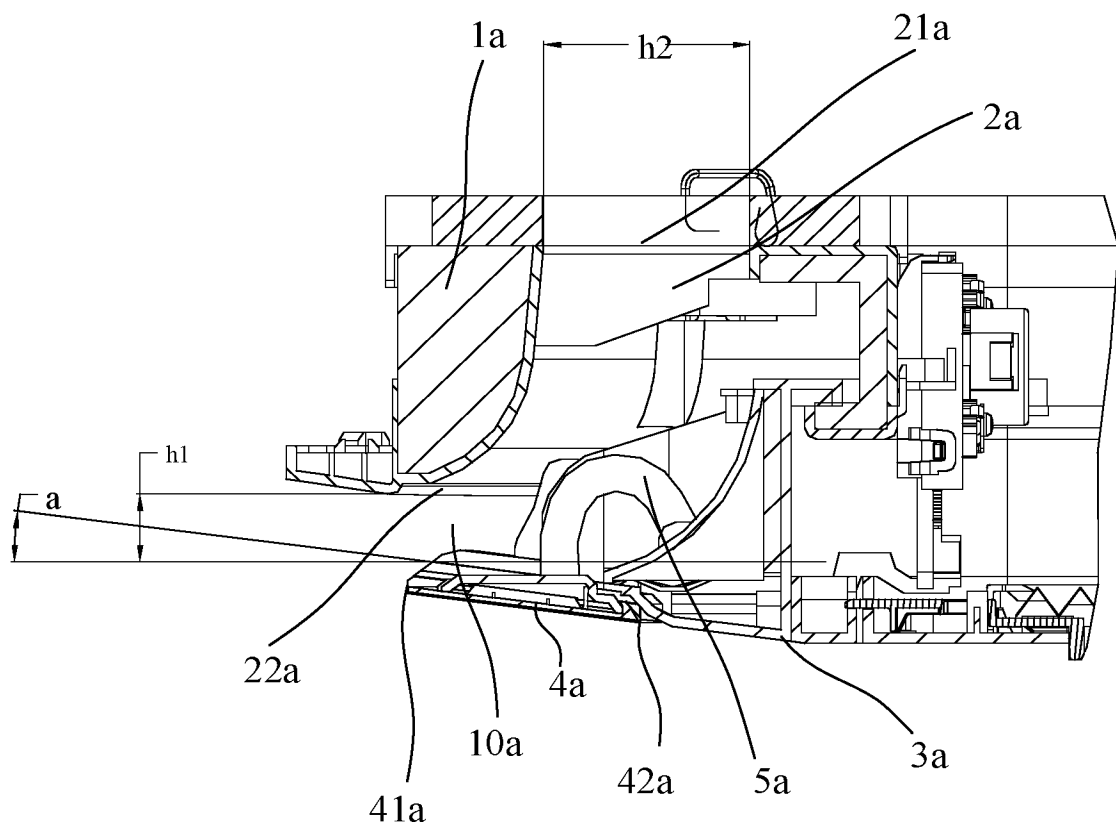


Figure 2

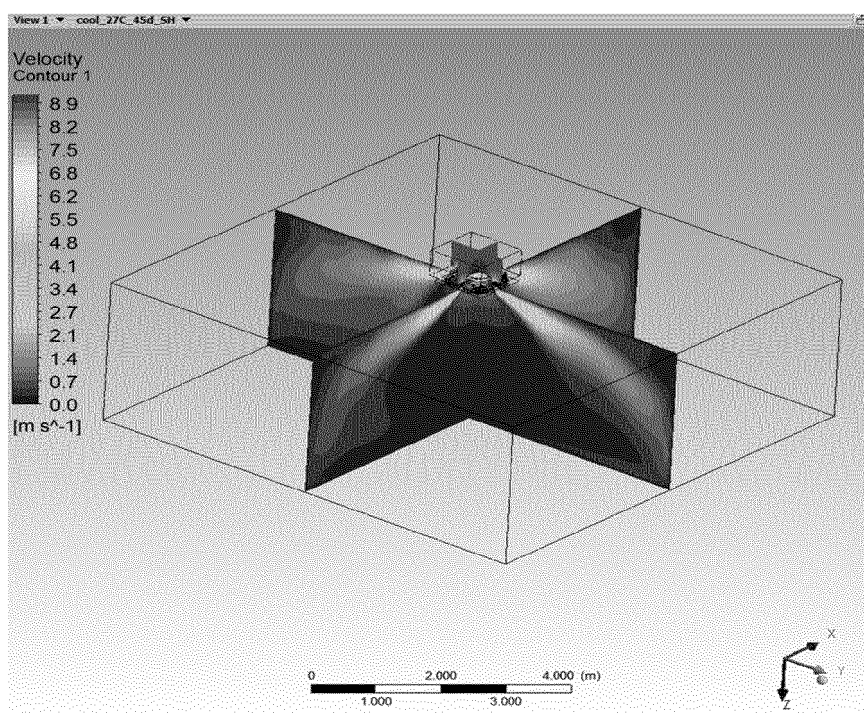


Figure 3

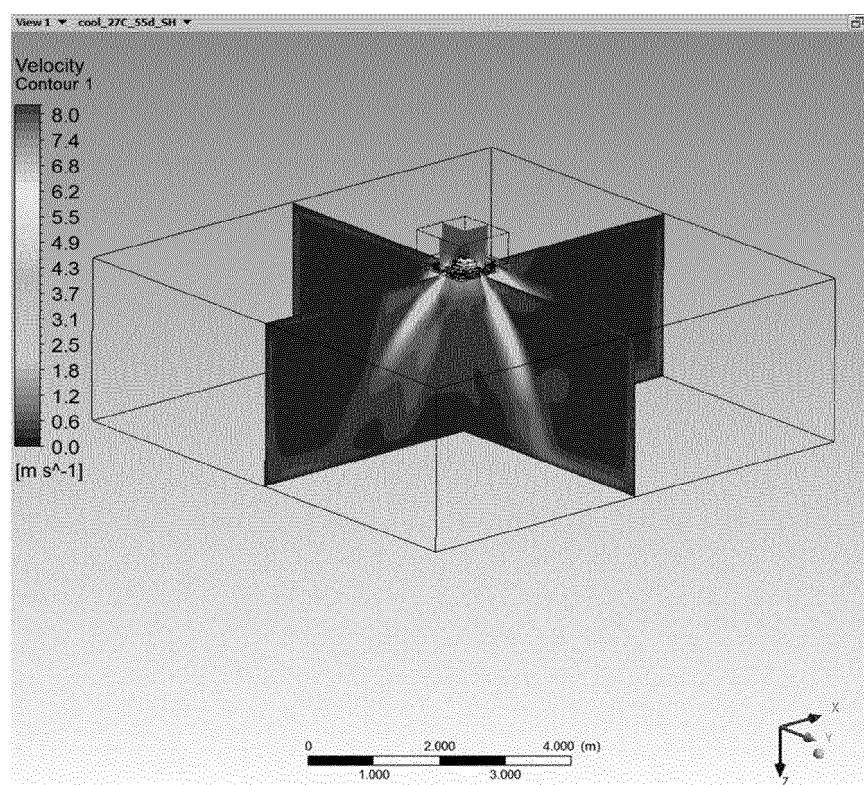


Figure 4

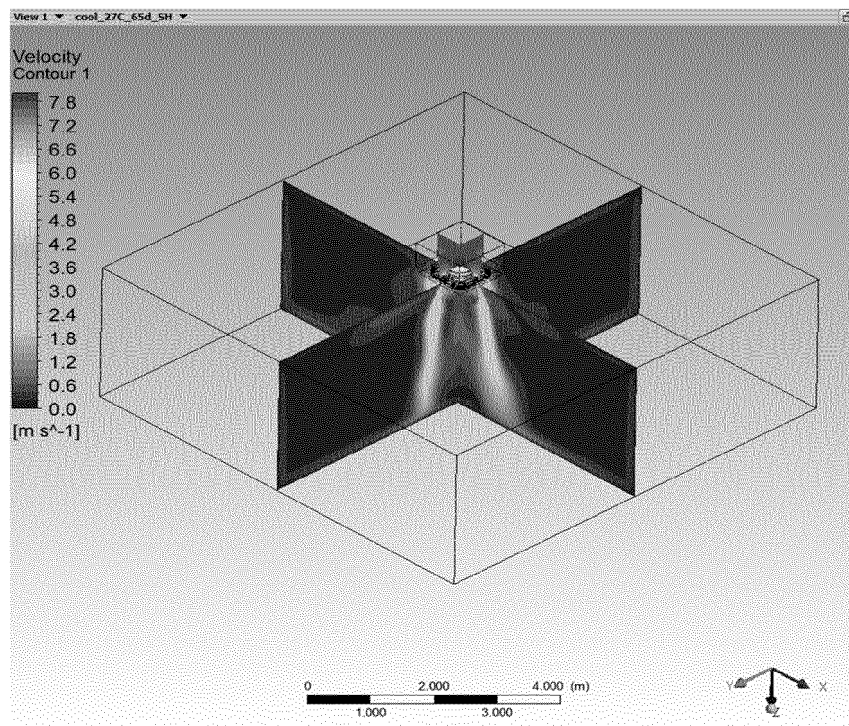


Figure 5

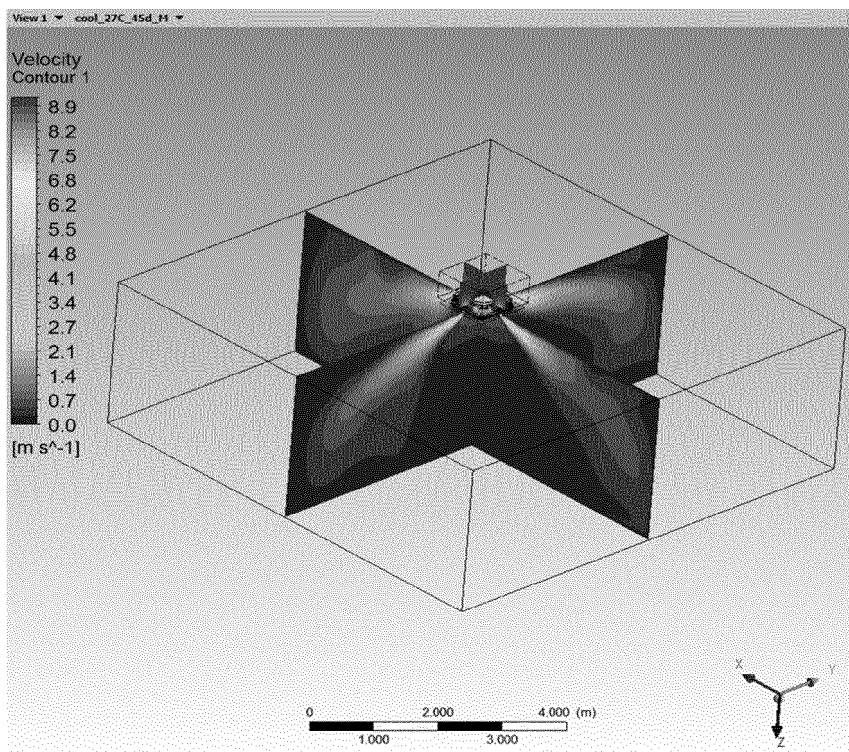


Figure 6

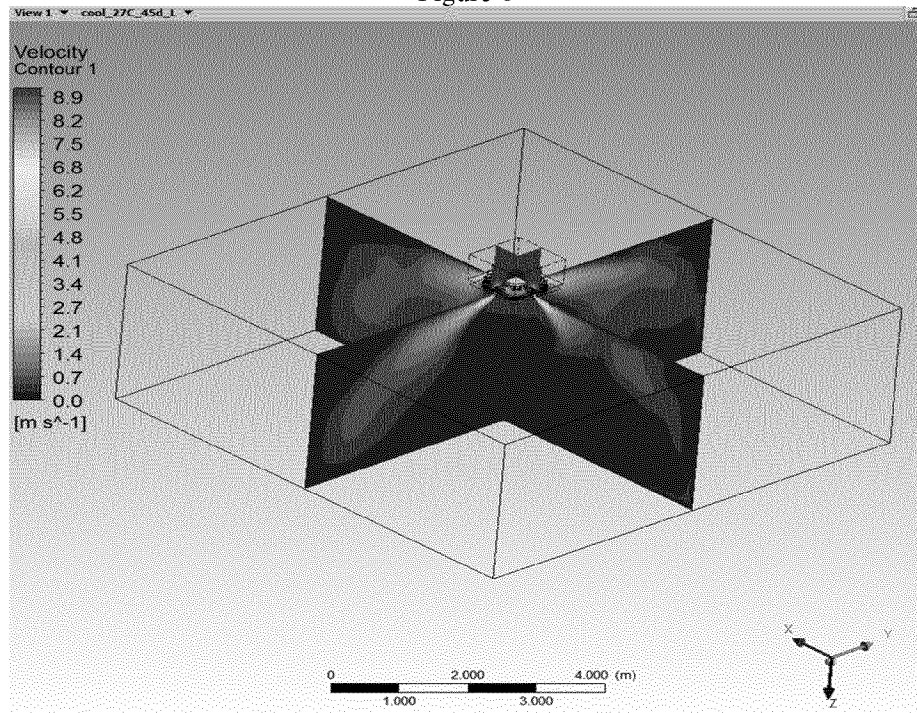
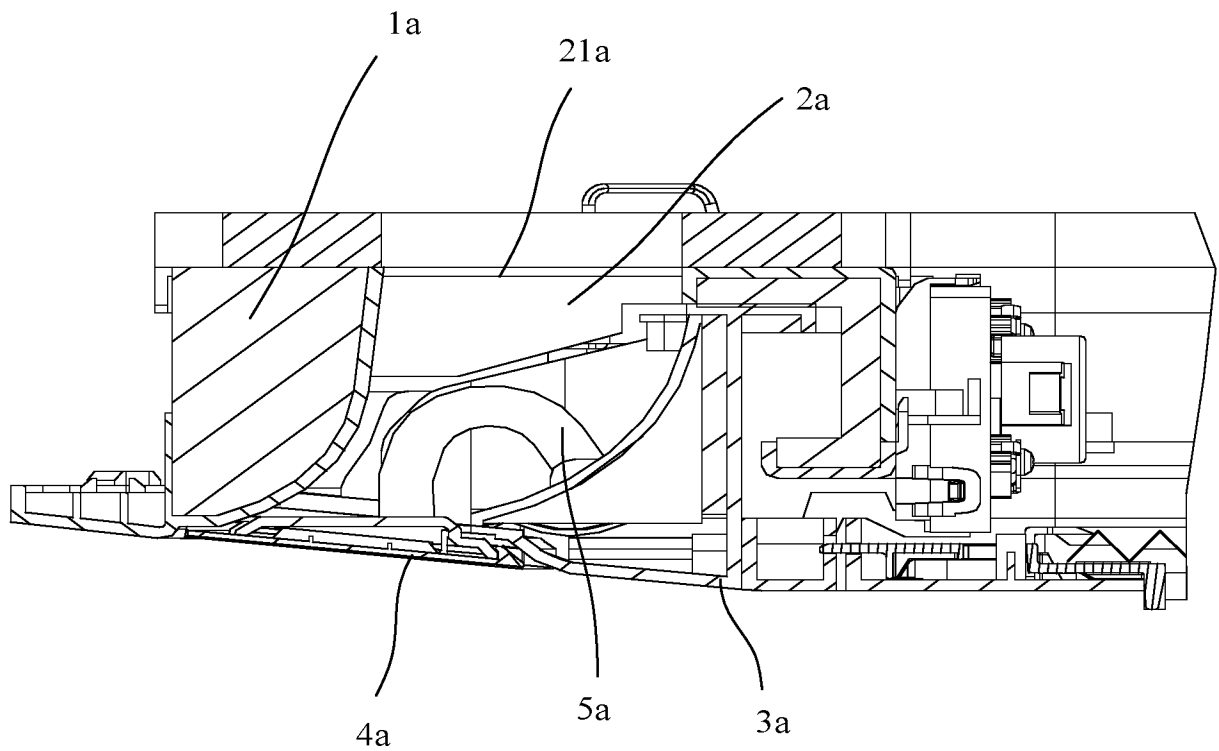


Figure 7



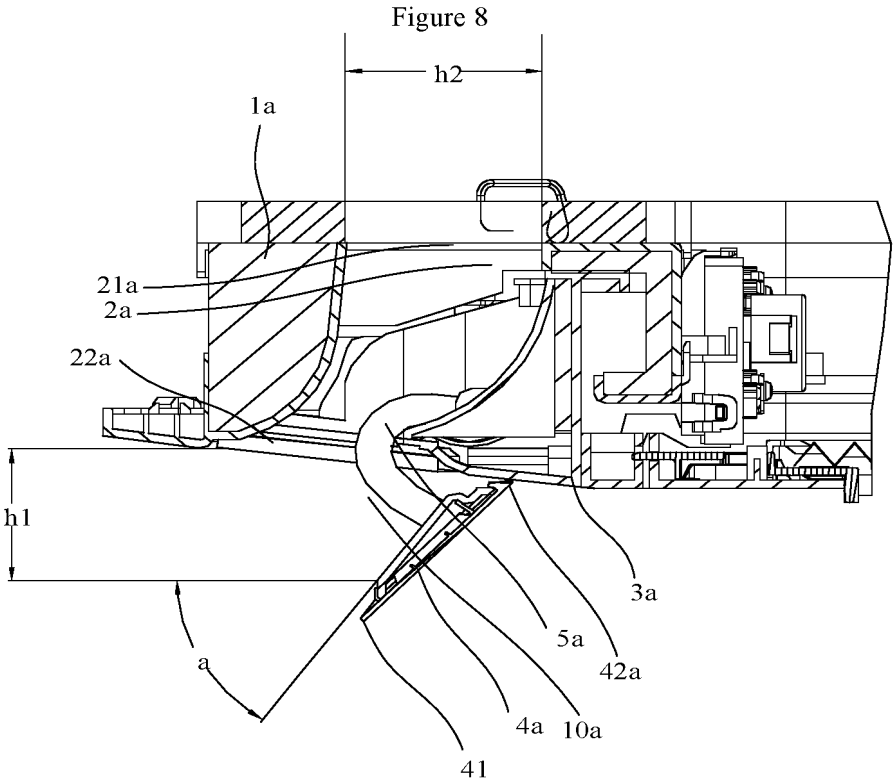


Figure 9

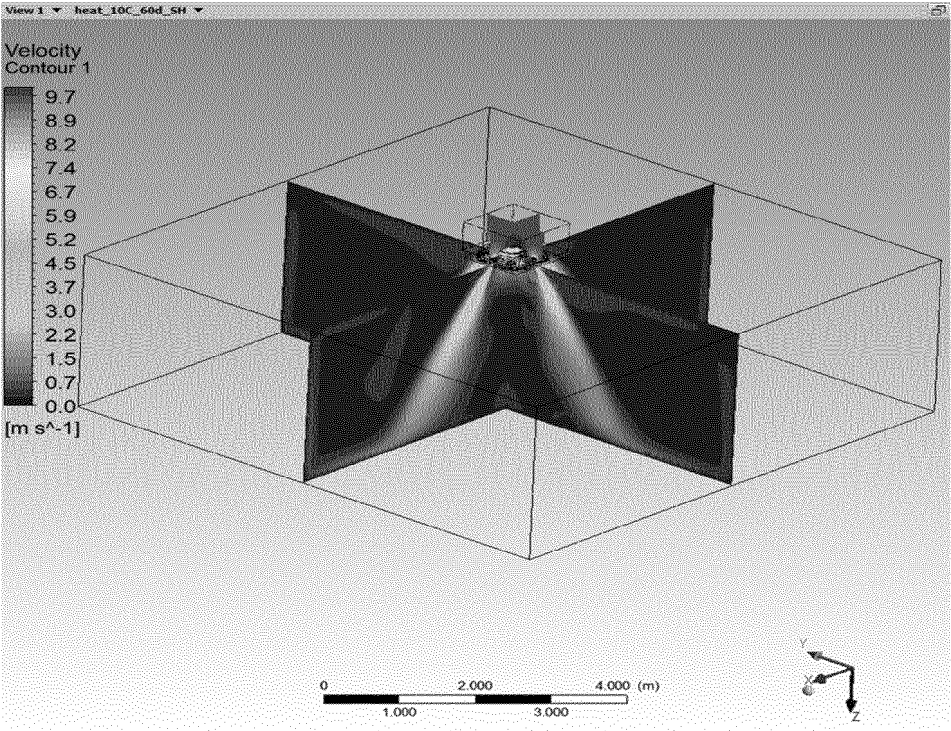


Figure 10

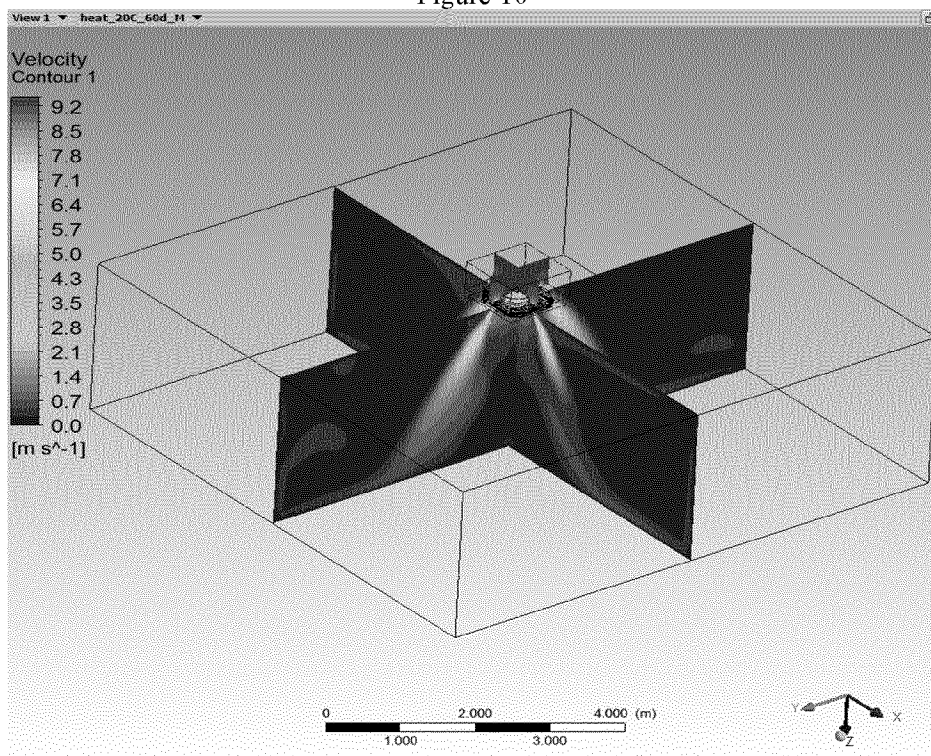


Figure 11

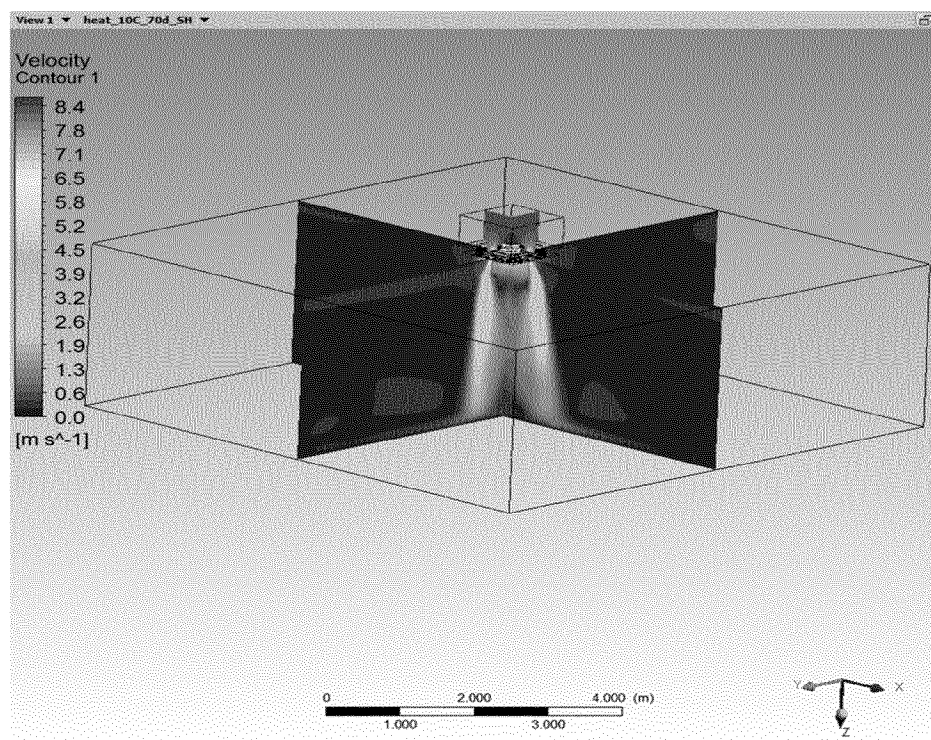


Figure 12

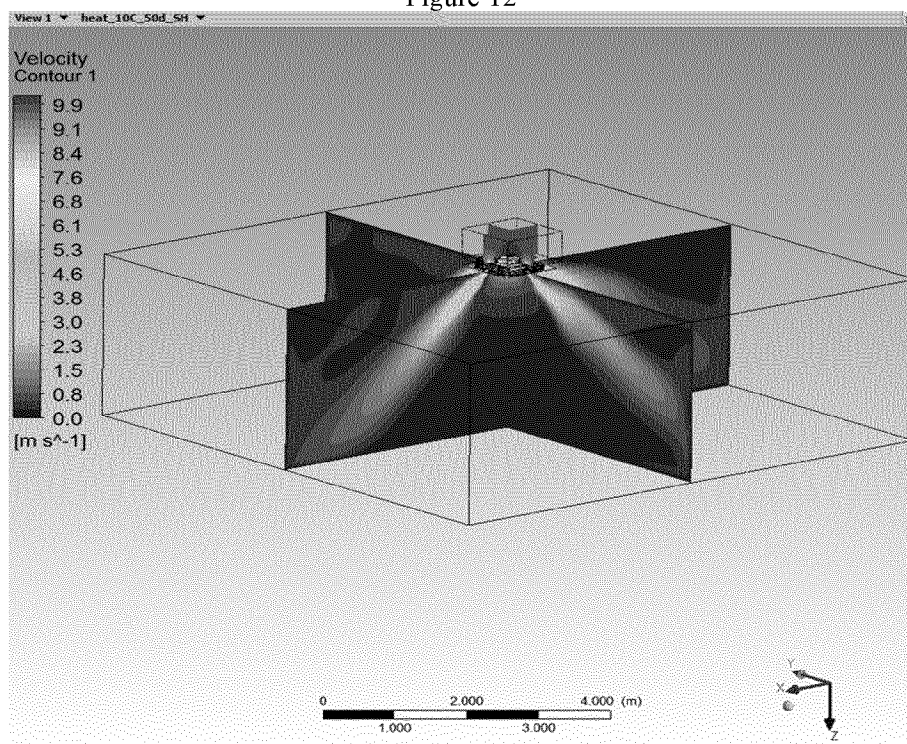


Figure 13

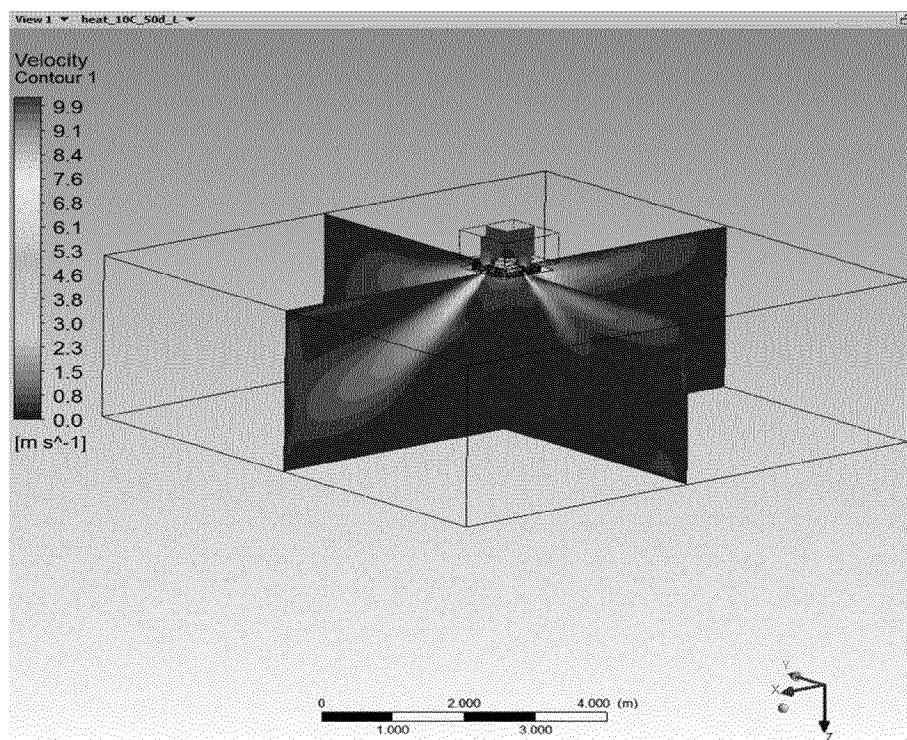


Figure 14

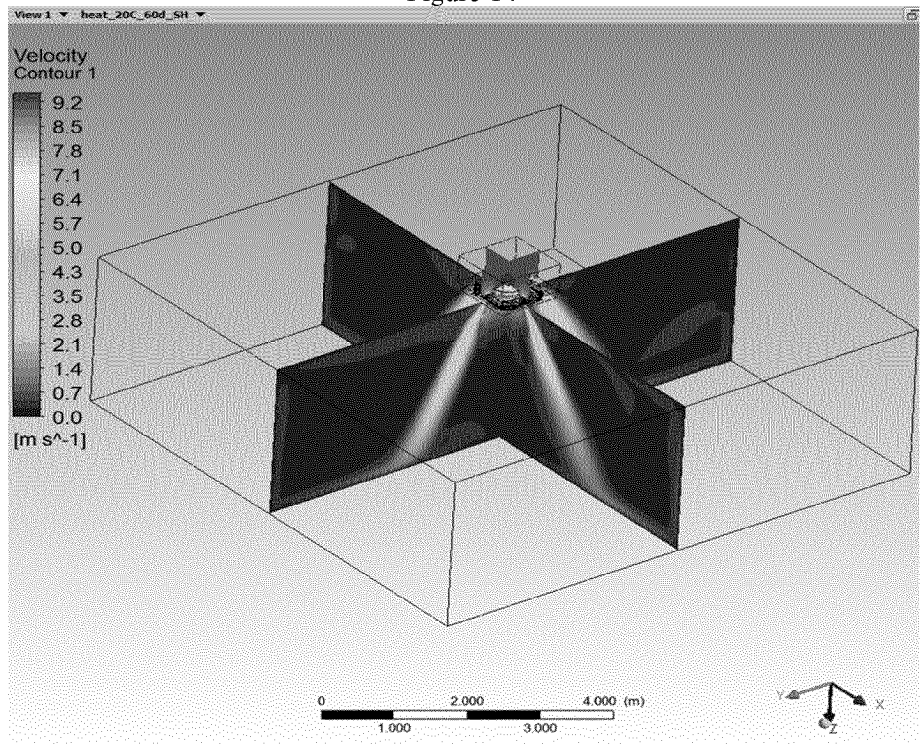


Figure 15

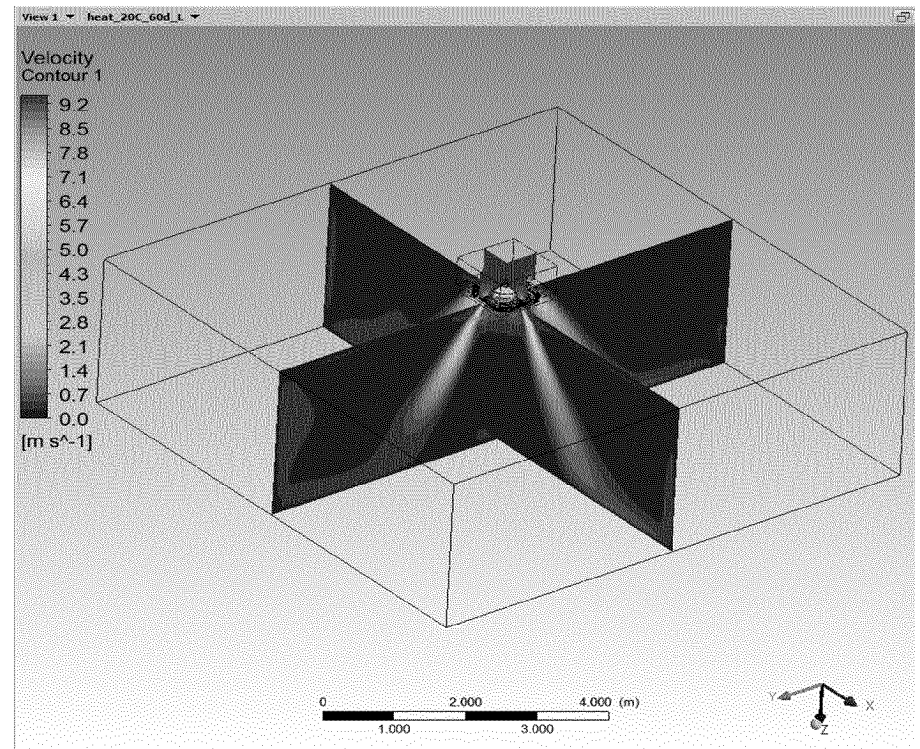


Figure 16

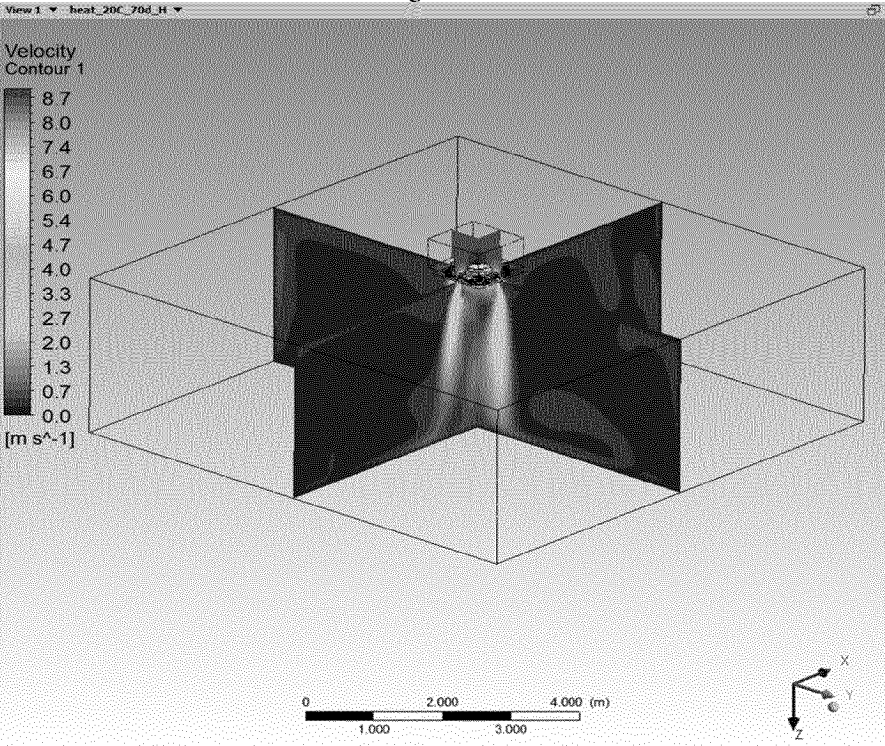


Figure 17

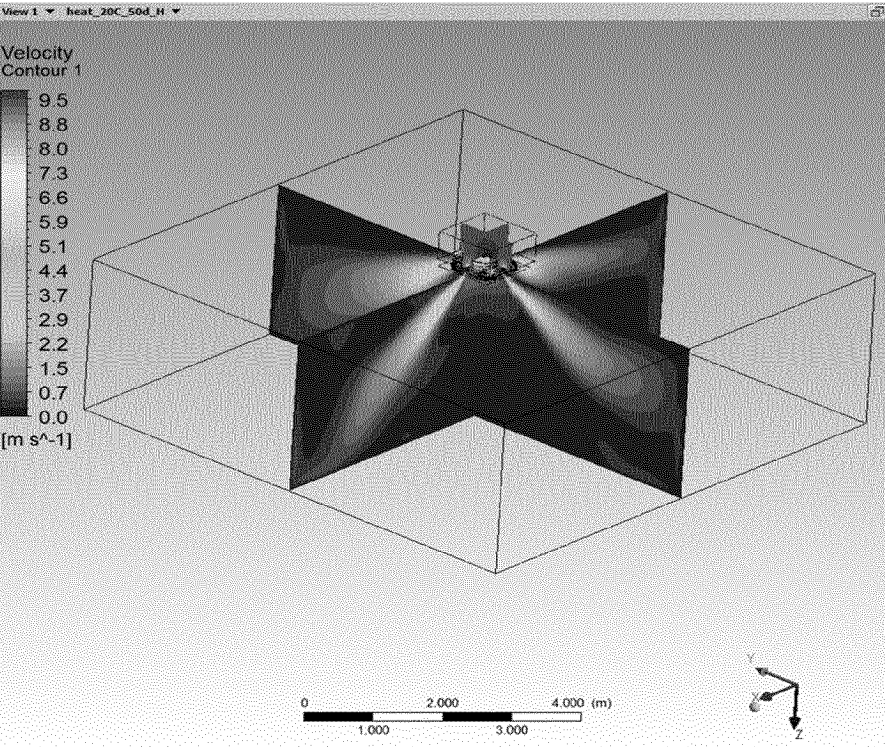


Figure 18

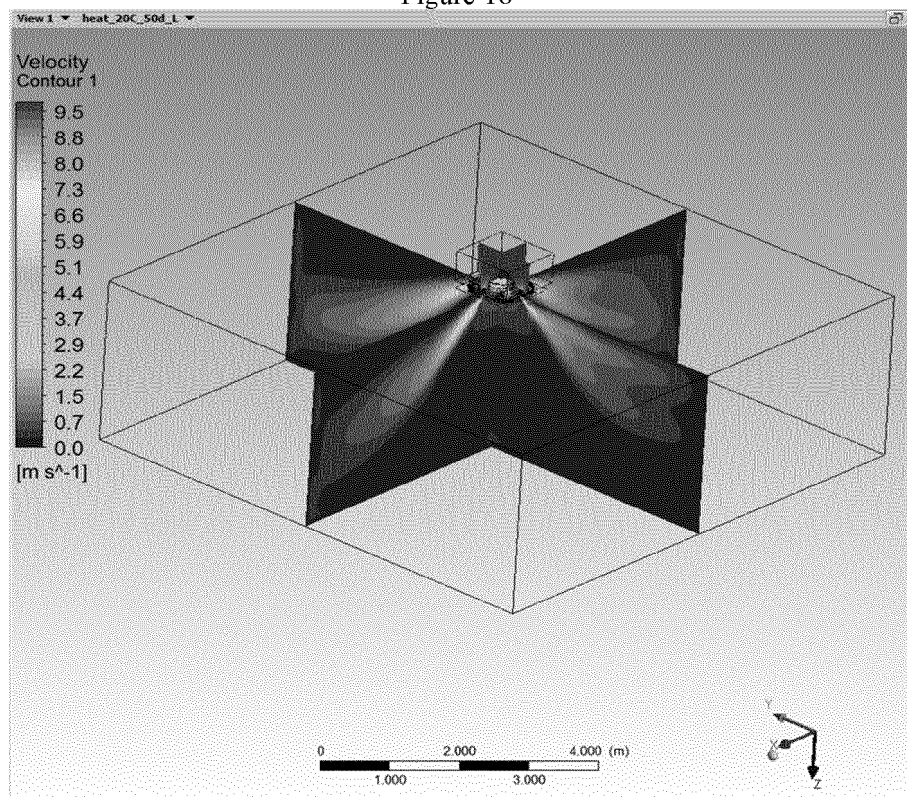


Figure 19

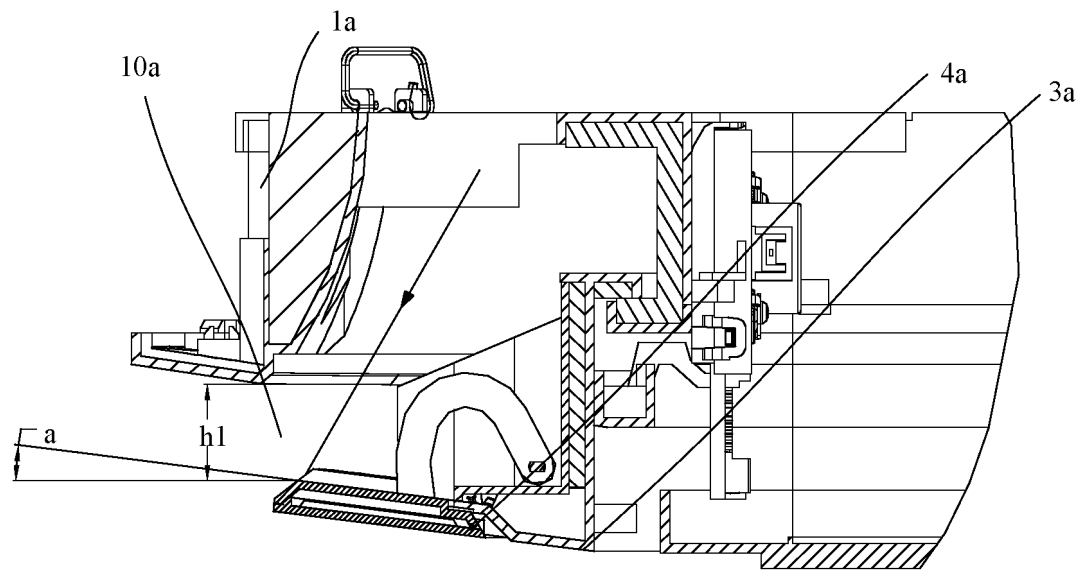


Figure 20

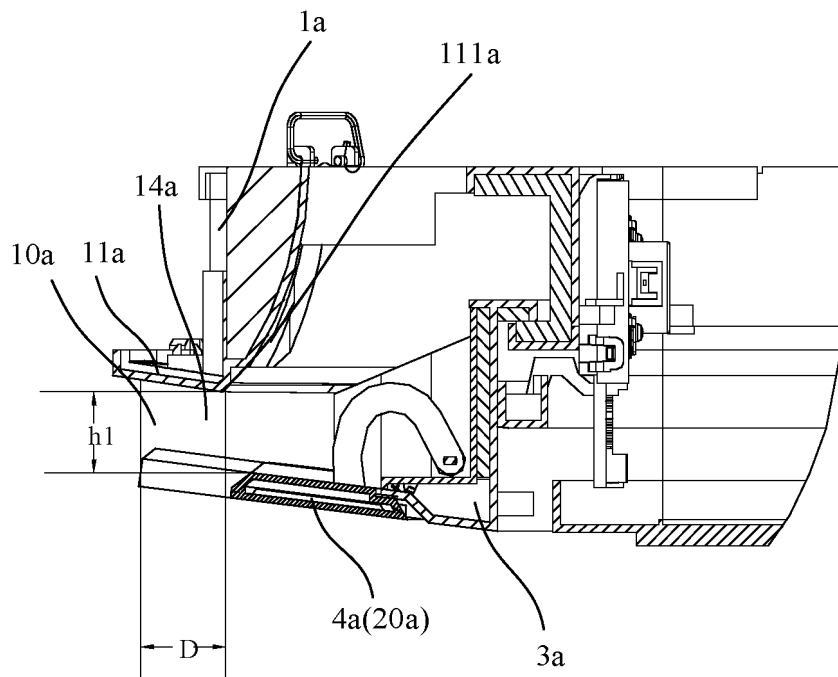


Figure 21

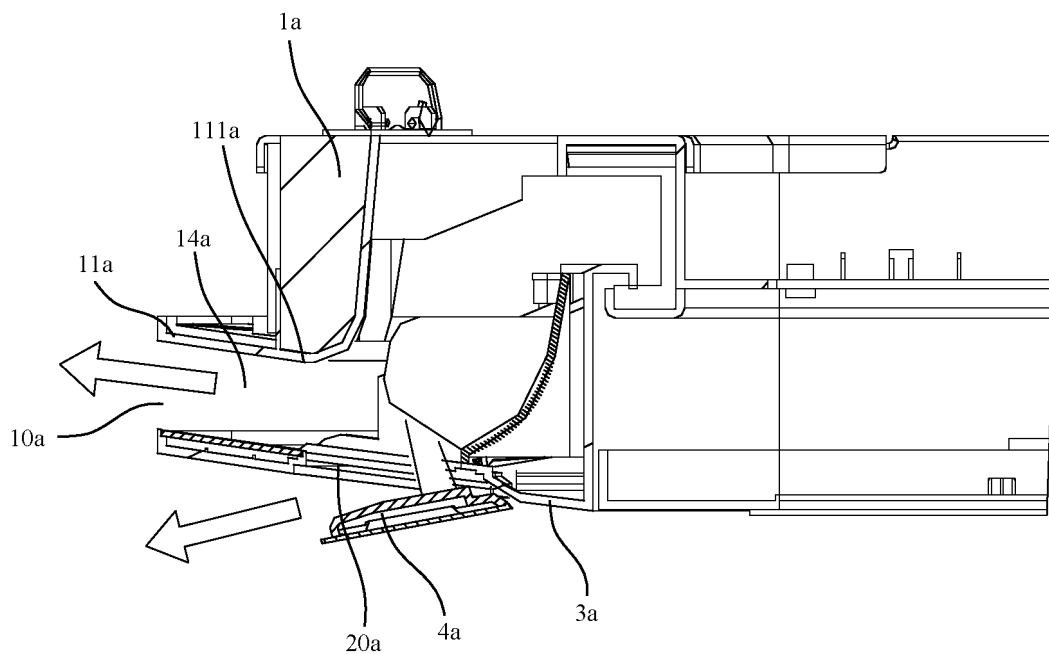


Figure 22

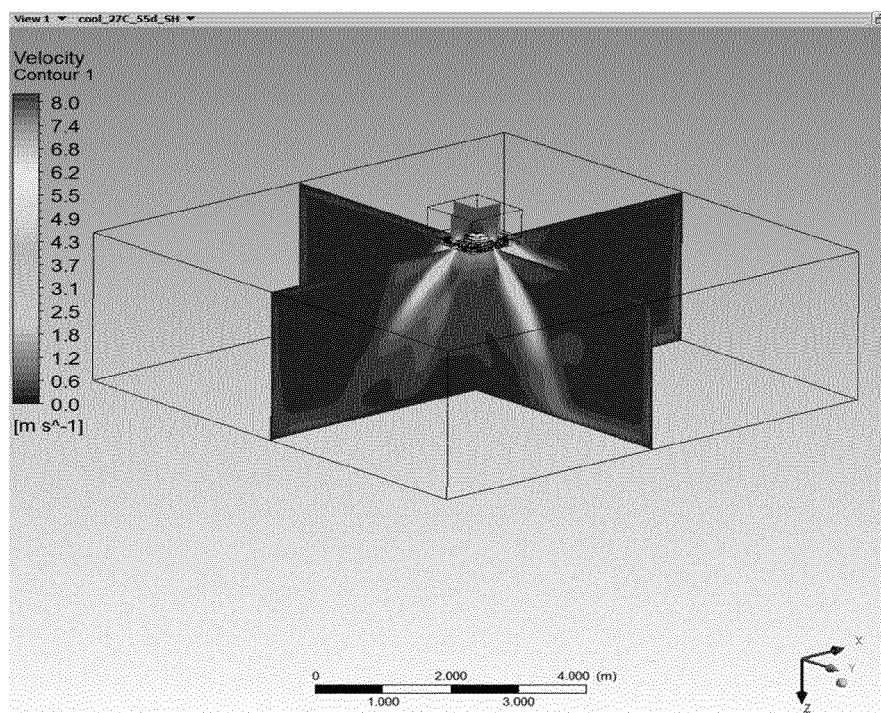


Figure 23

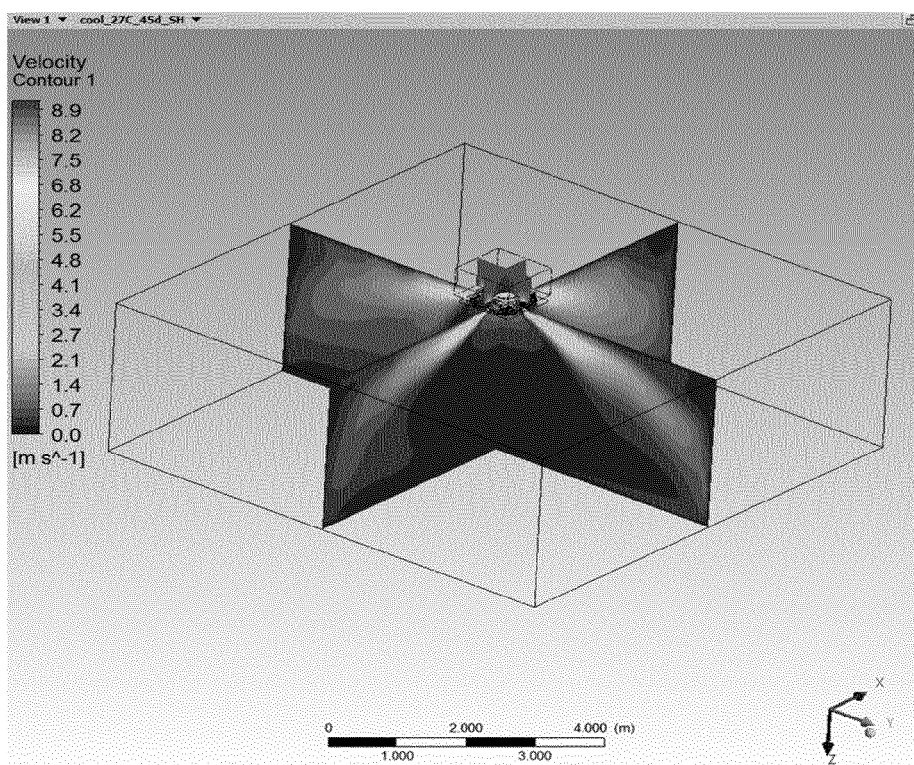


Figure 24

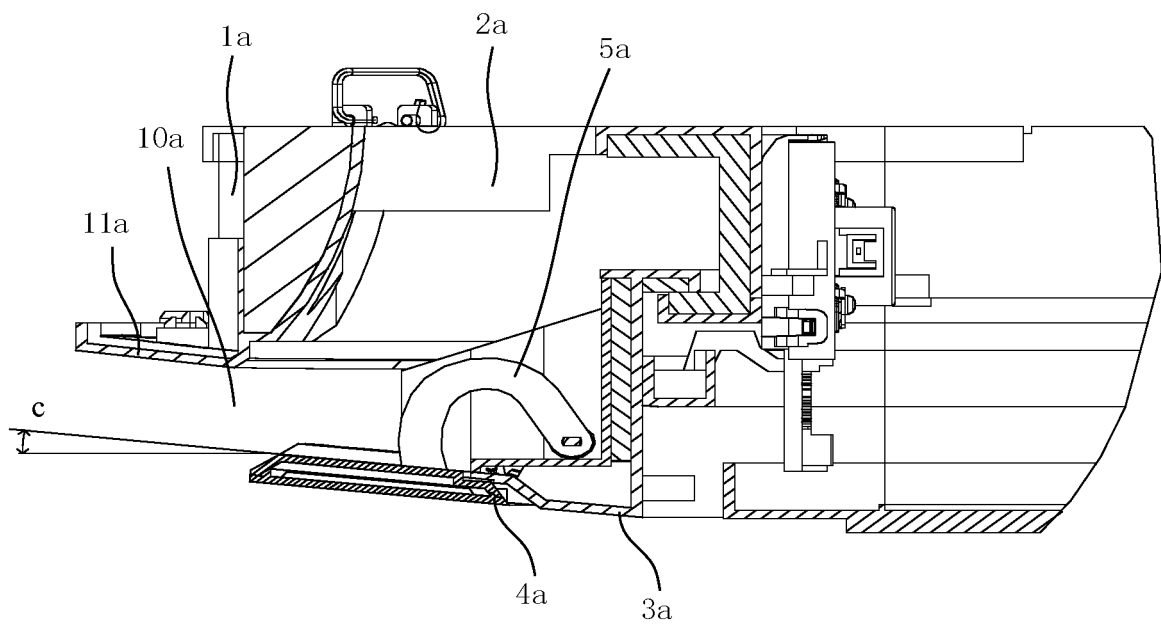


Figure 25

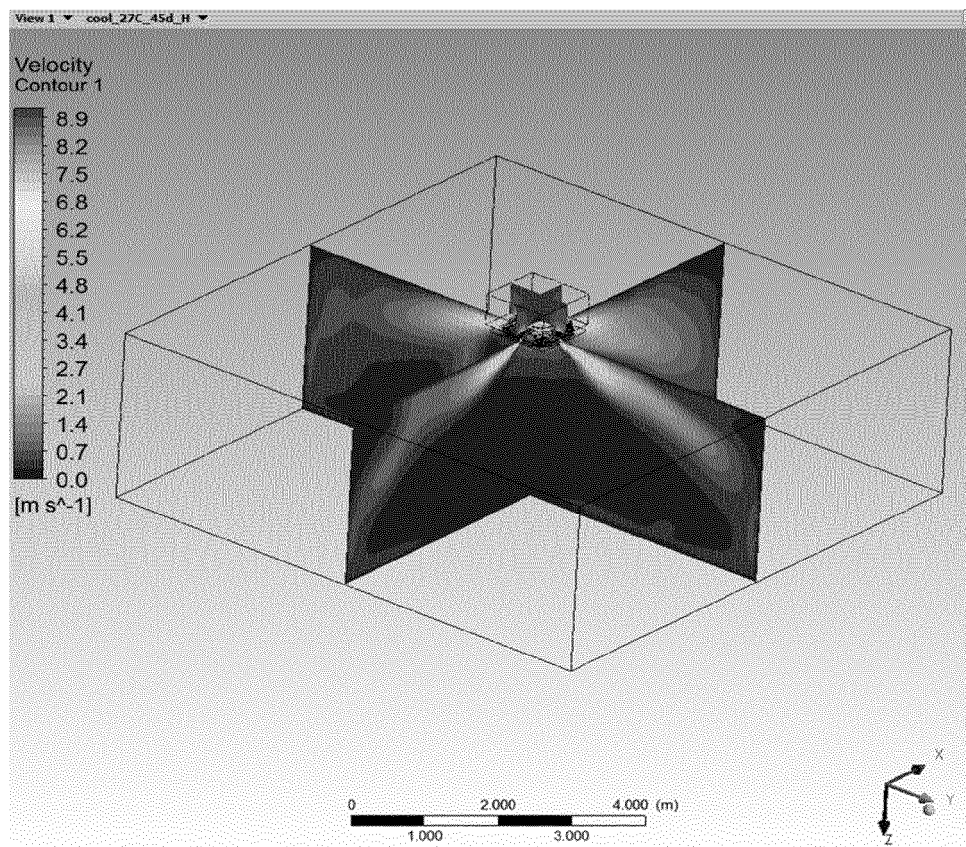


Figure 26

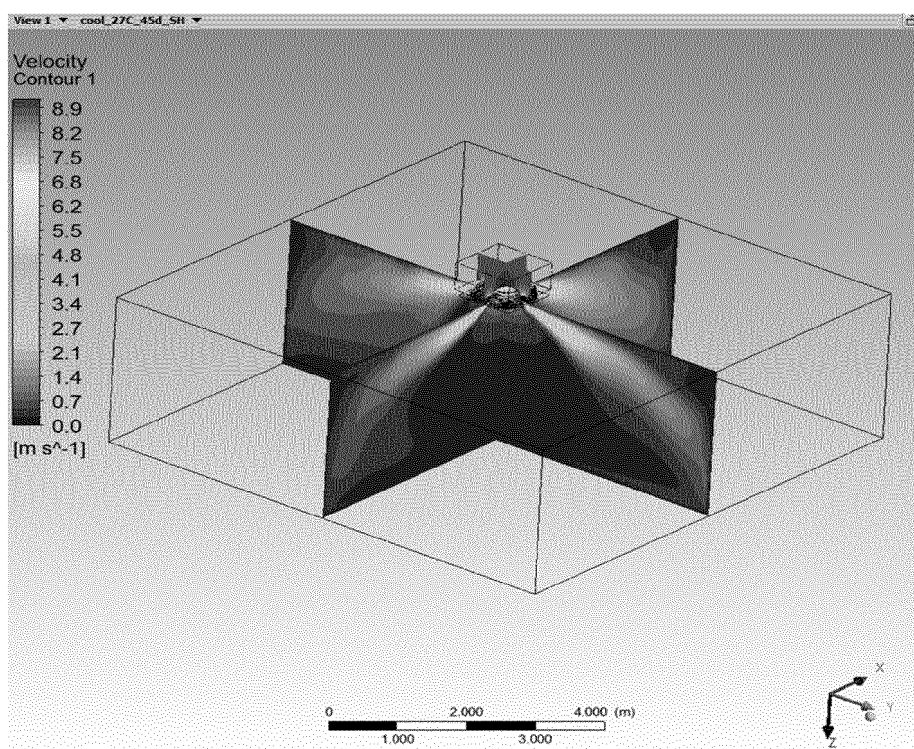


Figure 27

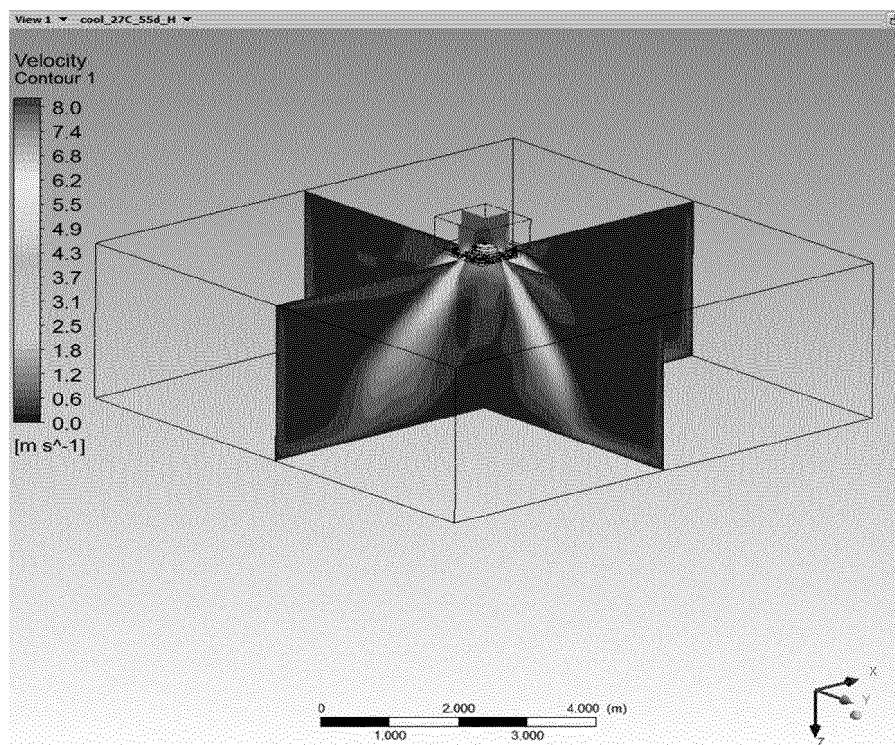


Figure 28

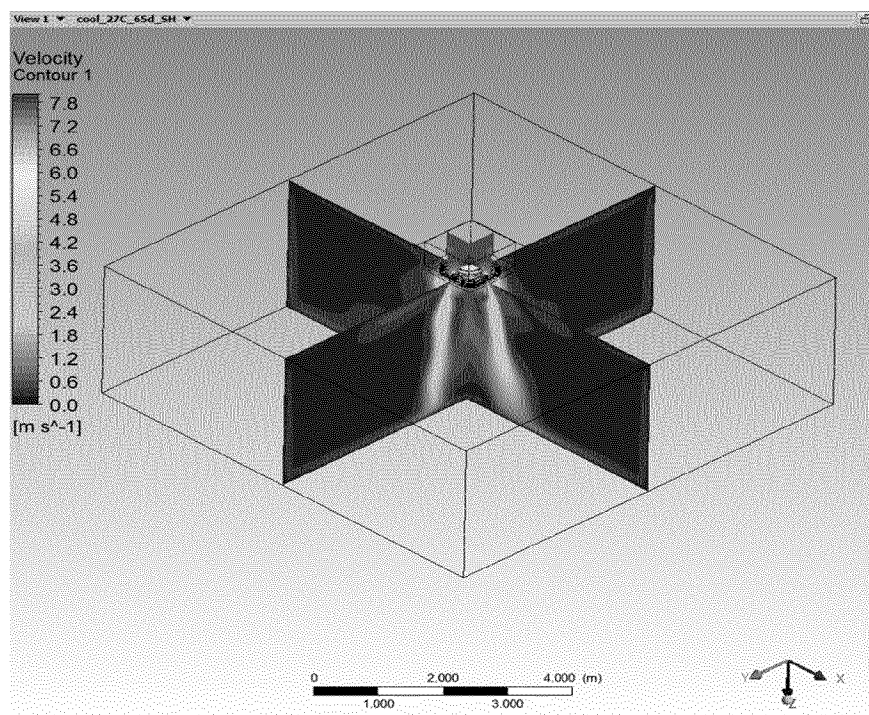


Figure 29

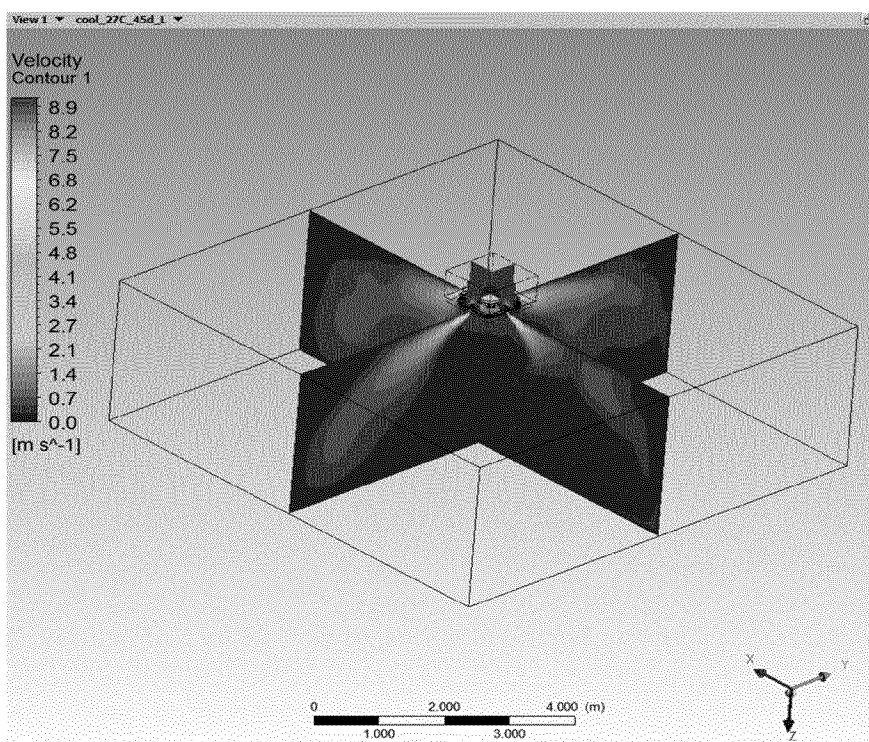


Figure 30

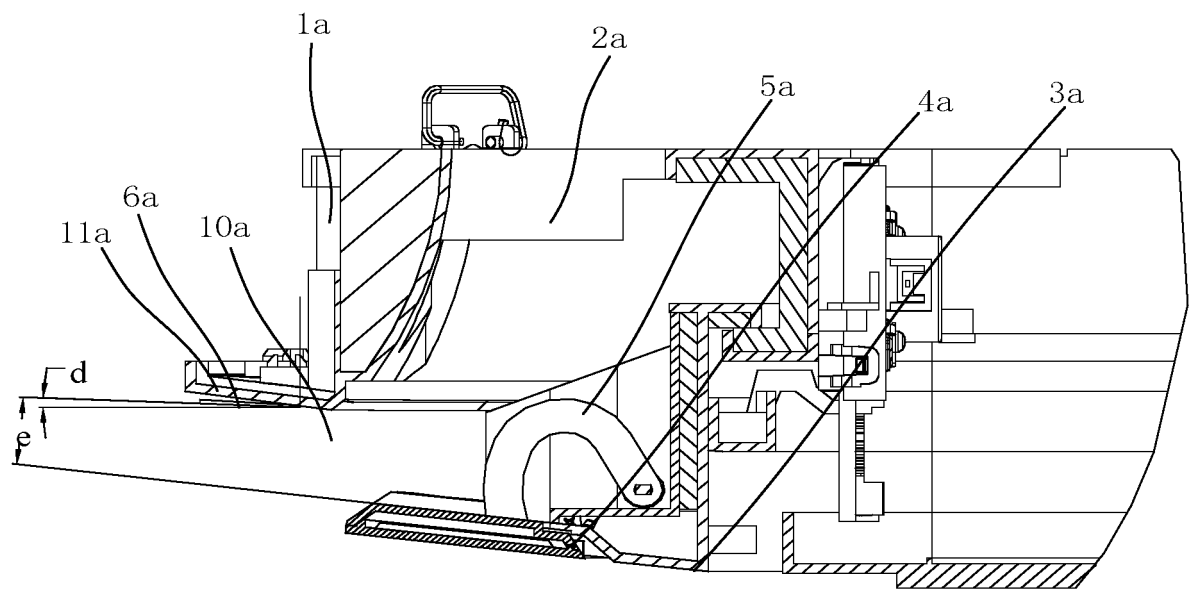


Figure 31

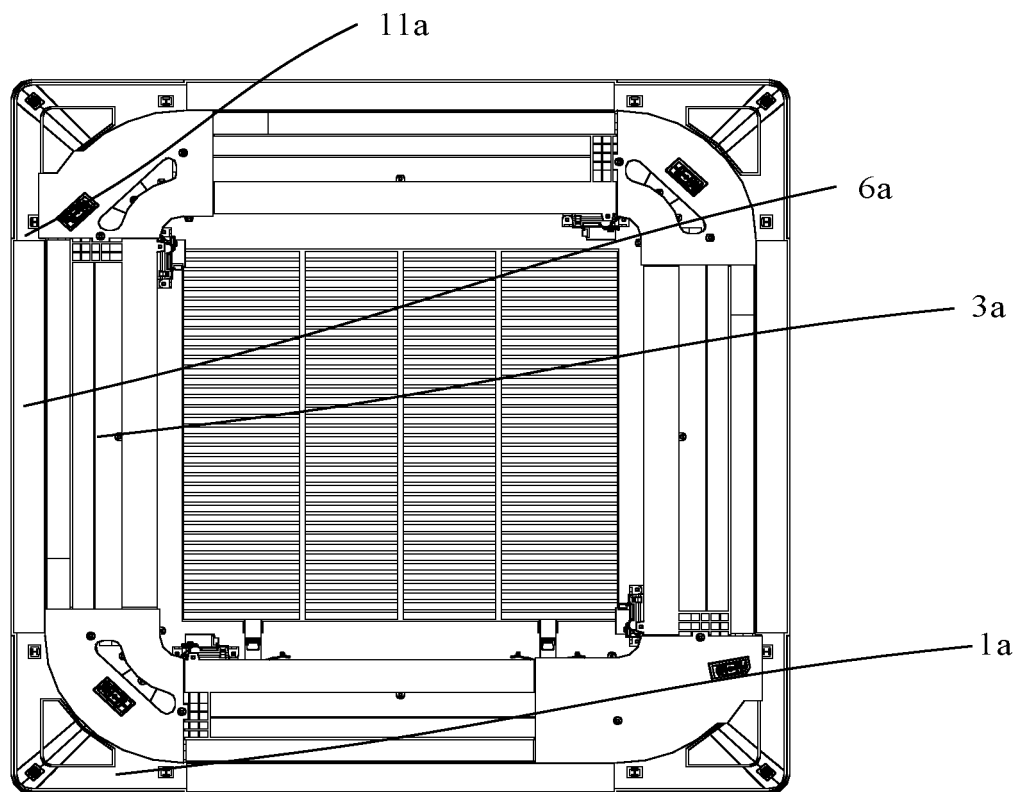


Figure 32

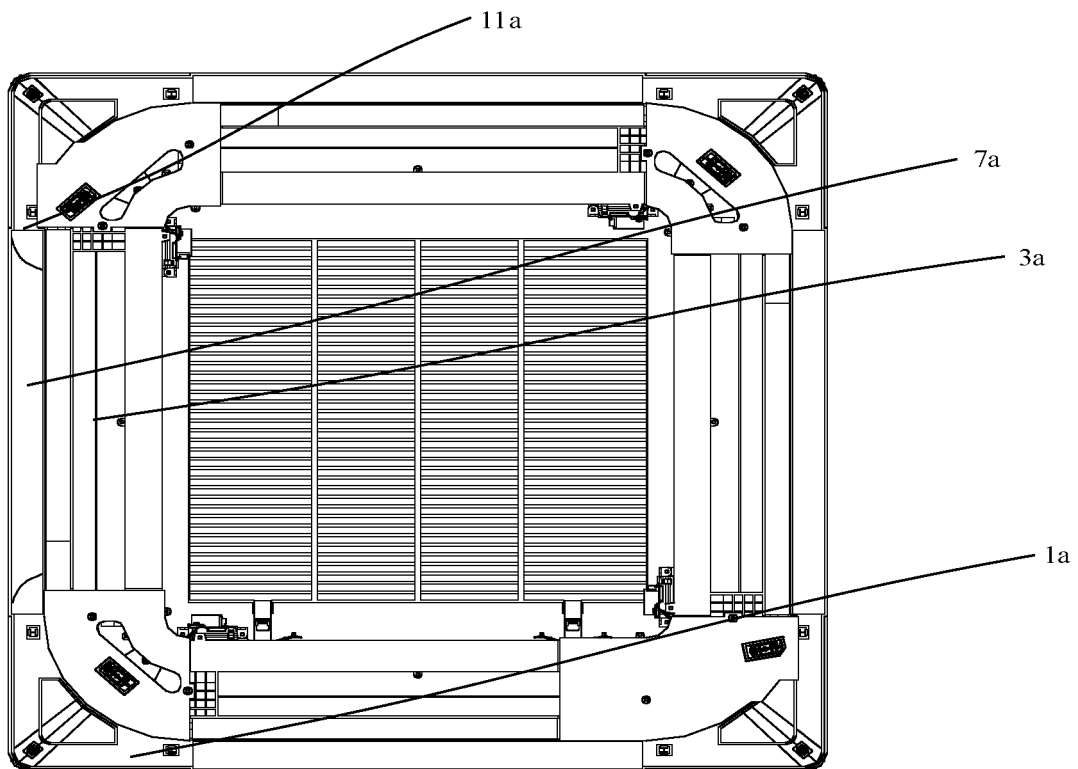


Figure 33

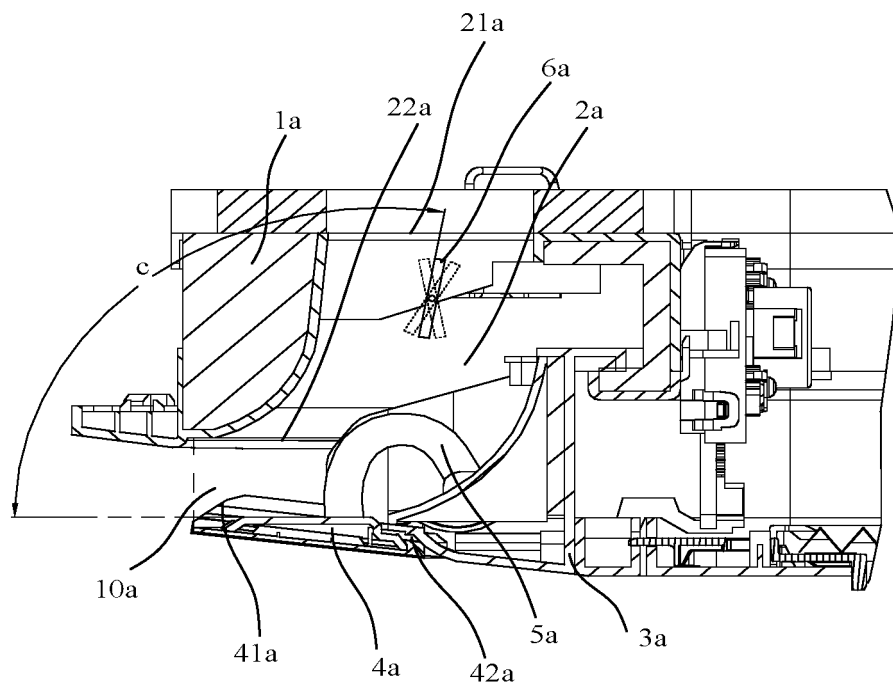


Figure 34

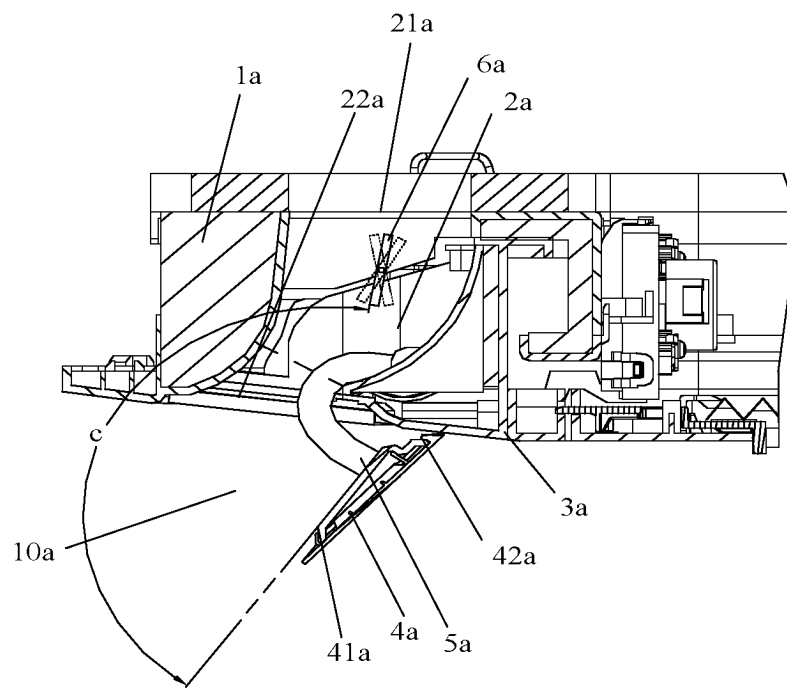


Figure 35

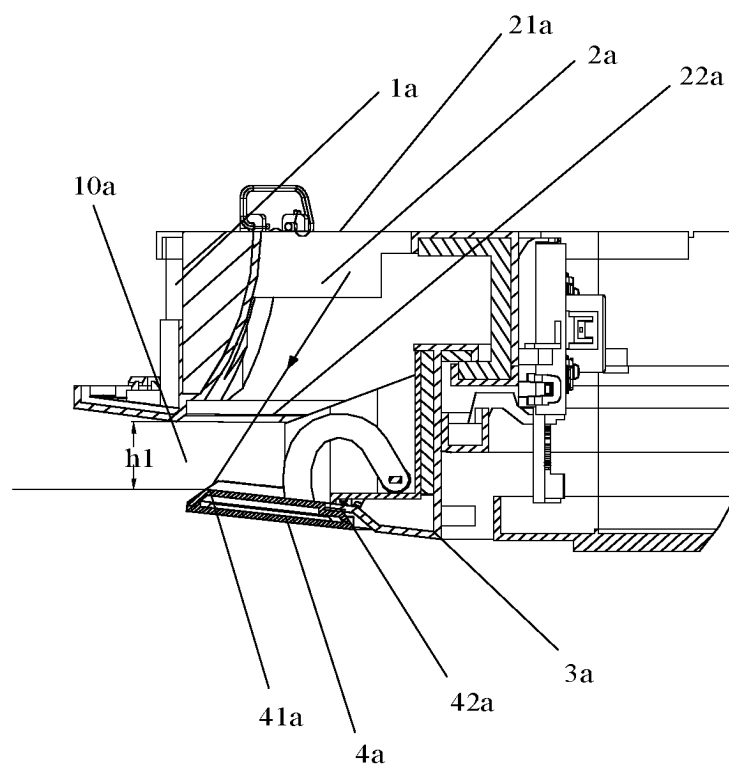


Figure 36

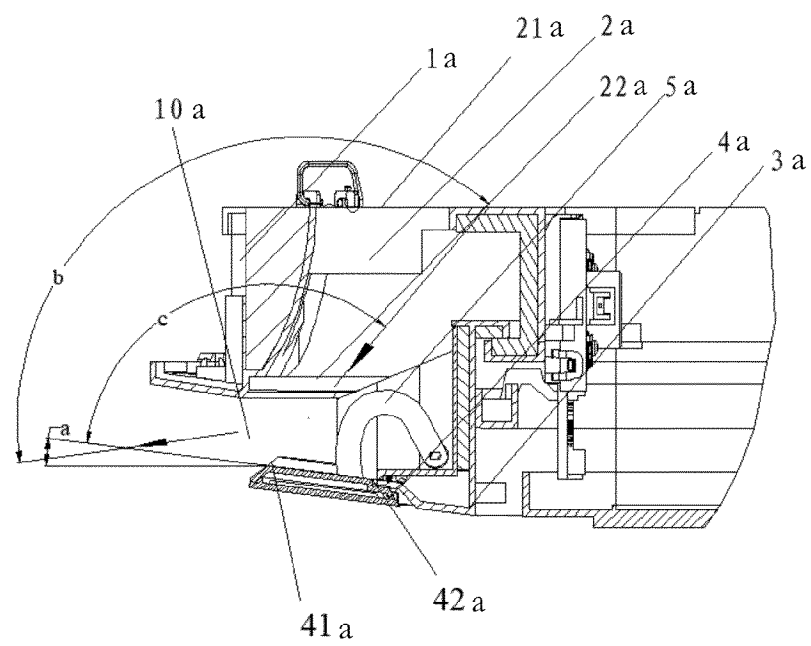


Figure 37

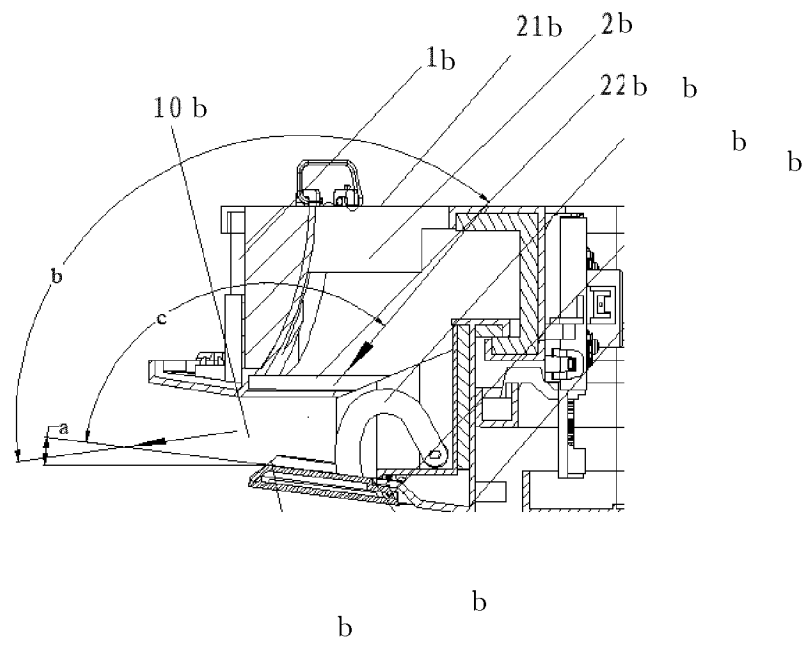


Figure 38

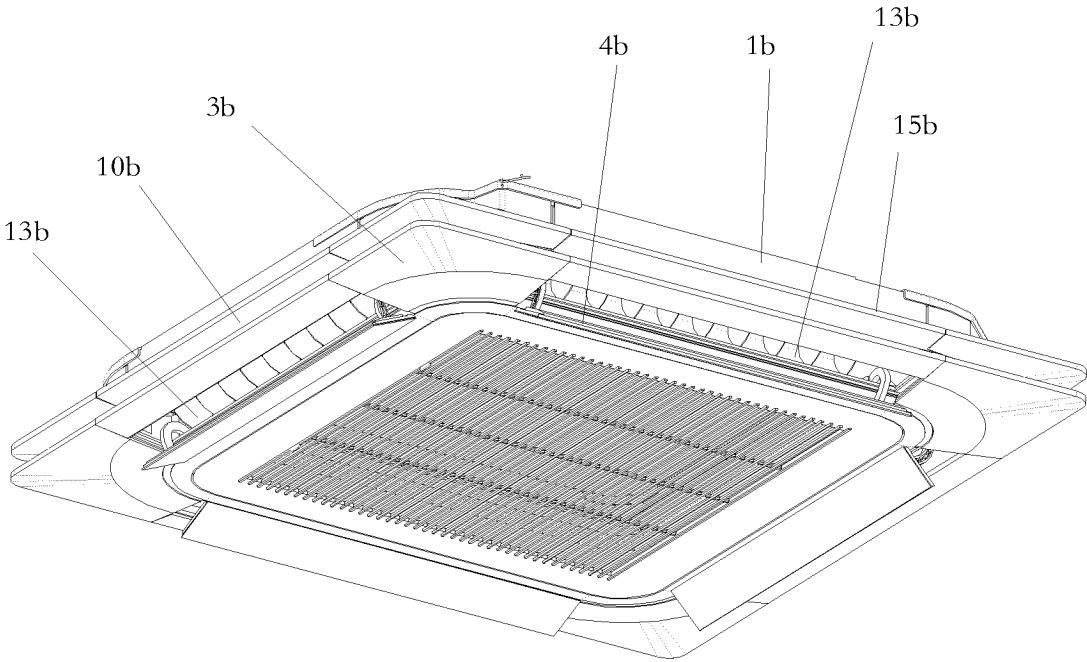


Figure 39

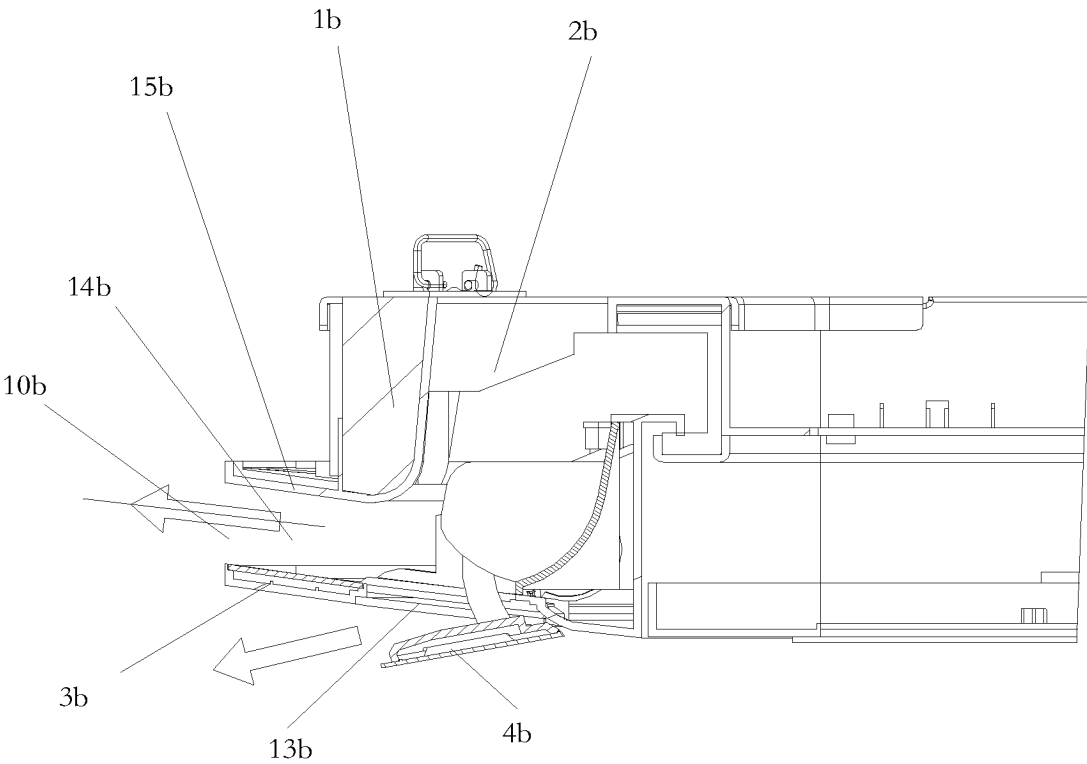


Figure 40

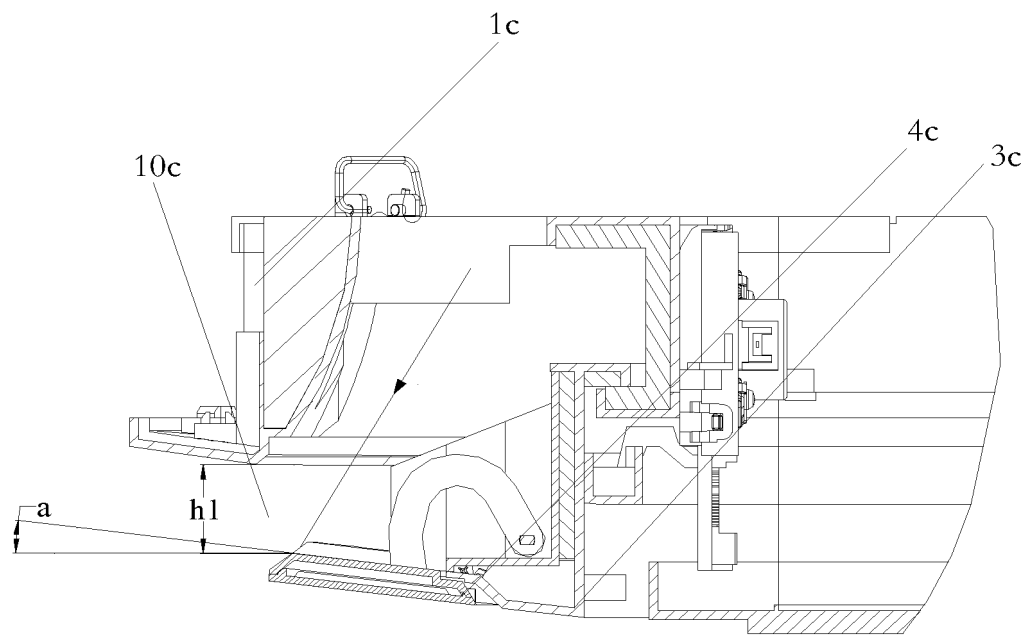


Figure 41

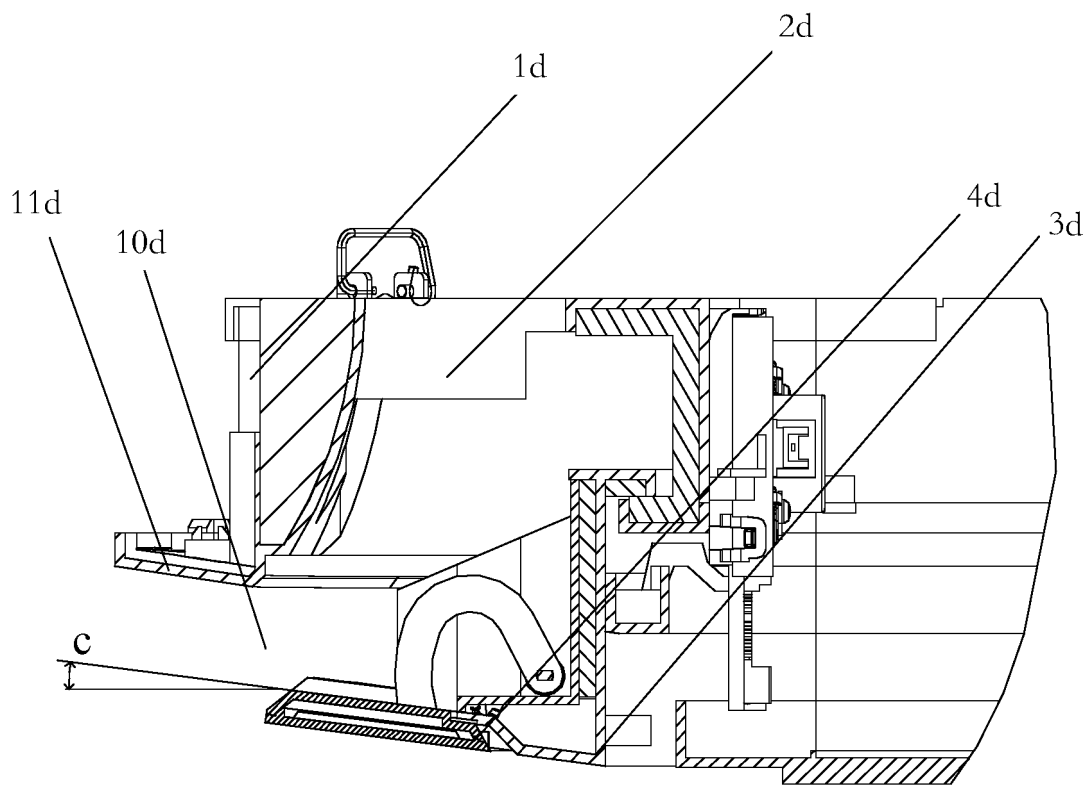


Figure 42

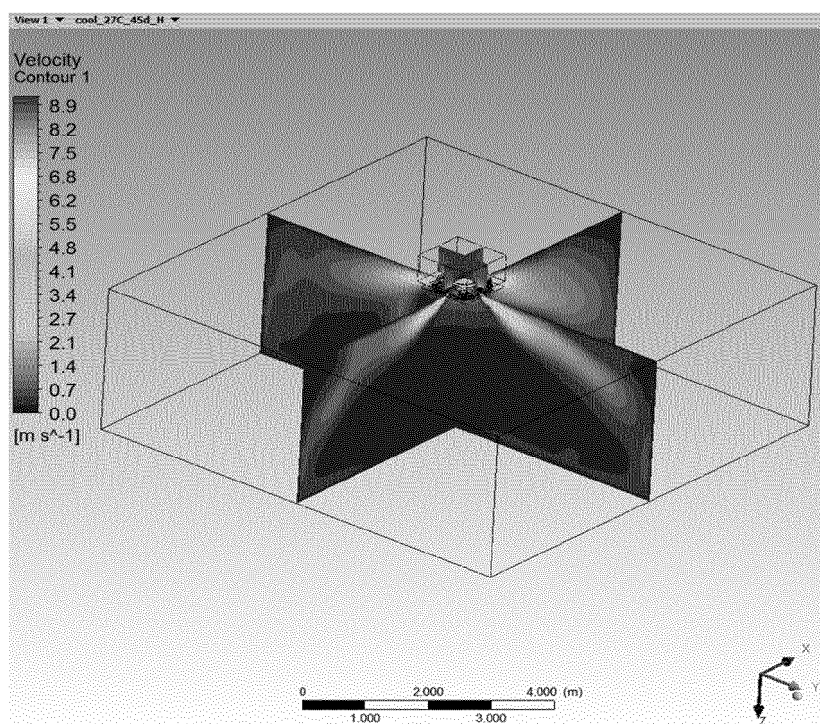


Figure 43

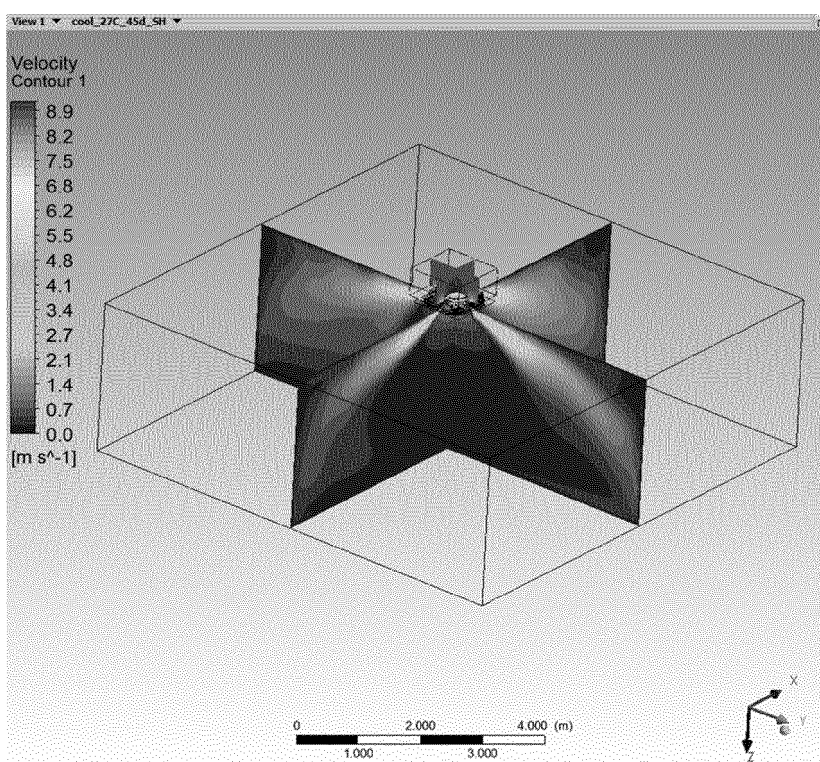


Figure 44

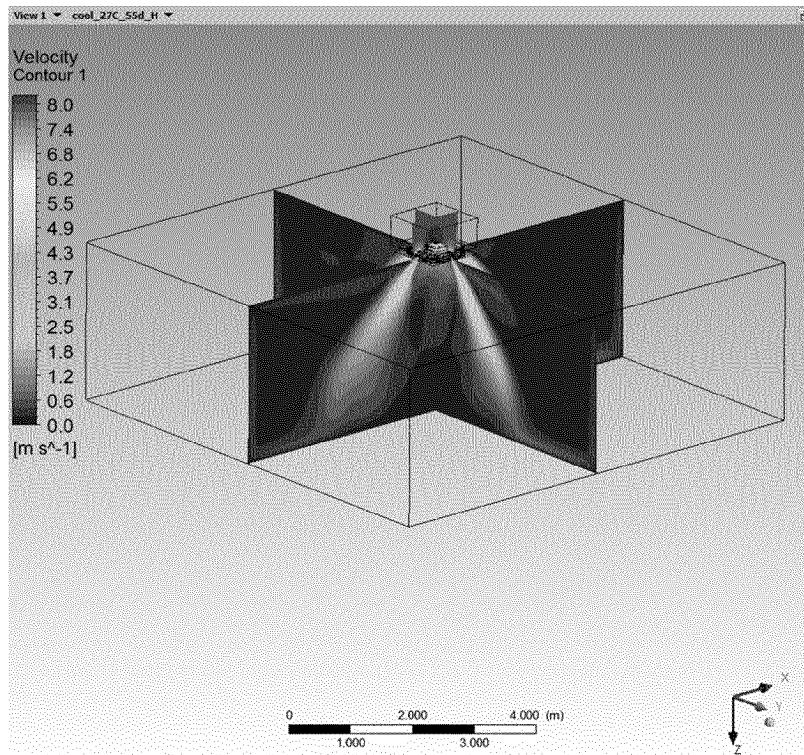


Figure 45

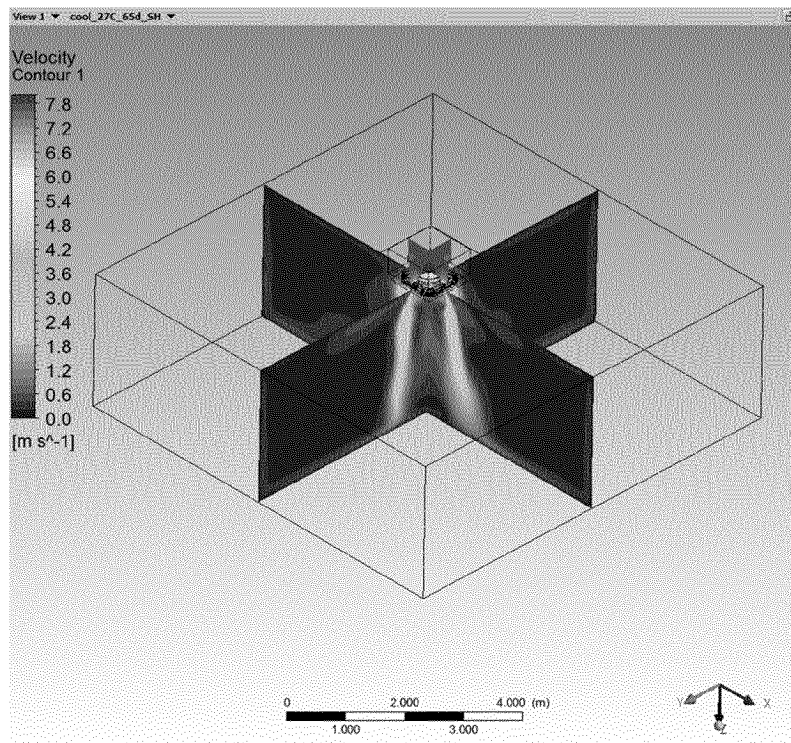


Figure 46

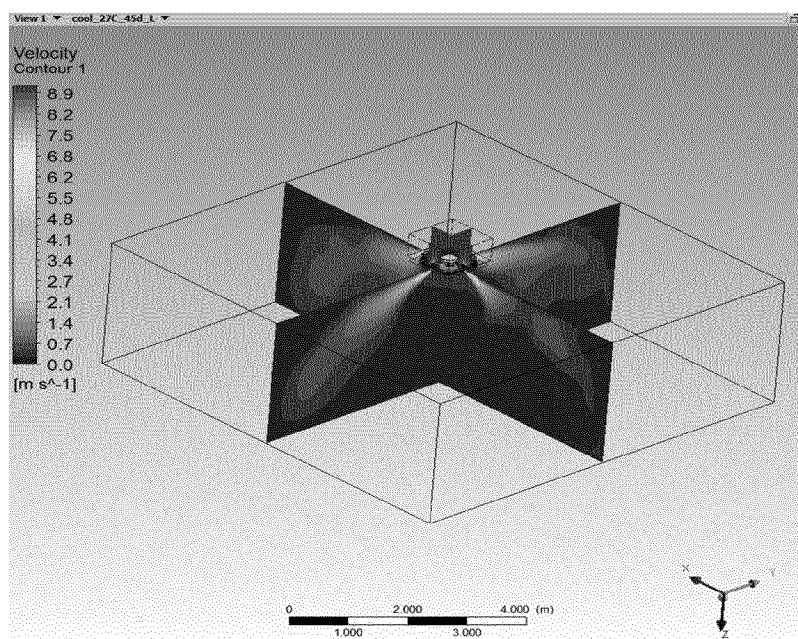


Figure 47

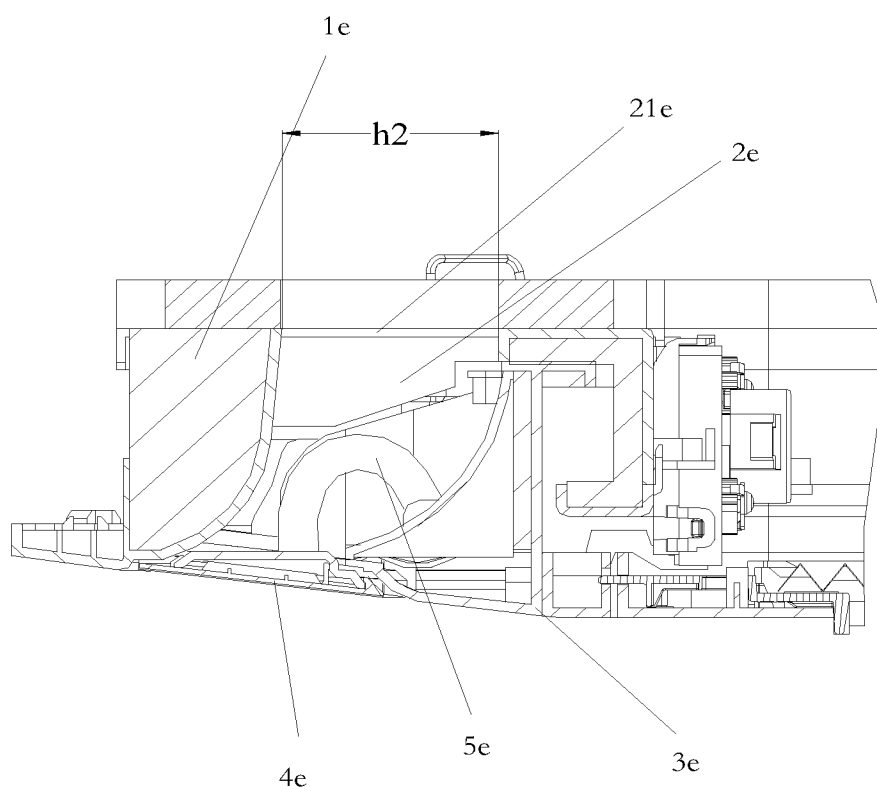


Figure 48

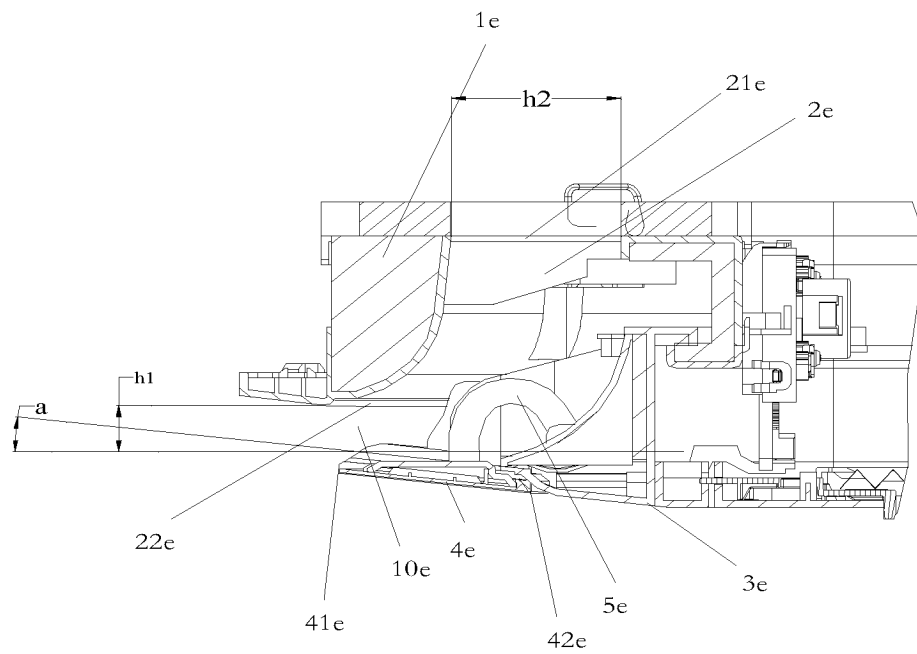


Figure 49

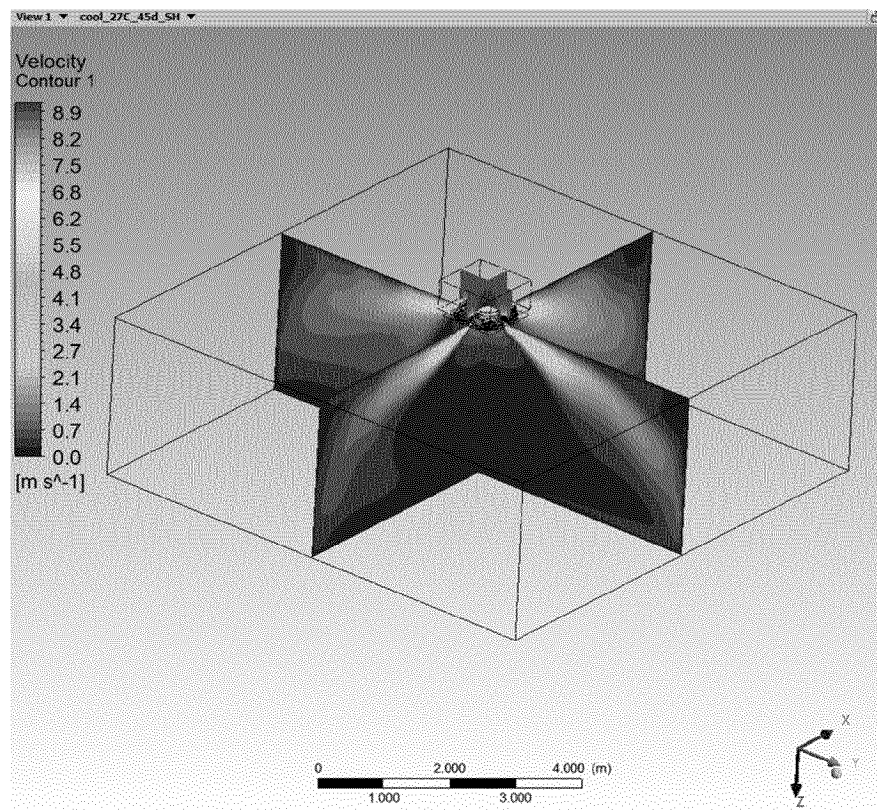


Figure 50

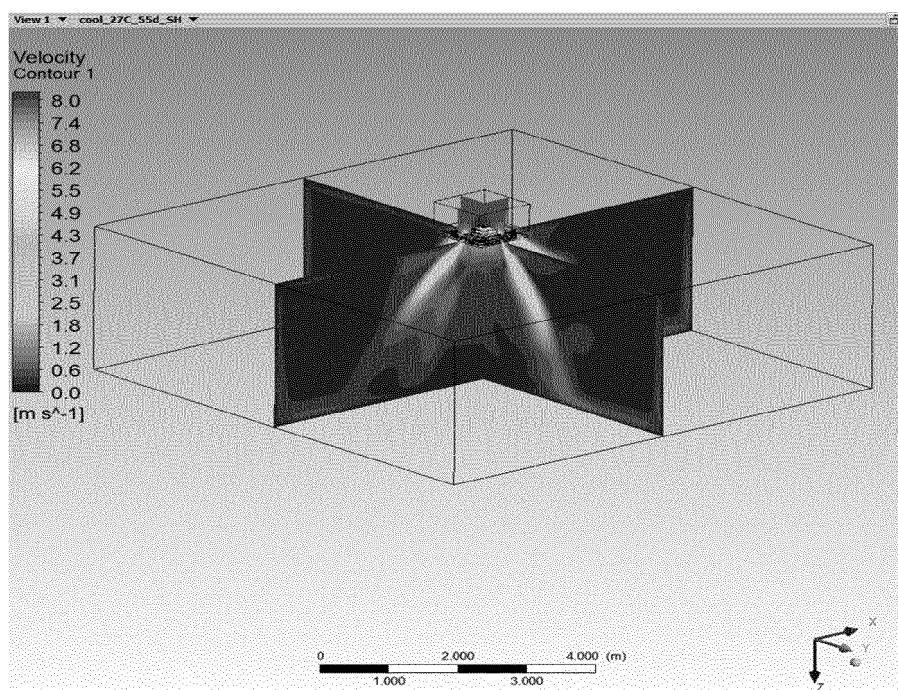


Figure 51

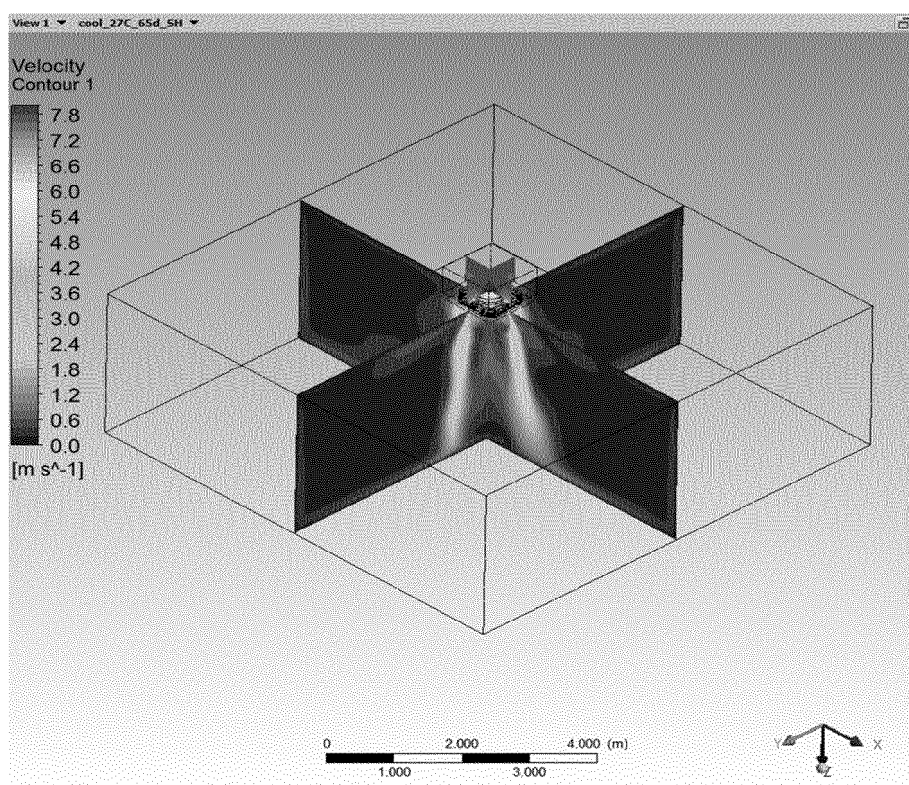


Figure 52

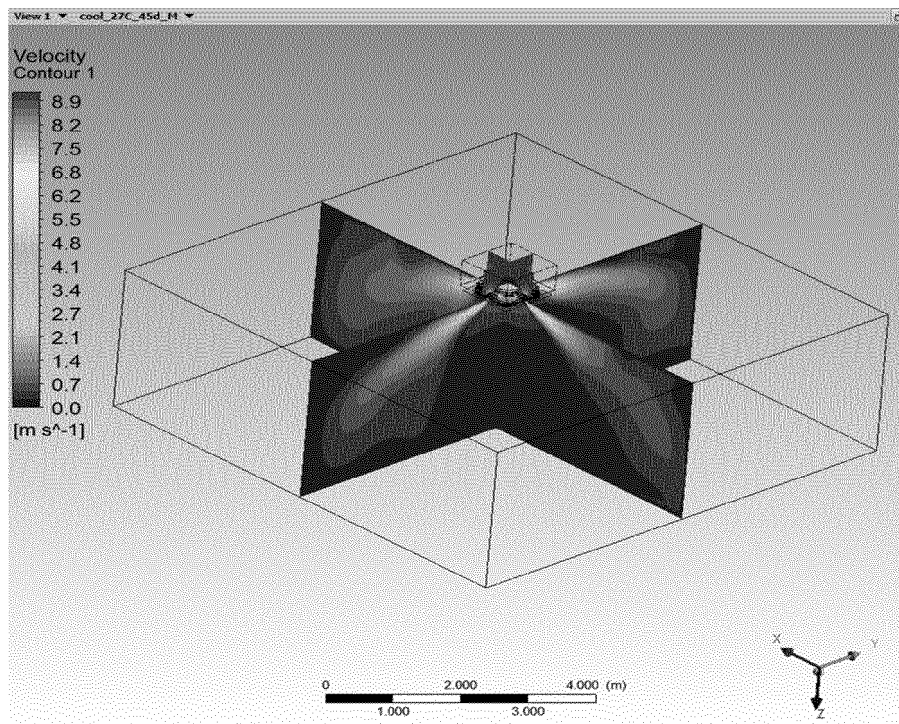


Figure 53

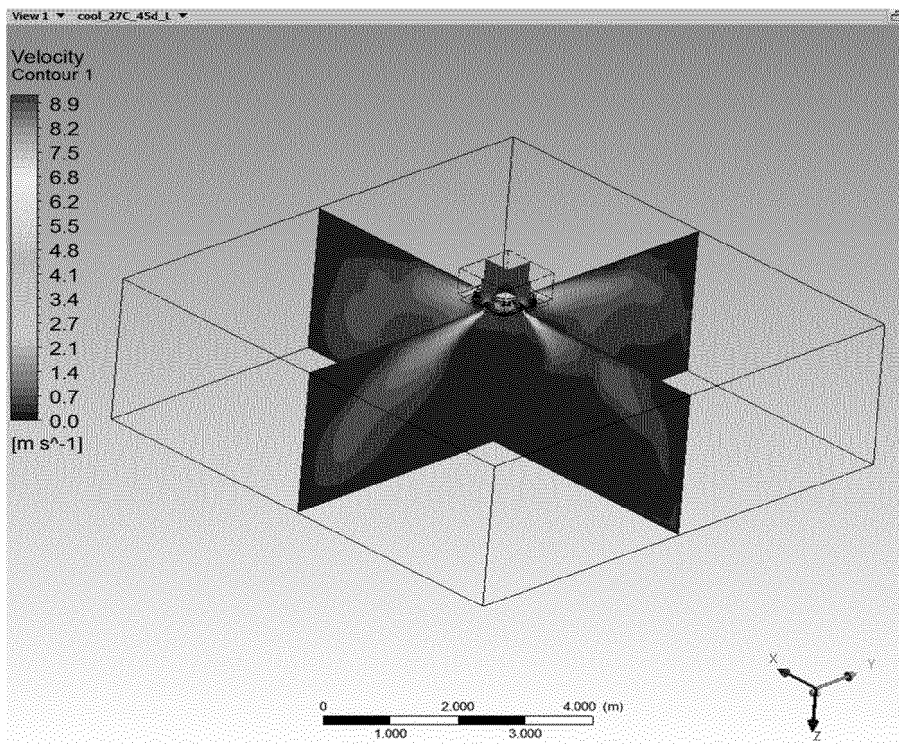


Figure 54

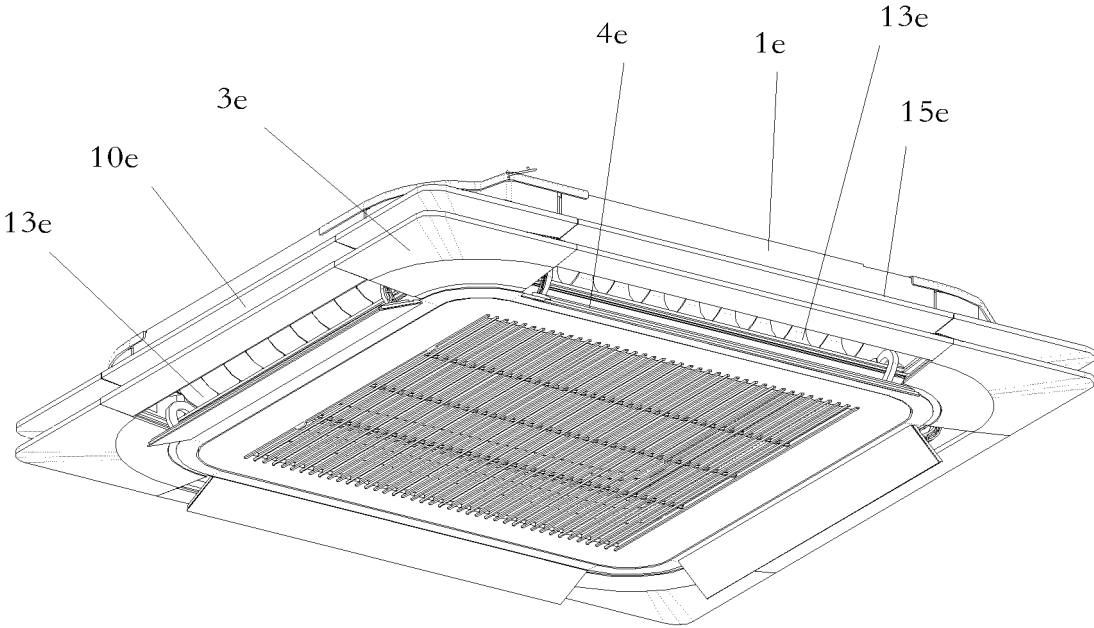


Figure 55

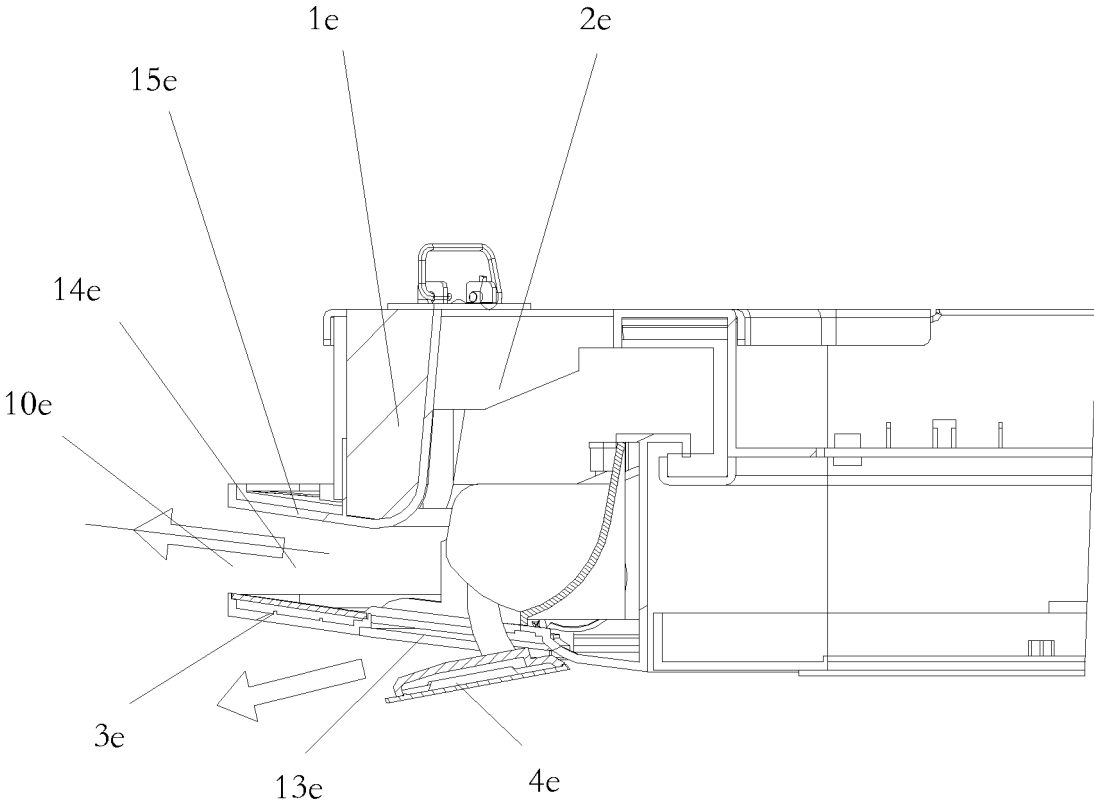


Figure 56

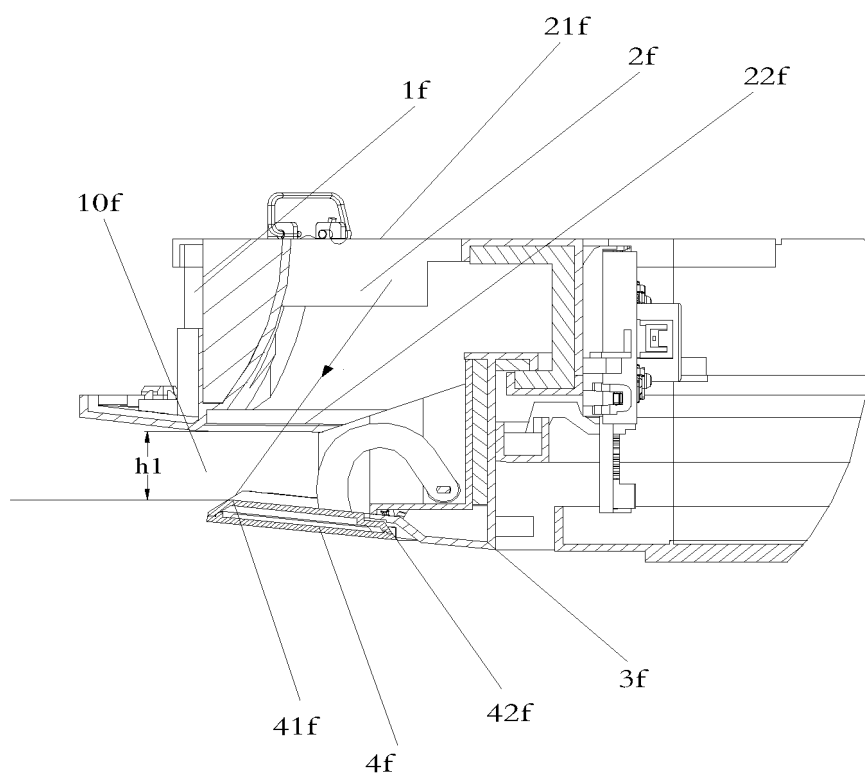


Figure 57

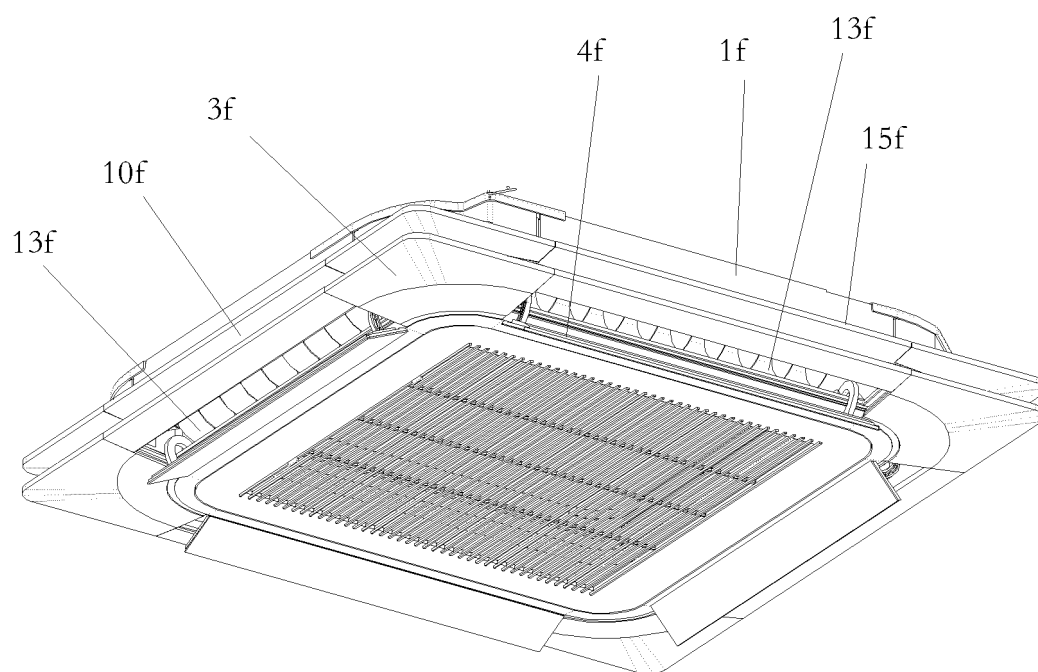


Figure 58

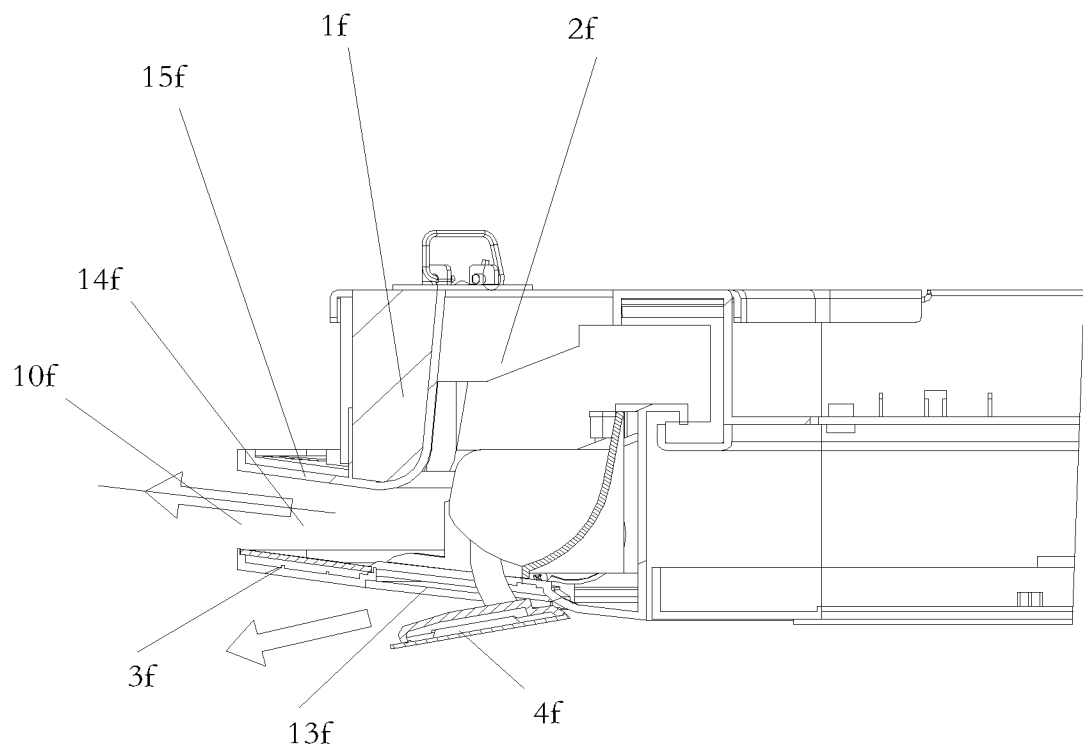


Figure 59

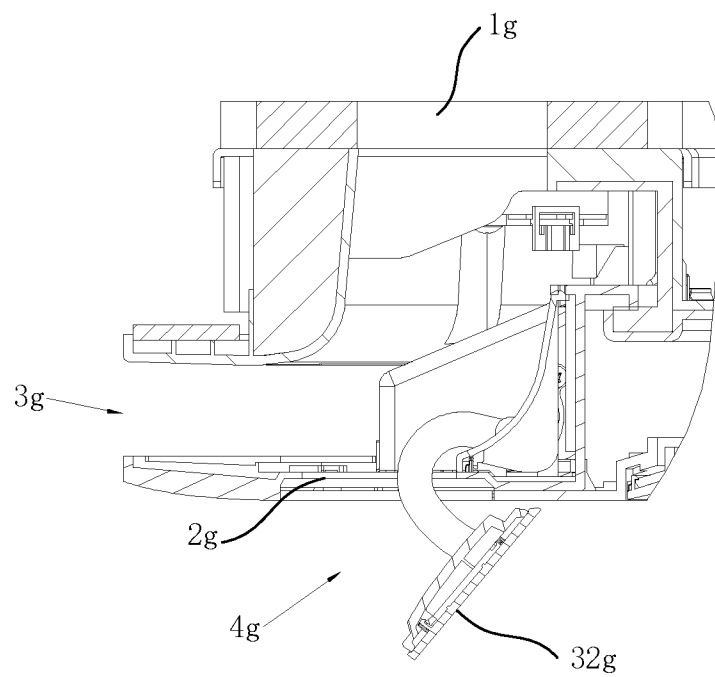


Figure 60

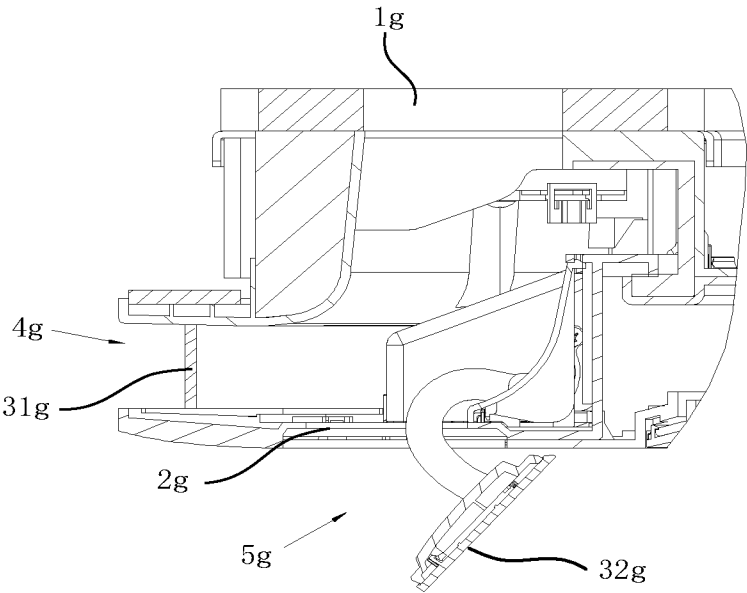


Figure 61

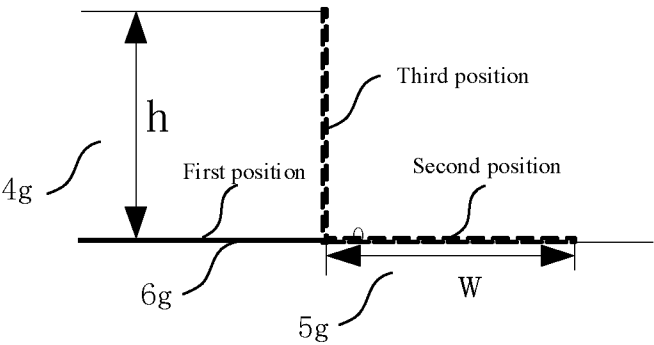


Figure 62

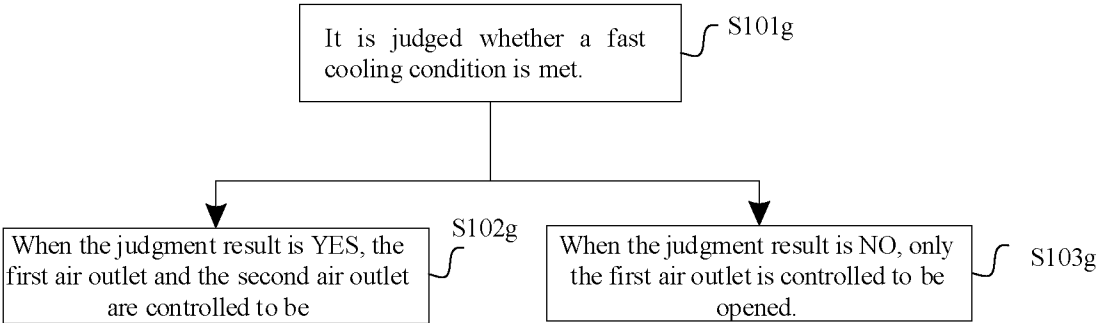


Figure 63

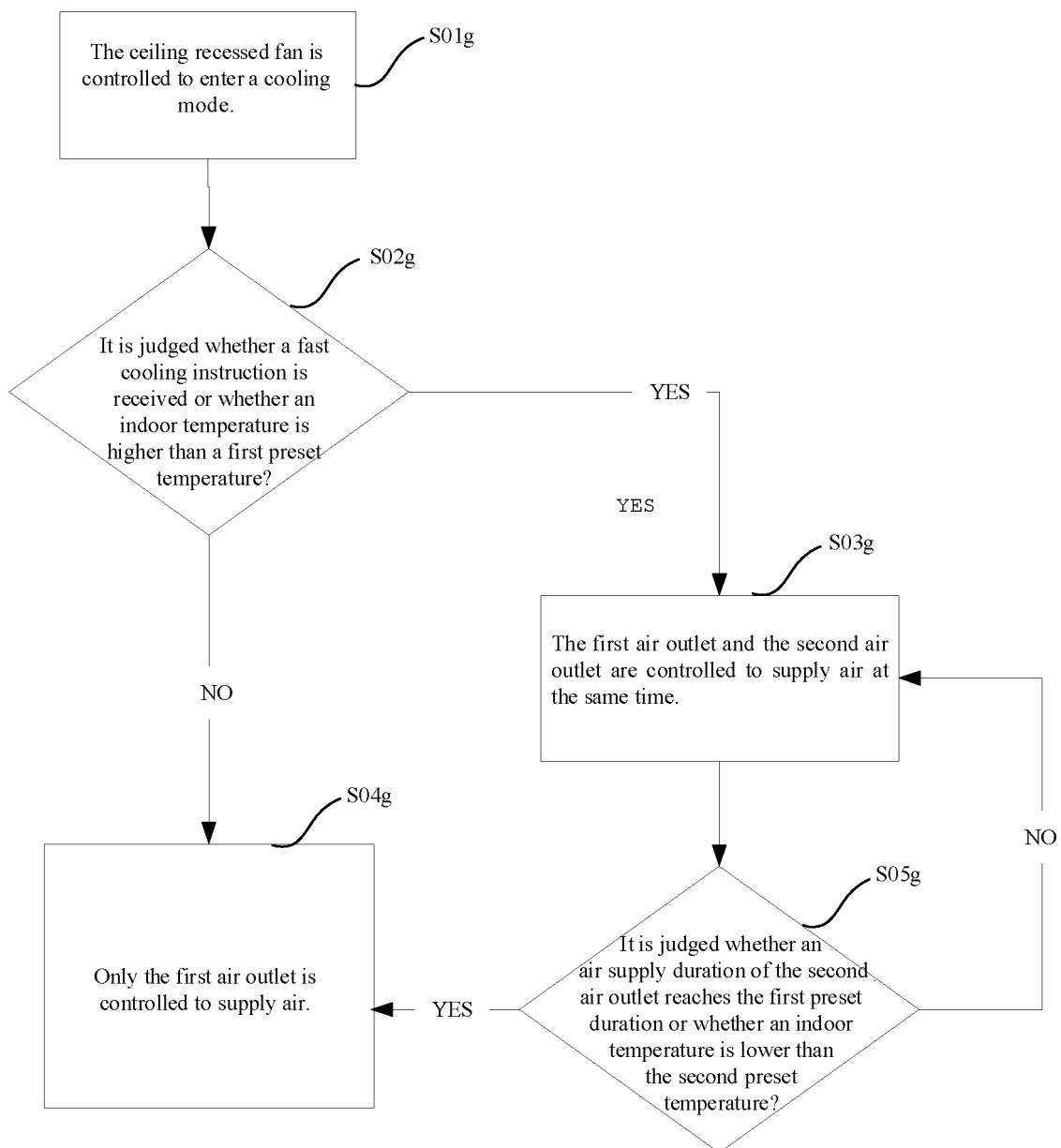


Figure 64

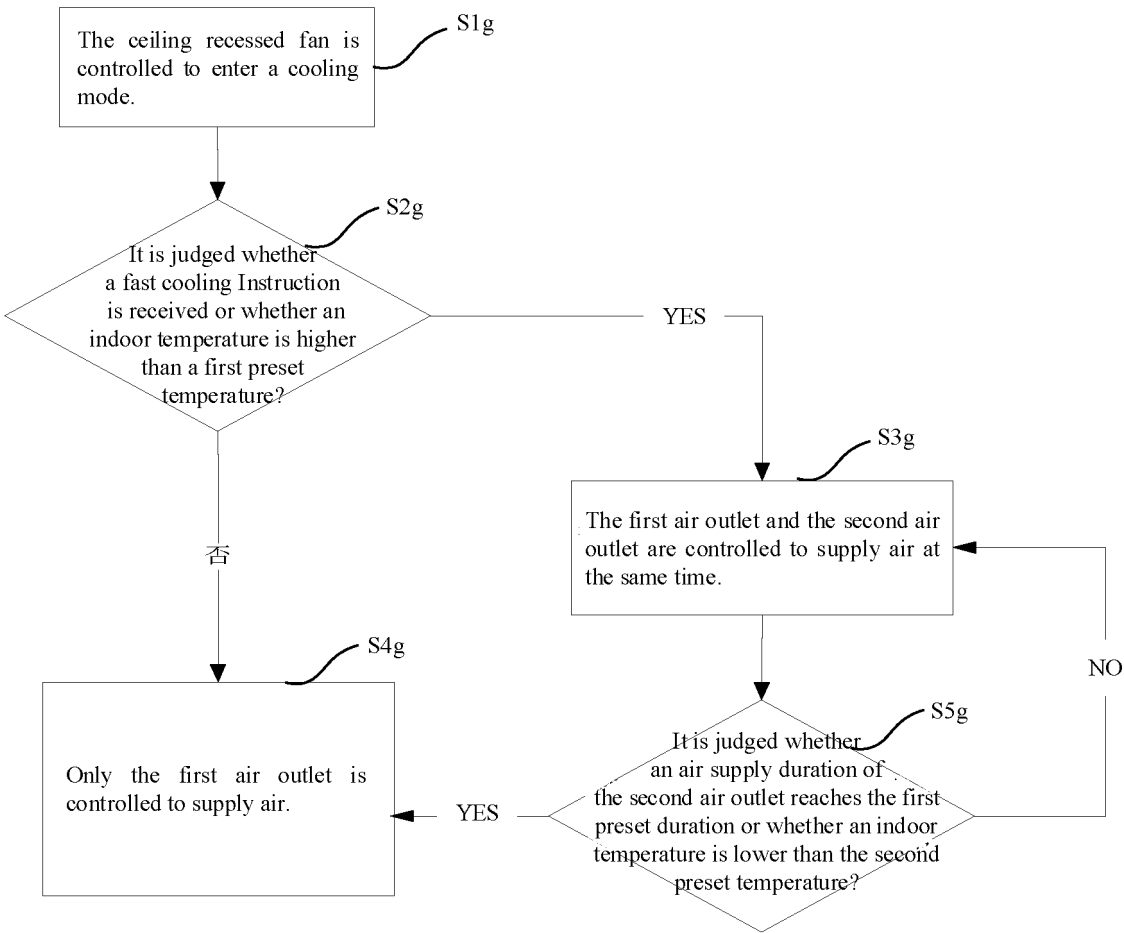


Figure 65

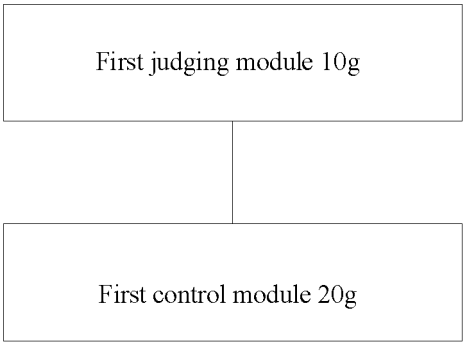


Figure 66

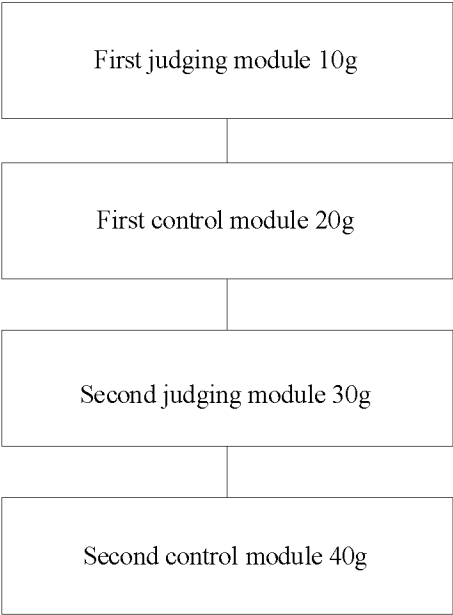


Figure 67

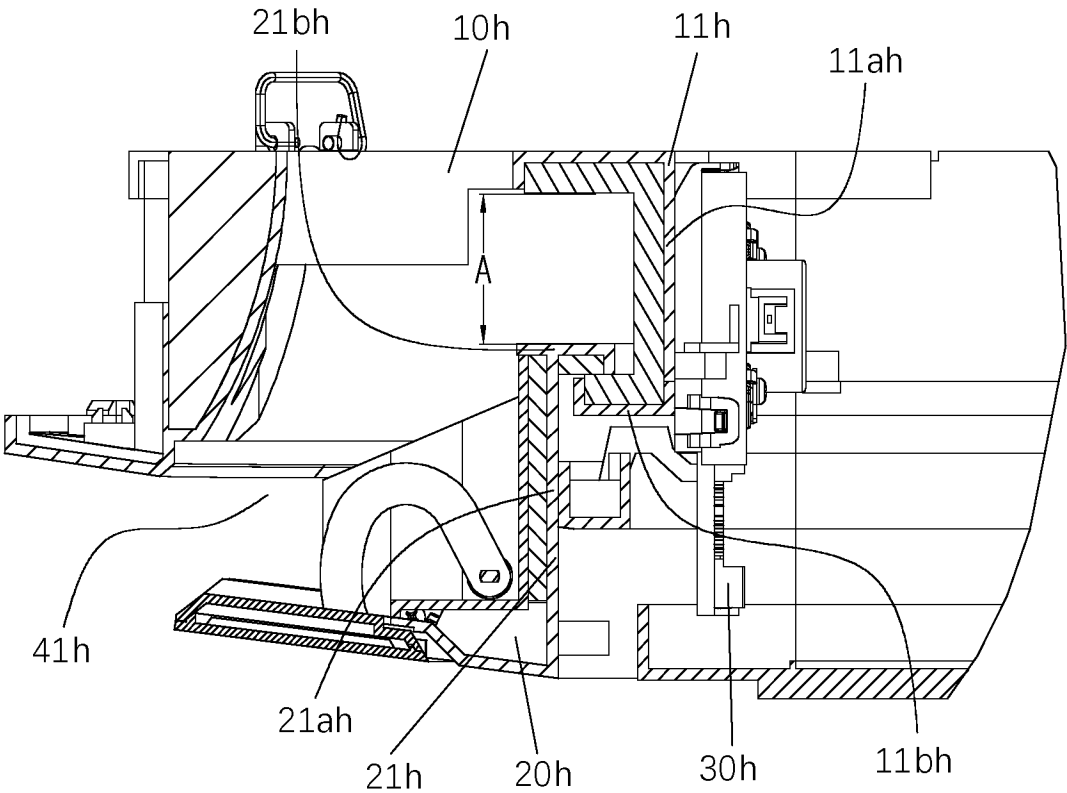


Figure 68

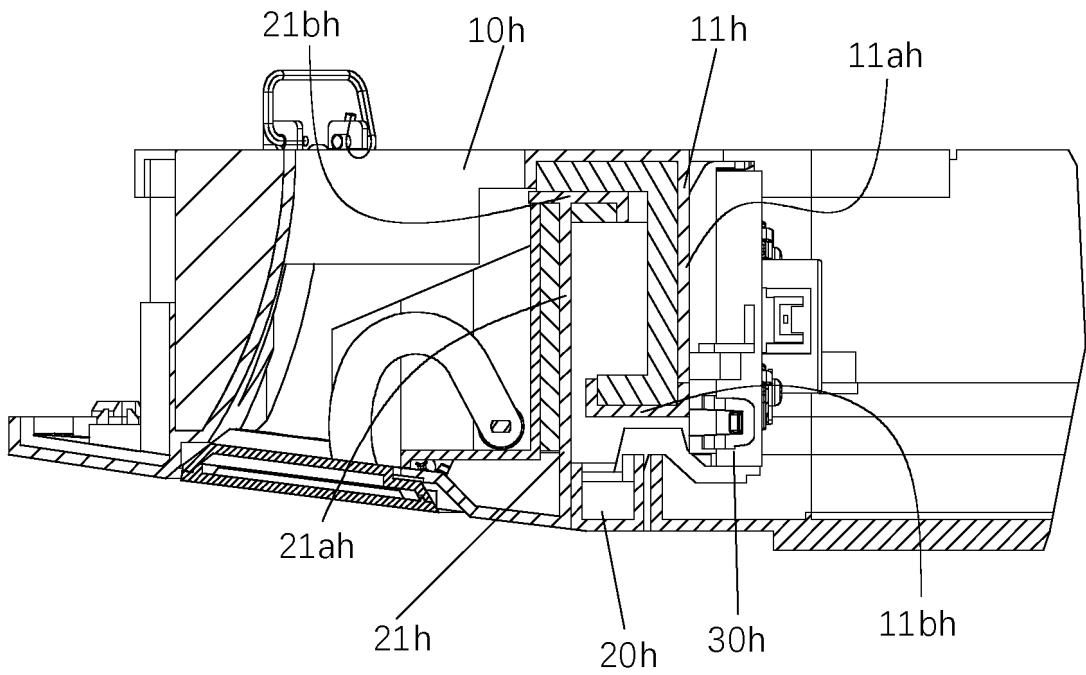


Figure 69

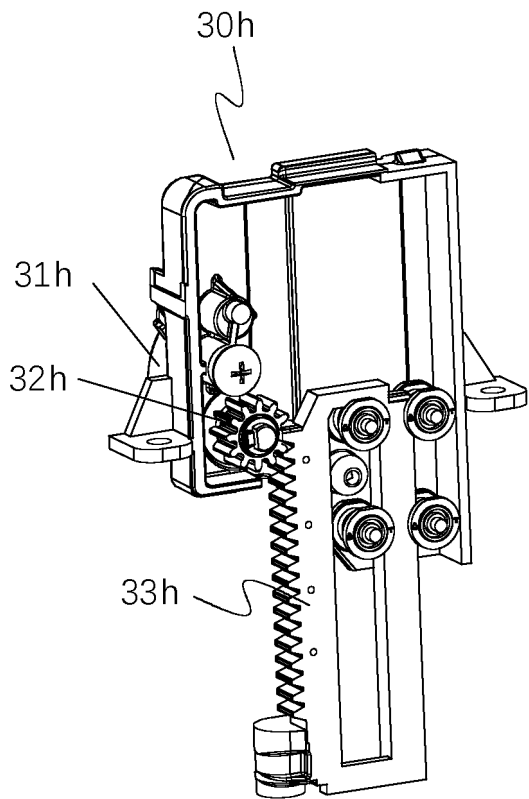


Figure 70

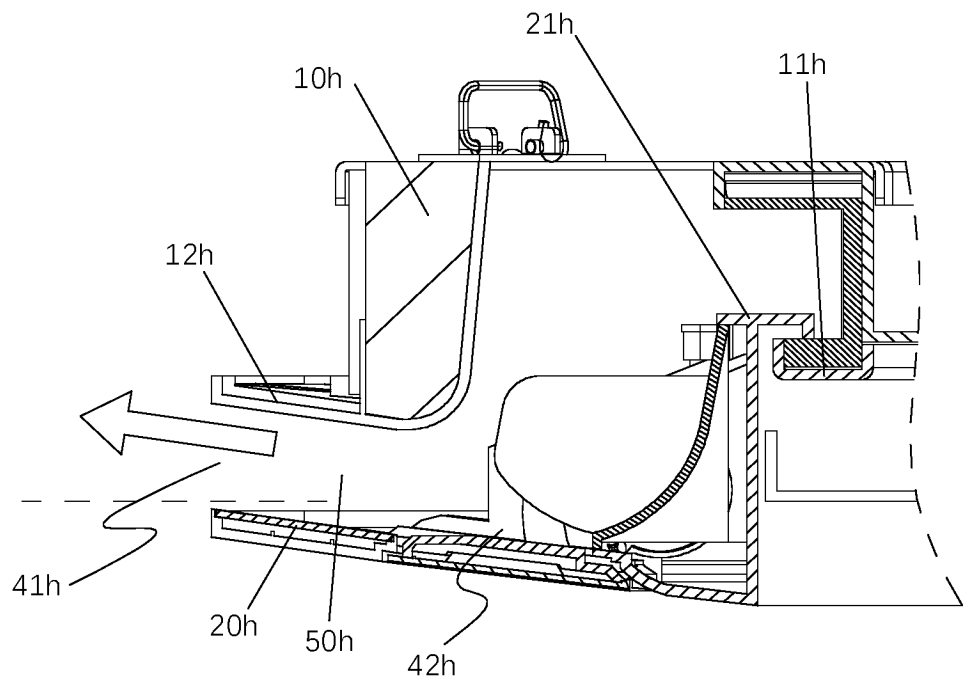


Figure 71

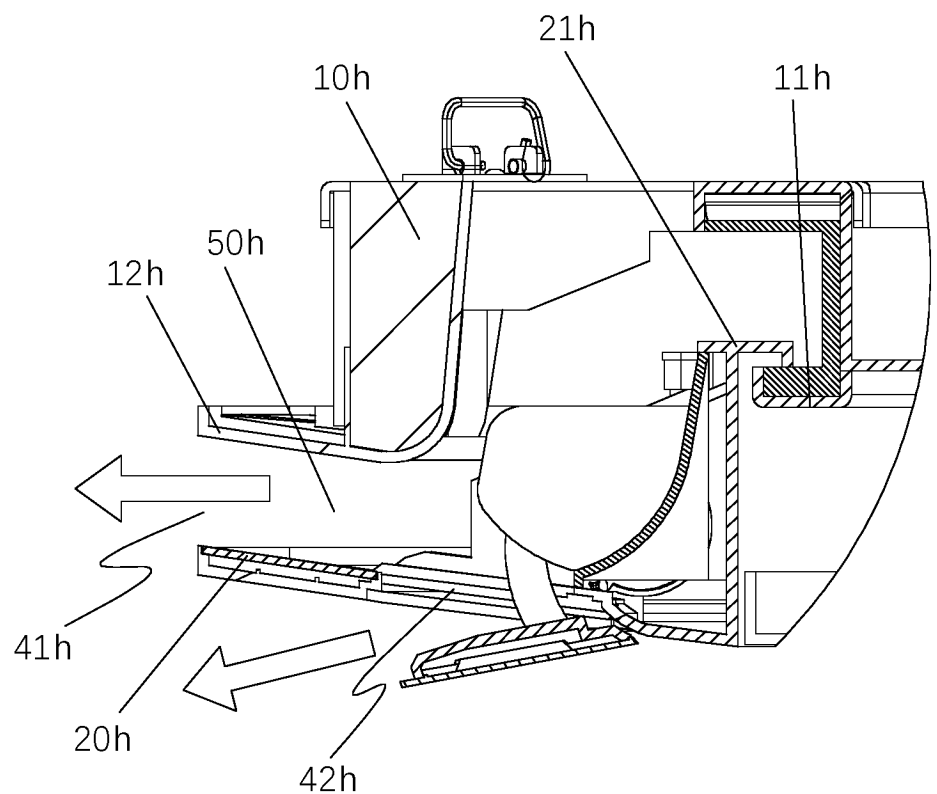


Figure 72

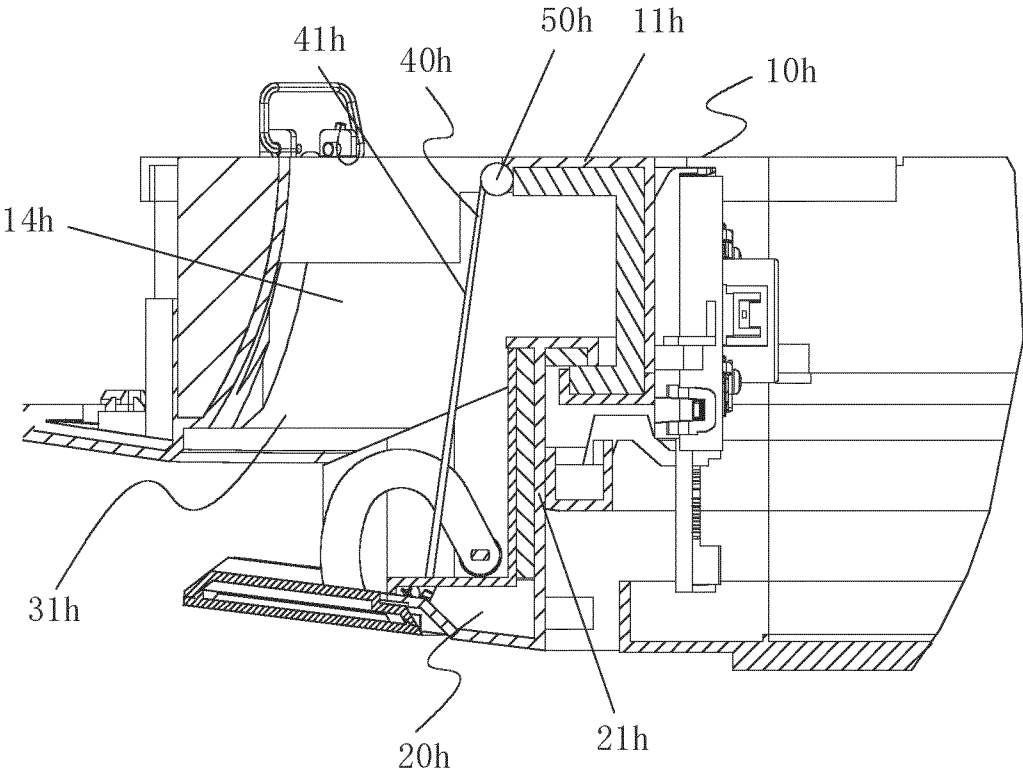


Figure 73

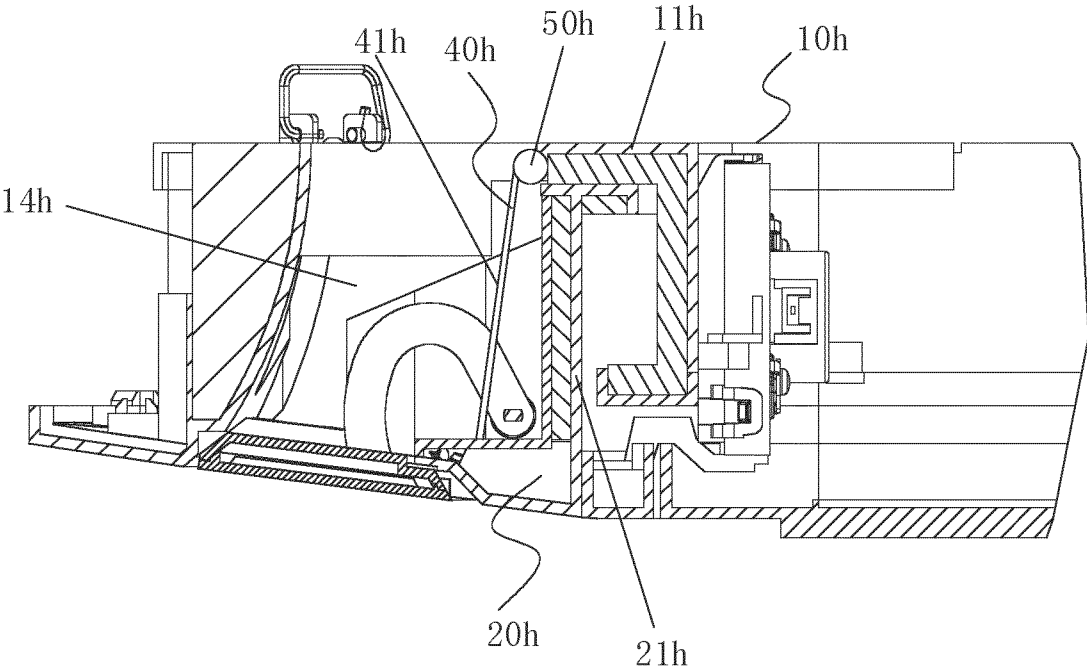


Figure 74

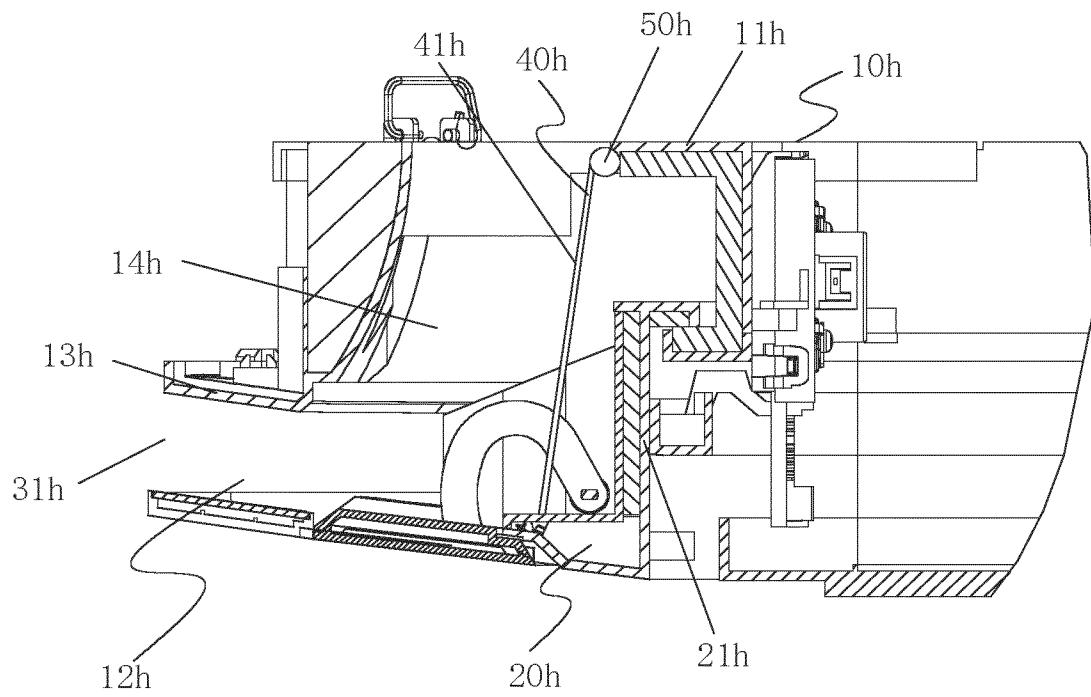


Figure 75

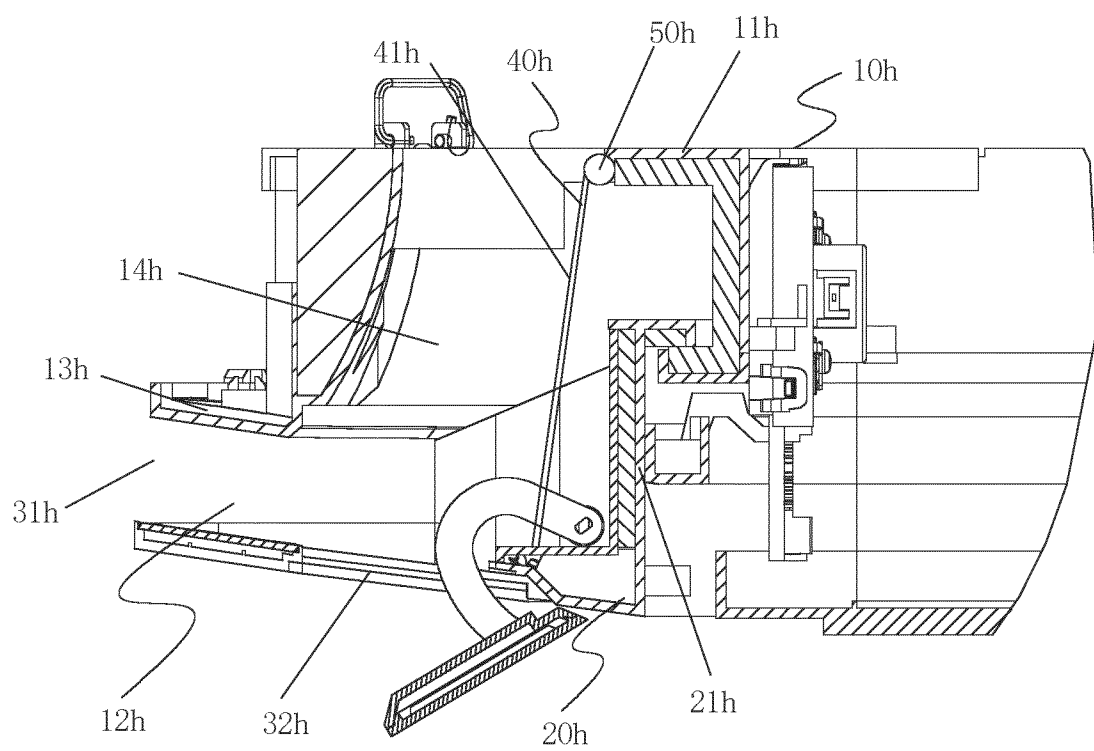


Figure 76

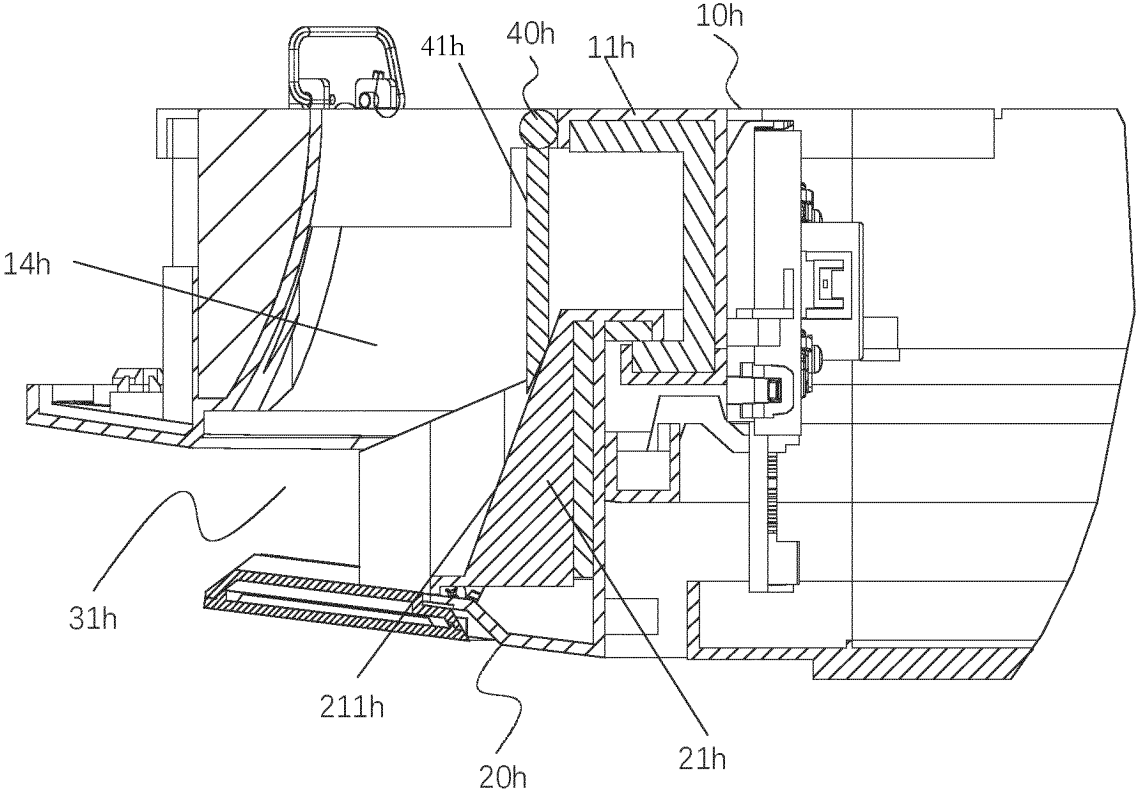


Figure 77

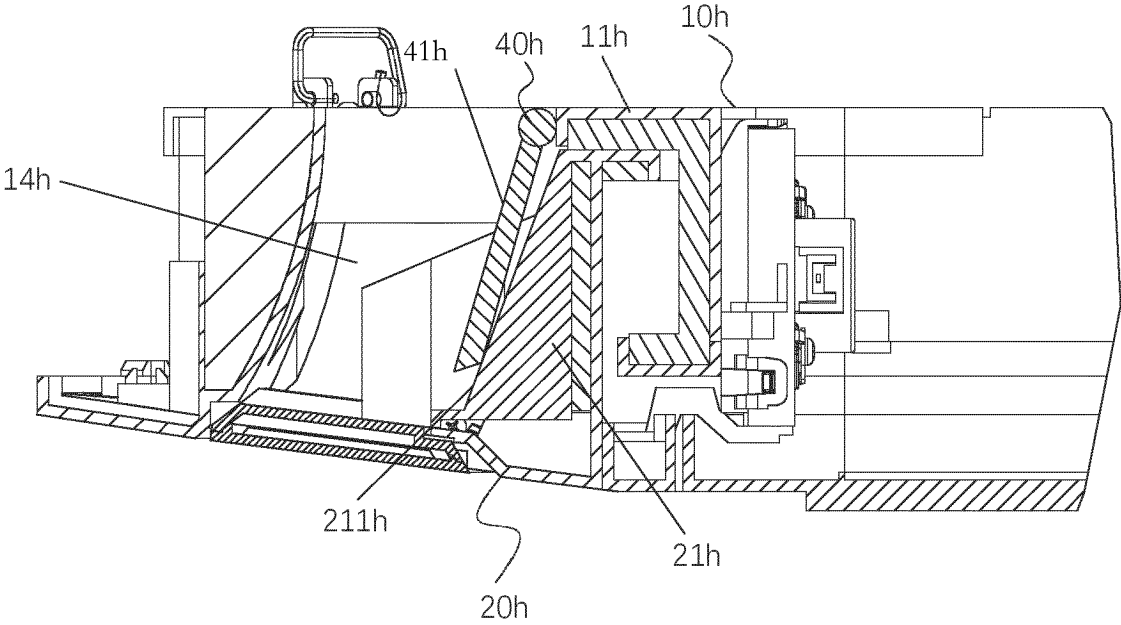


Figure 78

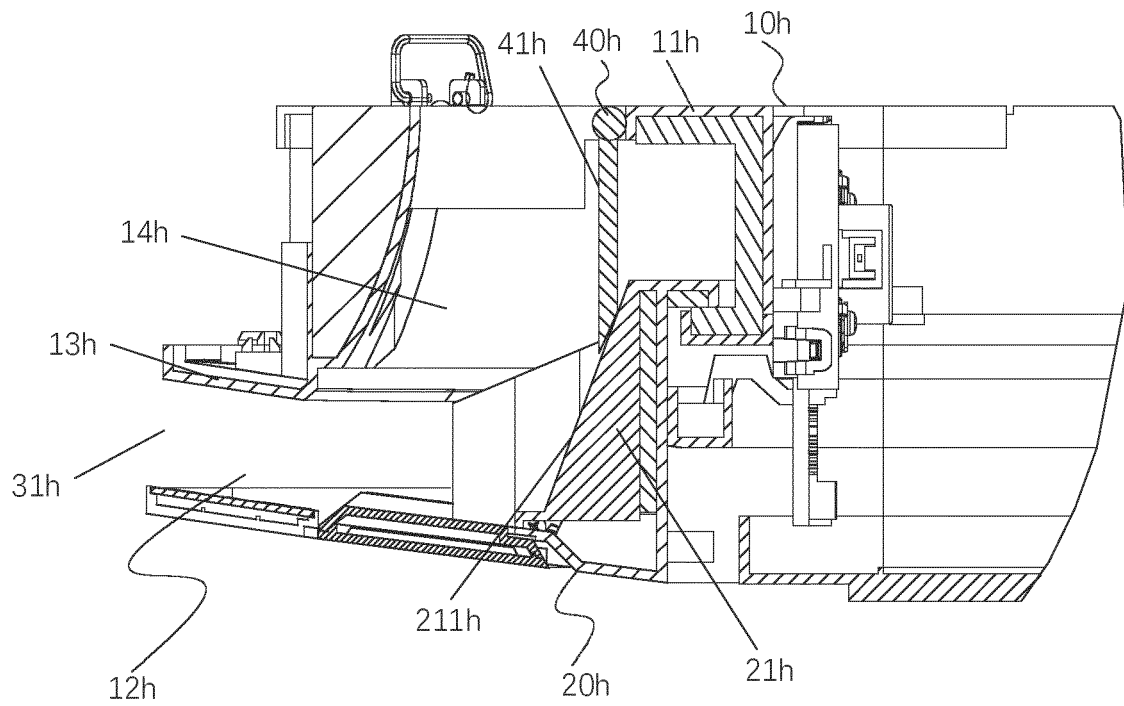


Figure 79

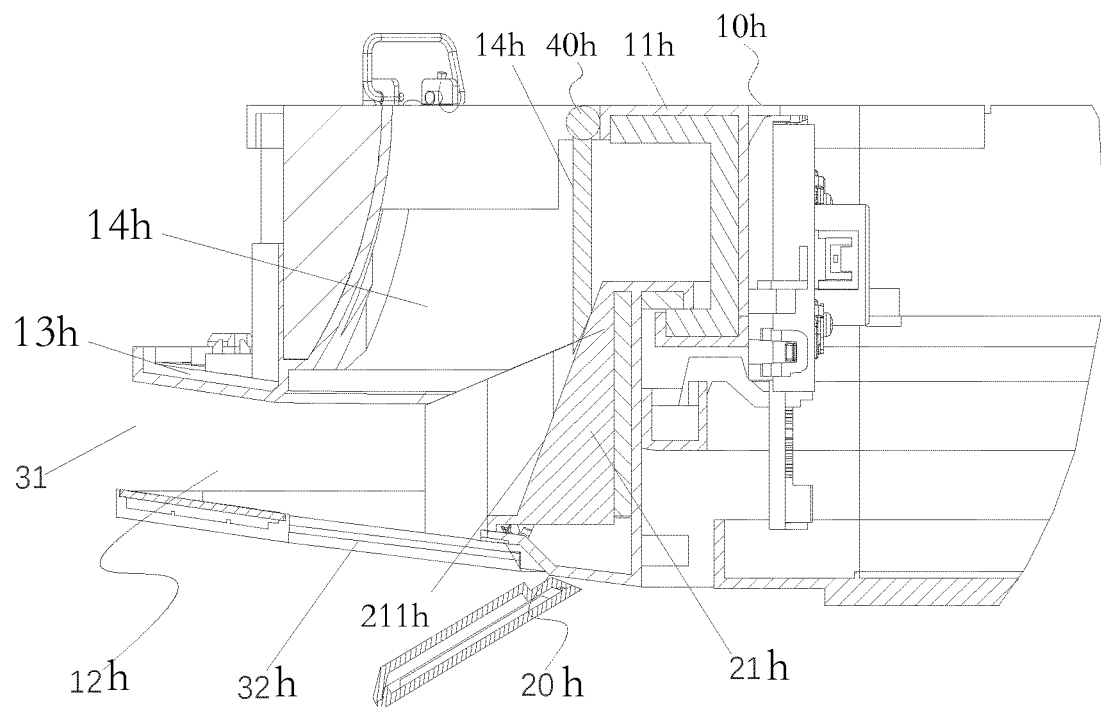


Figure 80

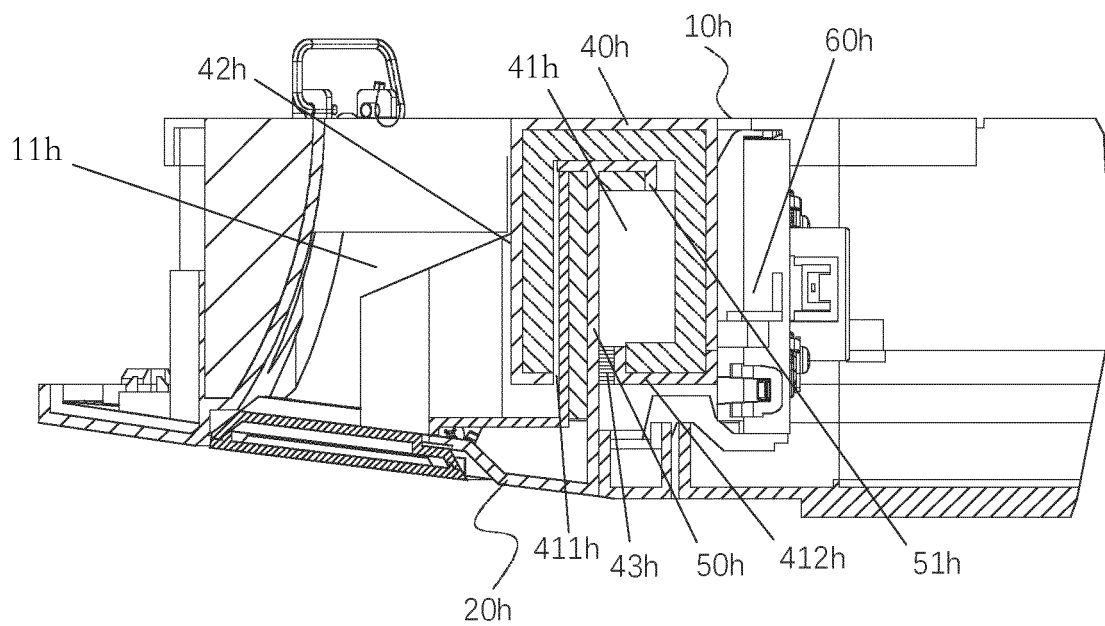


Figure 81

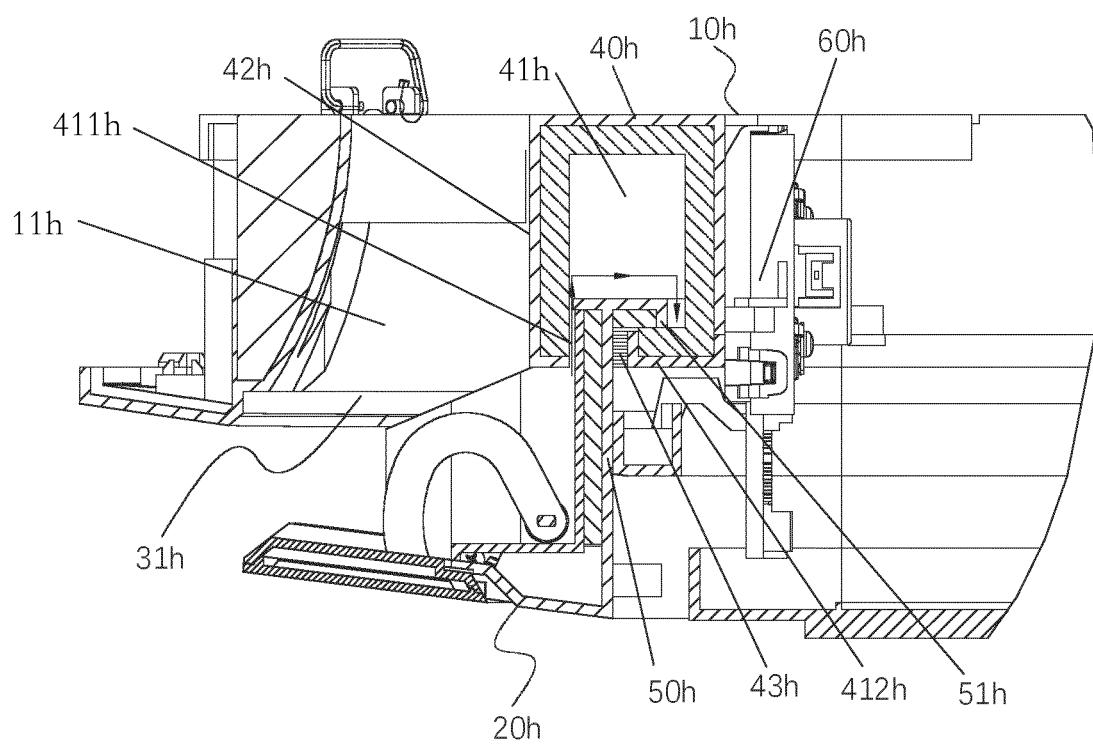


Figure 82

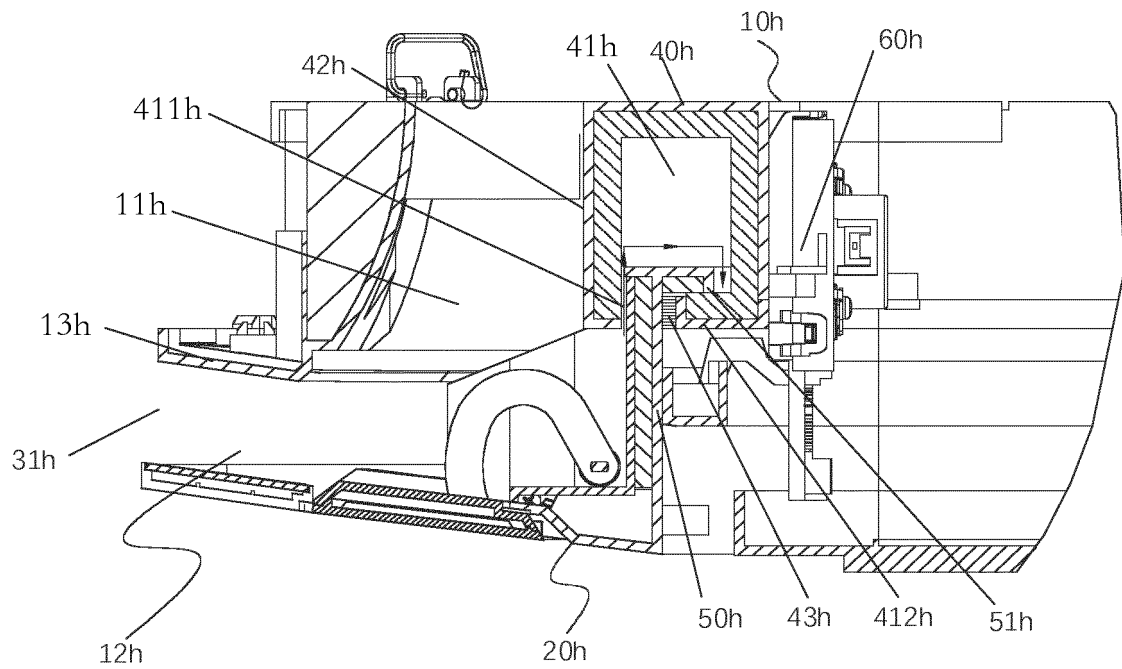


Figure 83

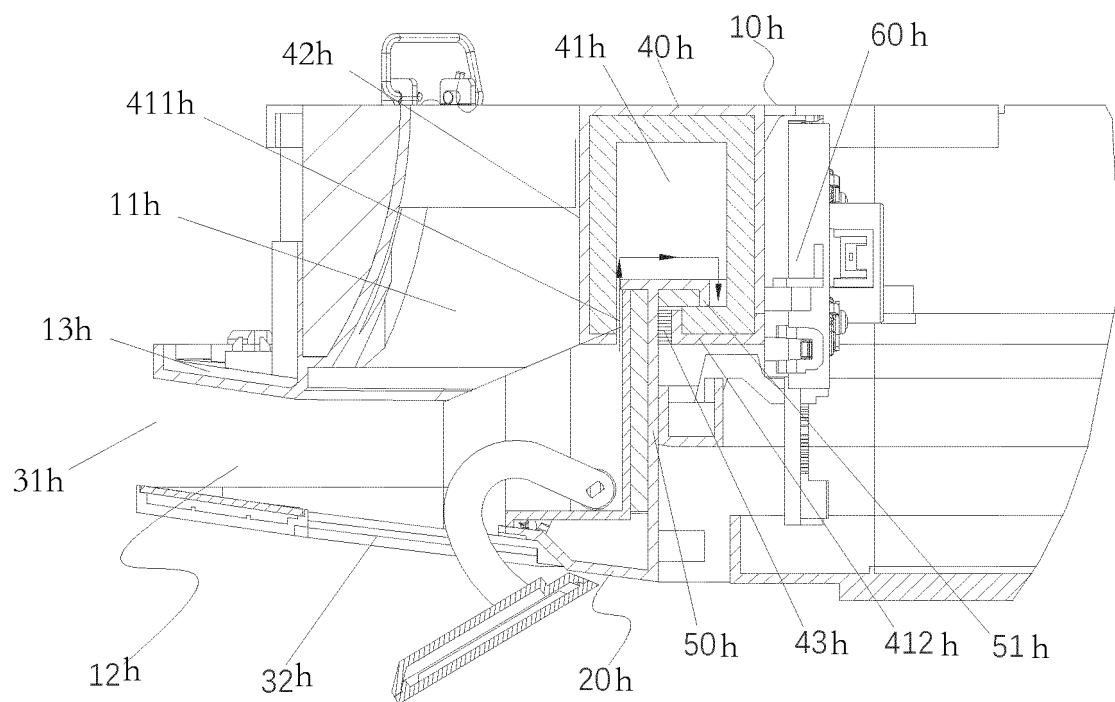


Figure 84

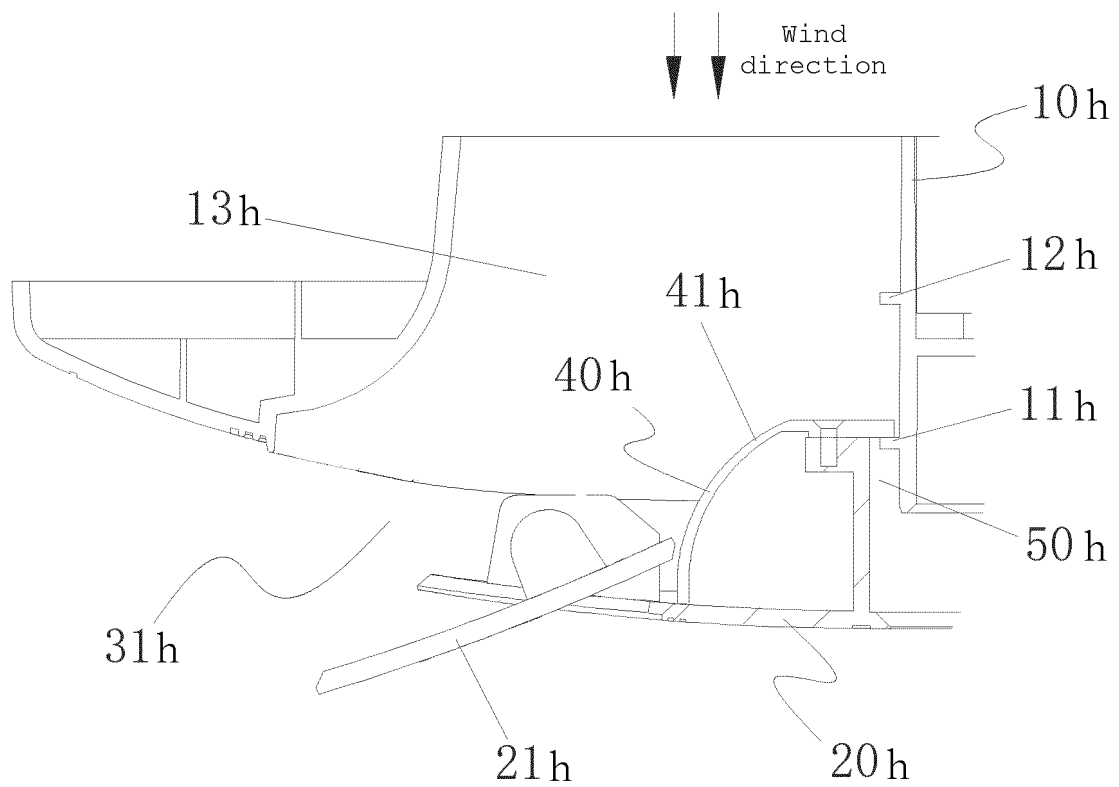


Figure 85

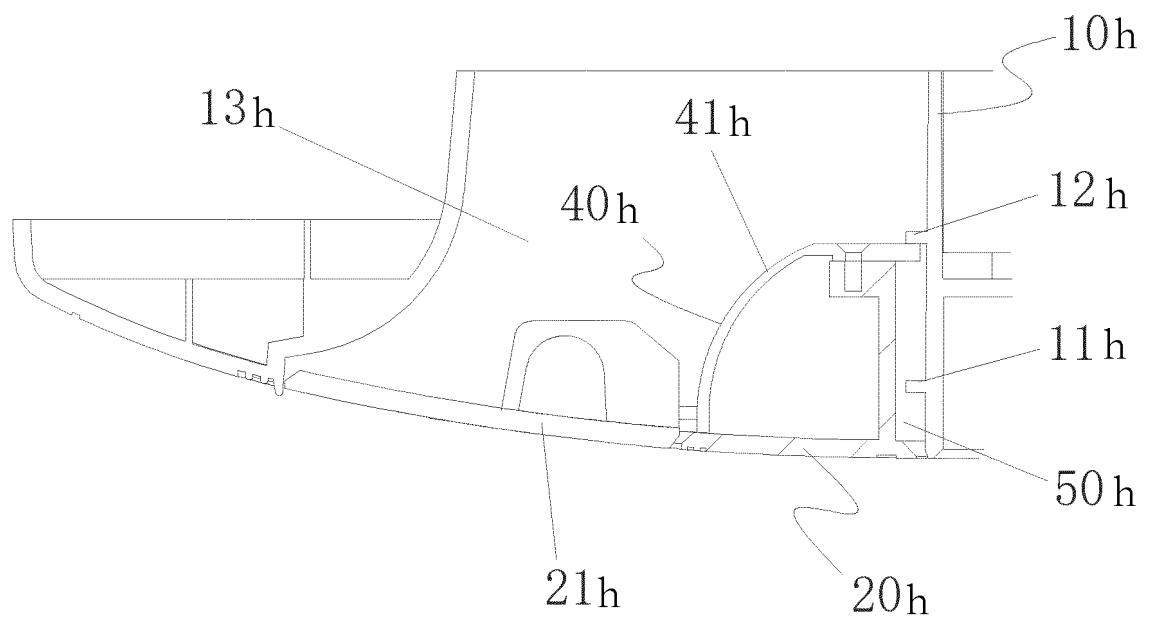


Figure 86

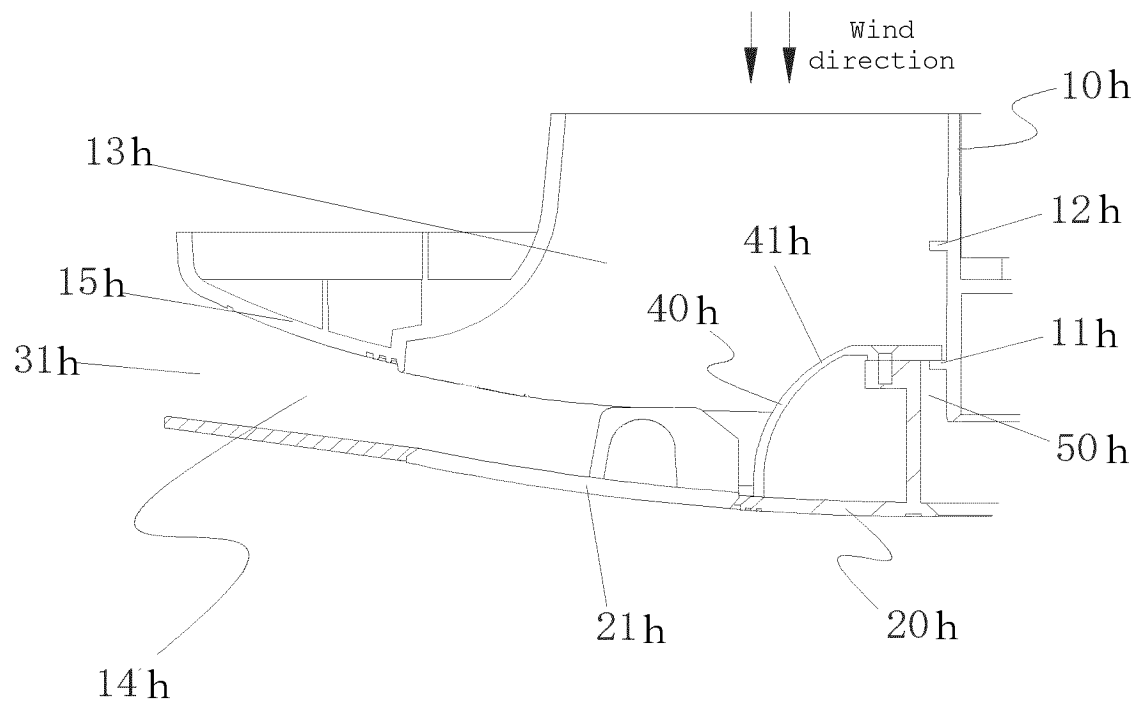


Figure 87

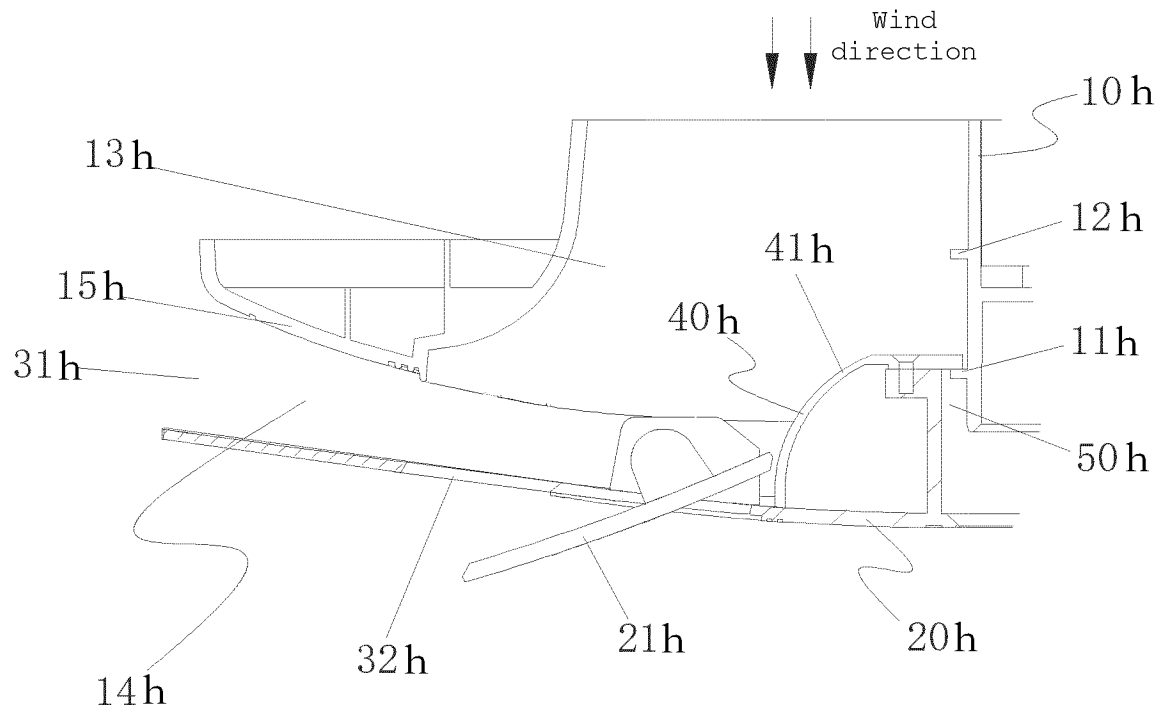


Figure 88

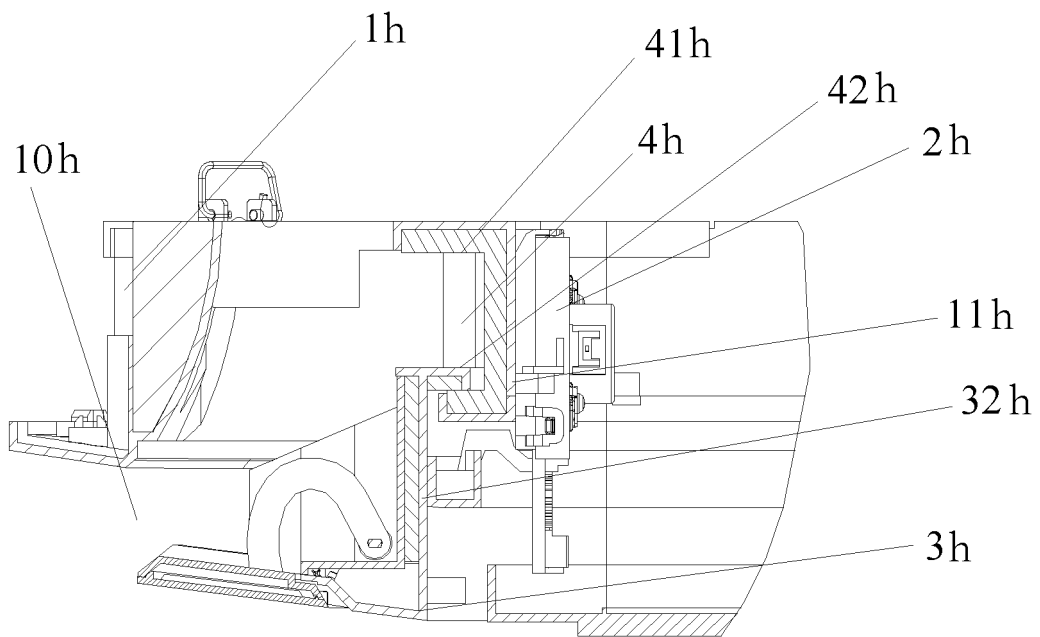


Figure 89

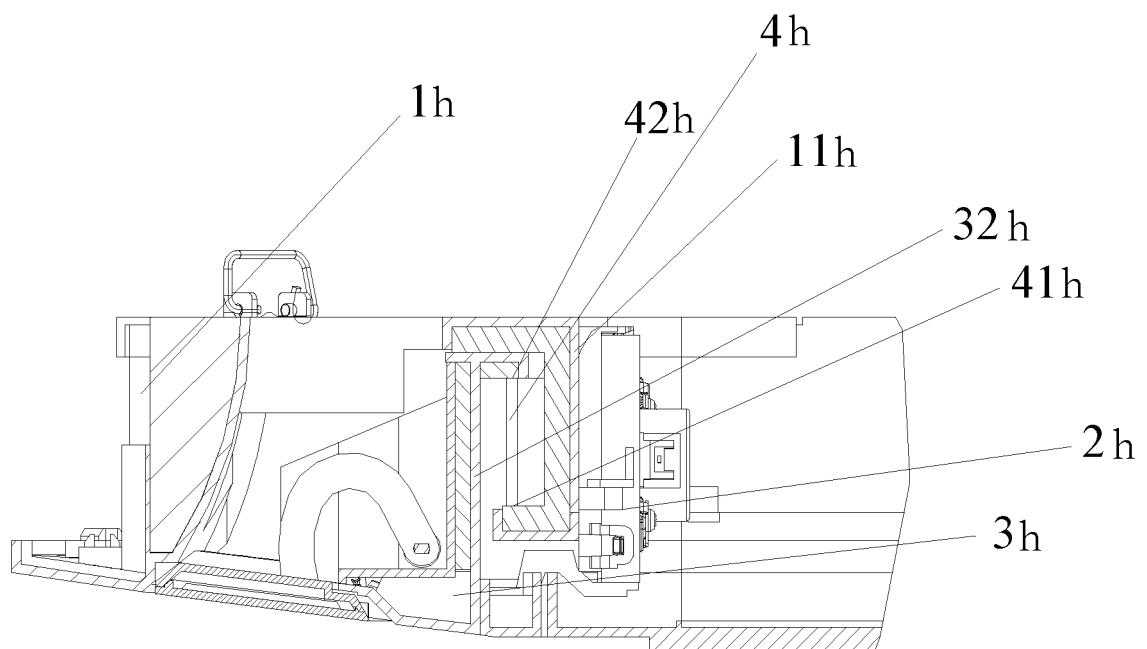


Figure 90

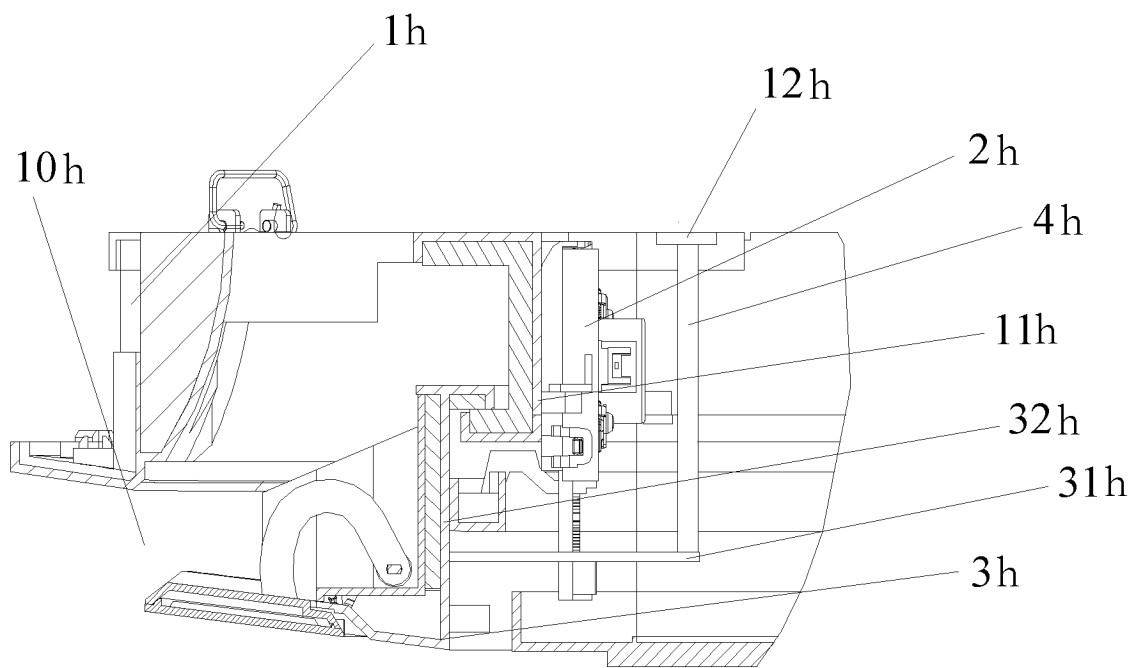


Figure 91

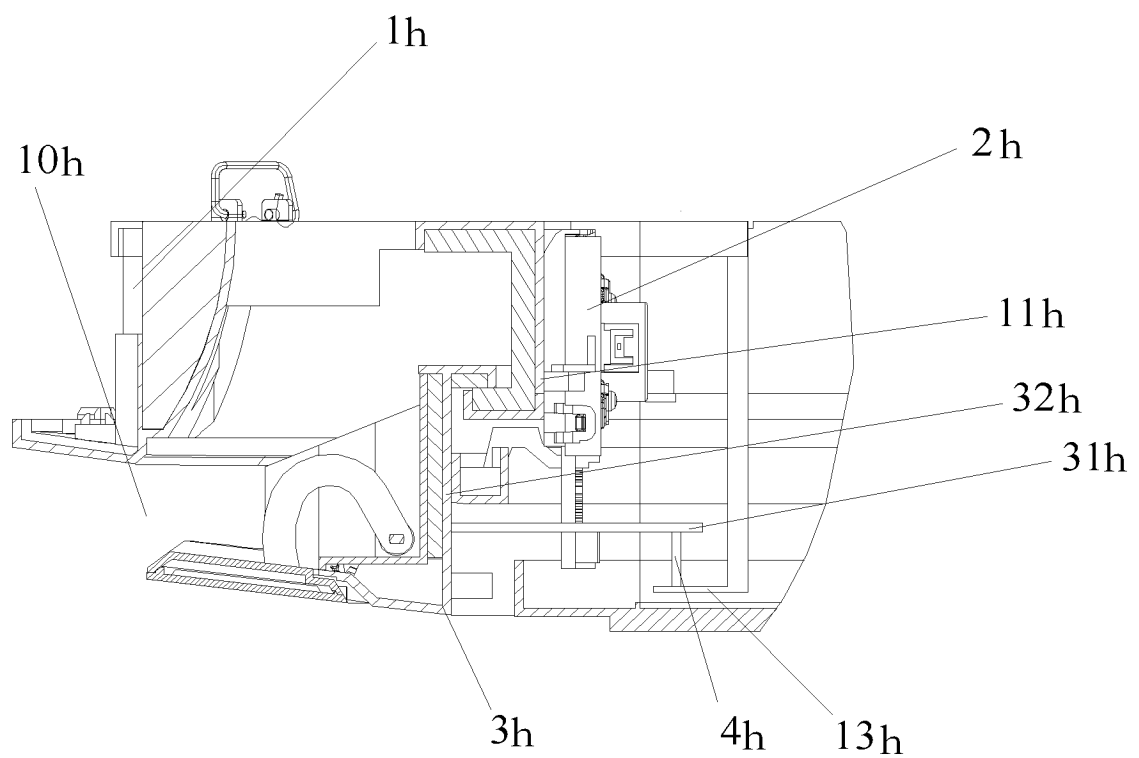


Figure 92

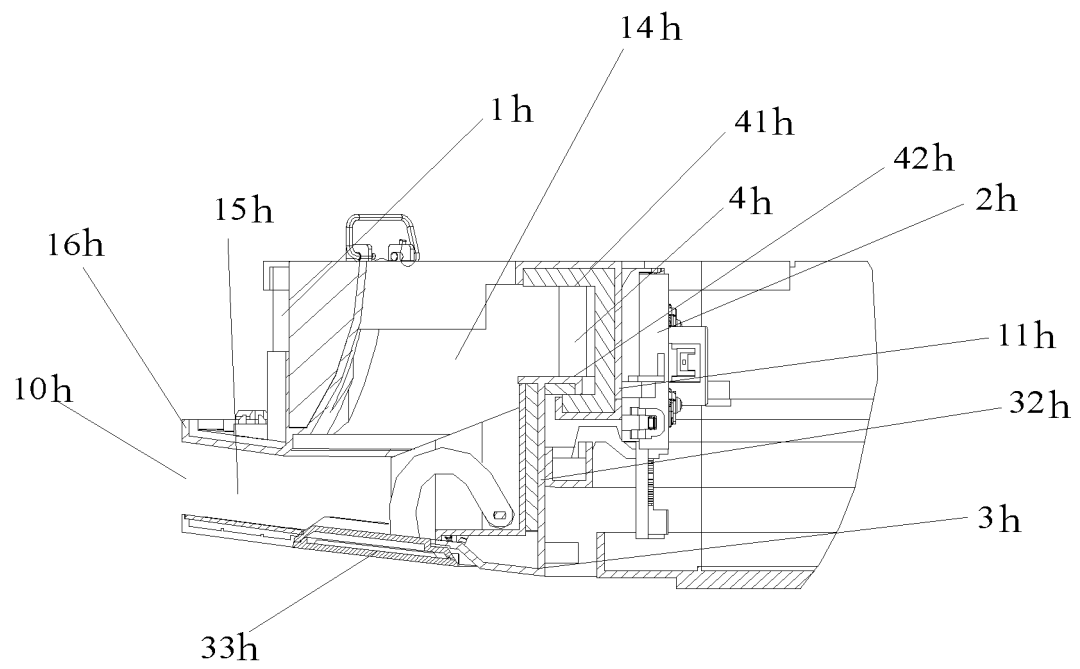


Figure 93

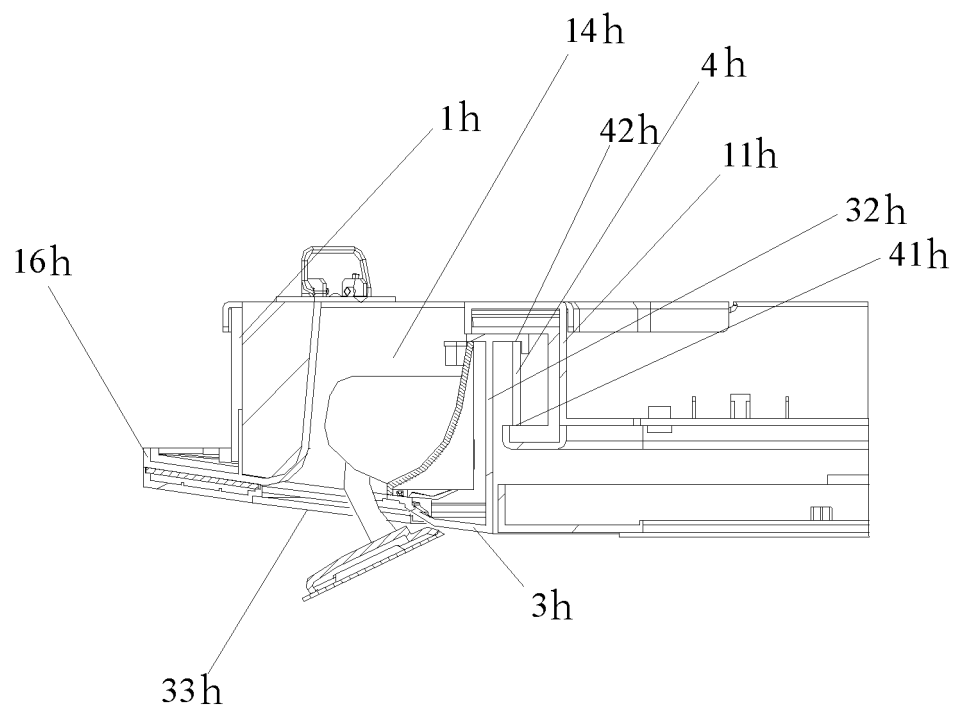


Figure 94

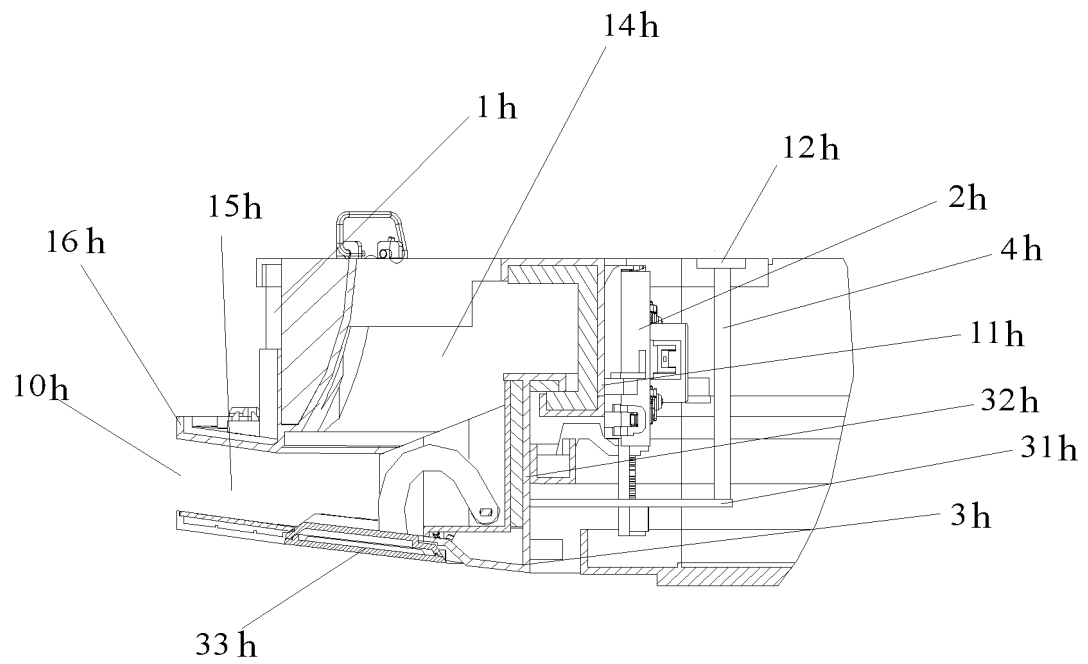


Figure 95

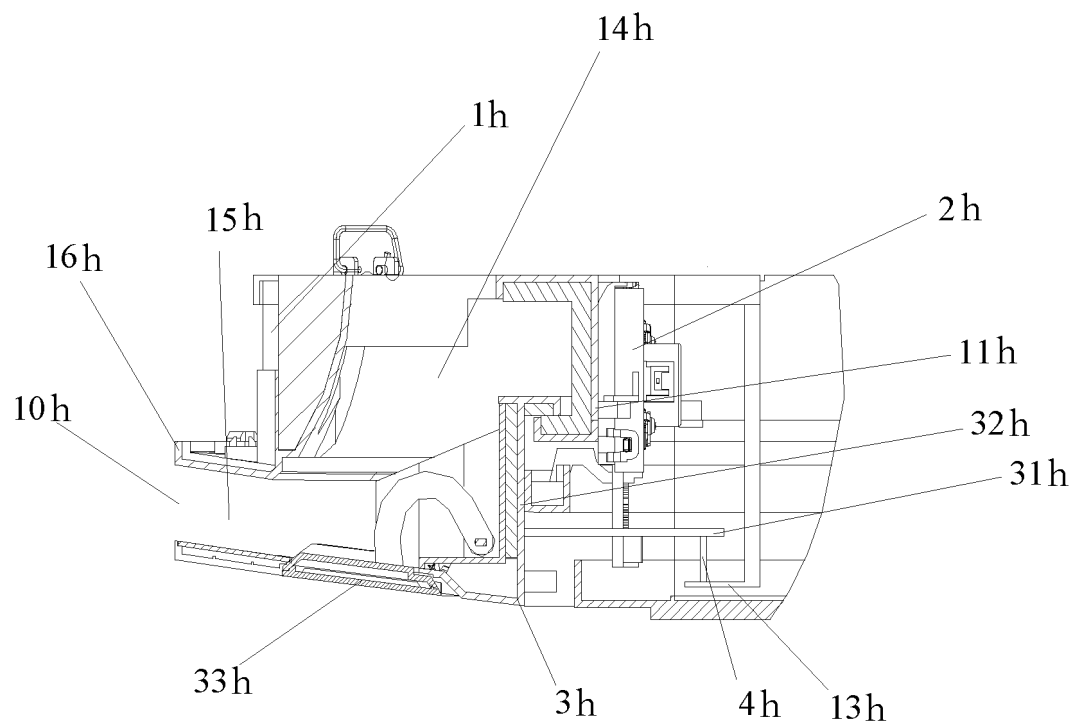


Figure 96

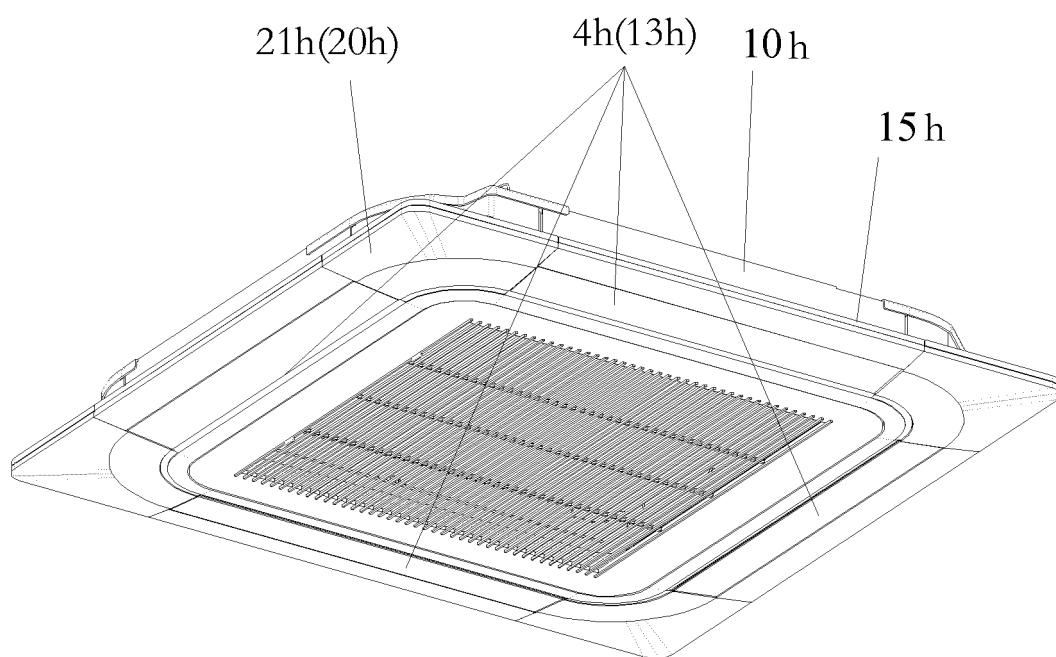


Figure 97

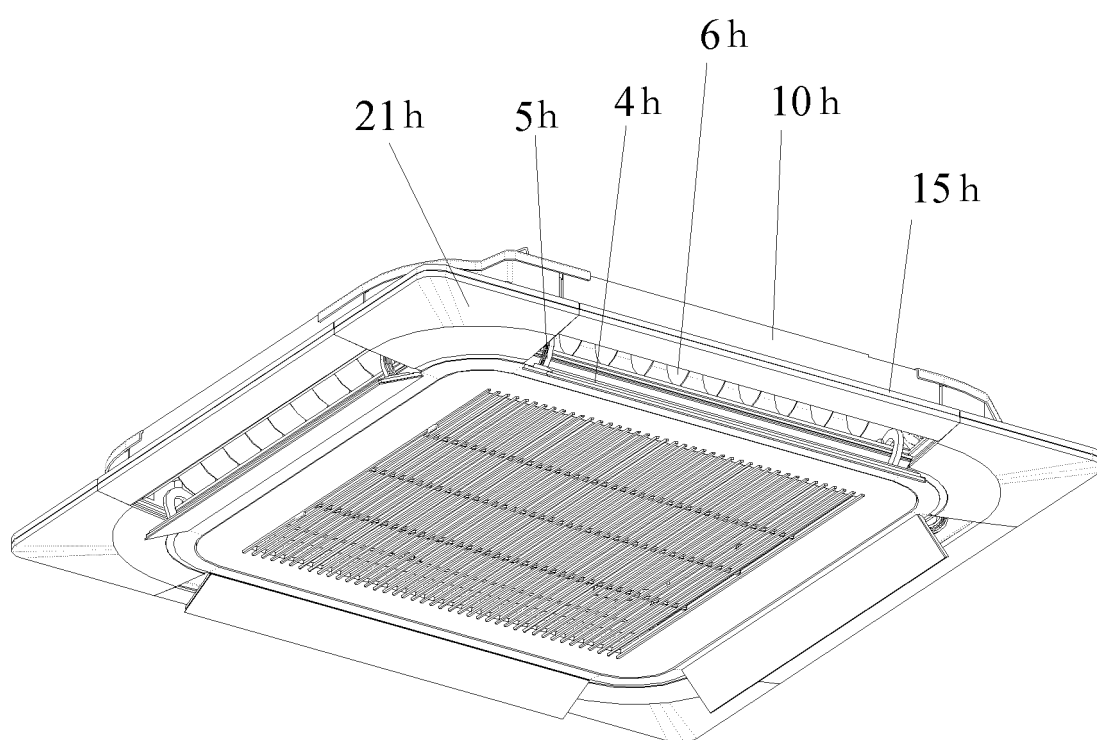


Figure 98

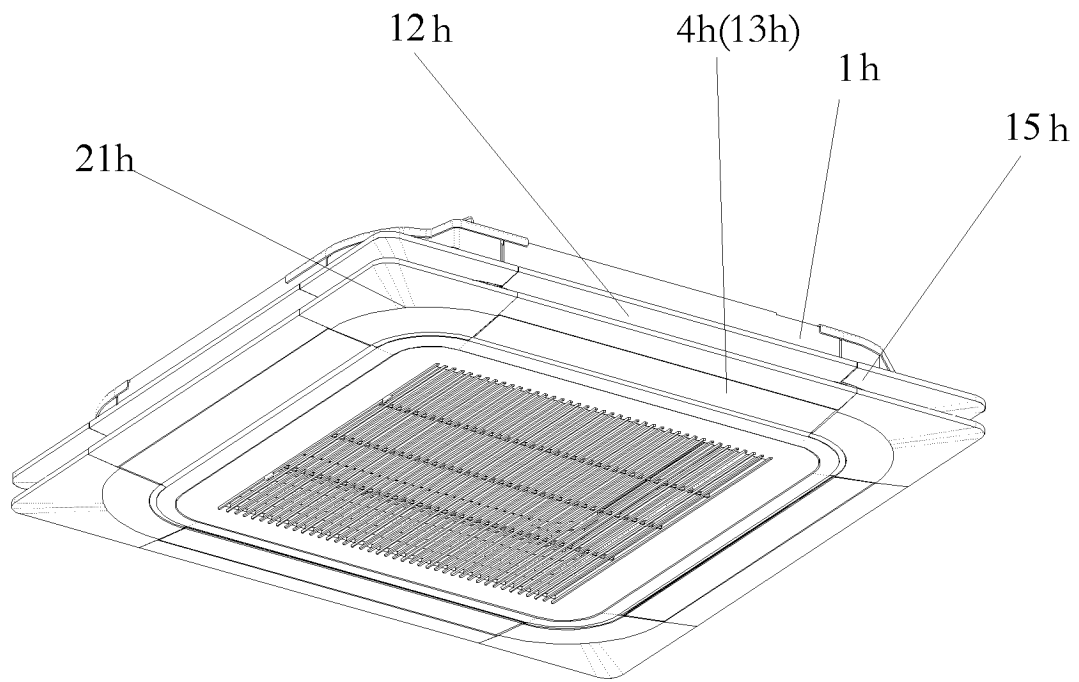


Figure 99

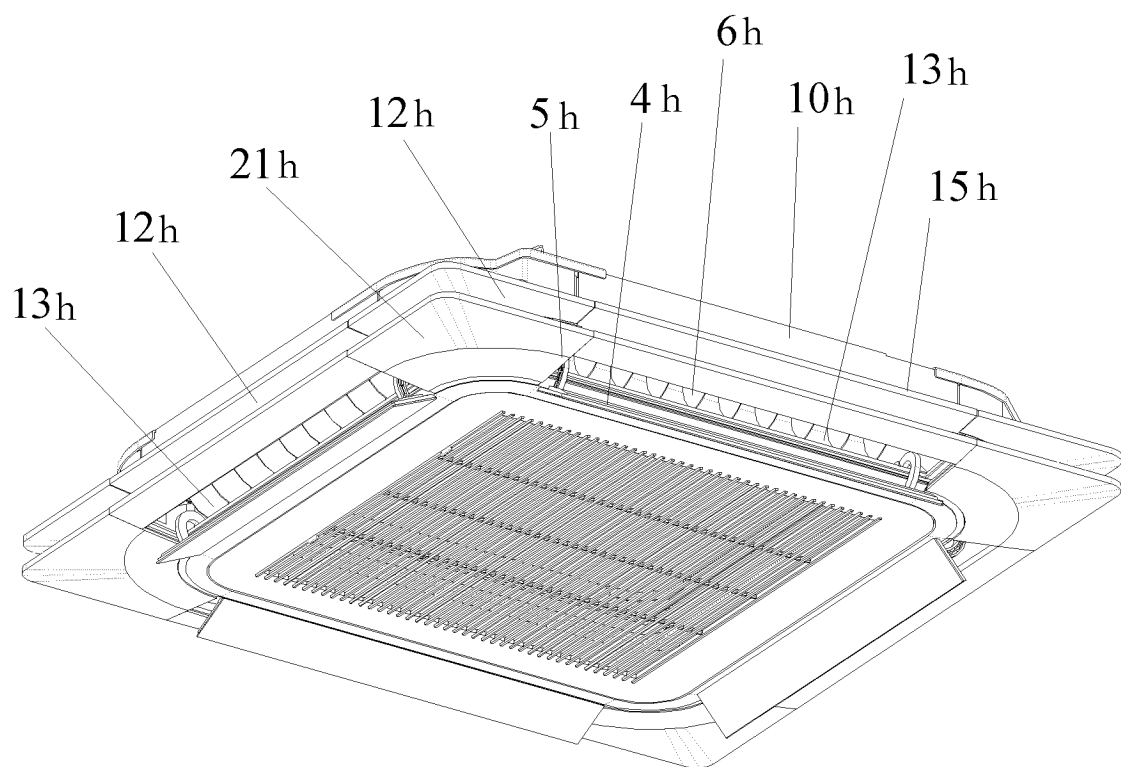


Figure 100

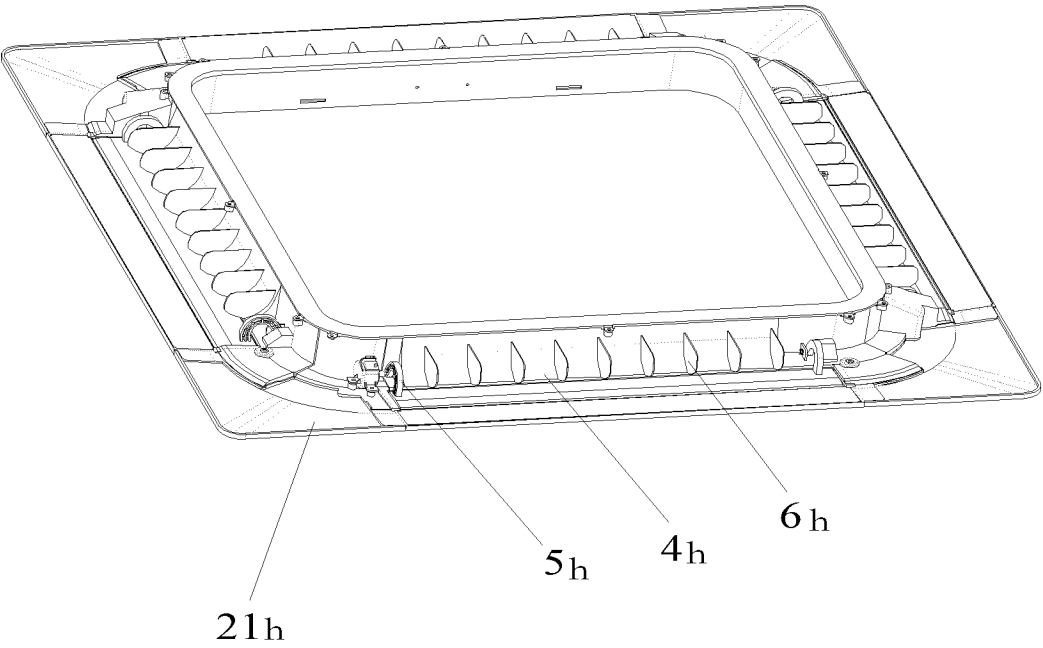


Figure 101

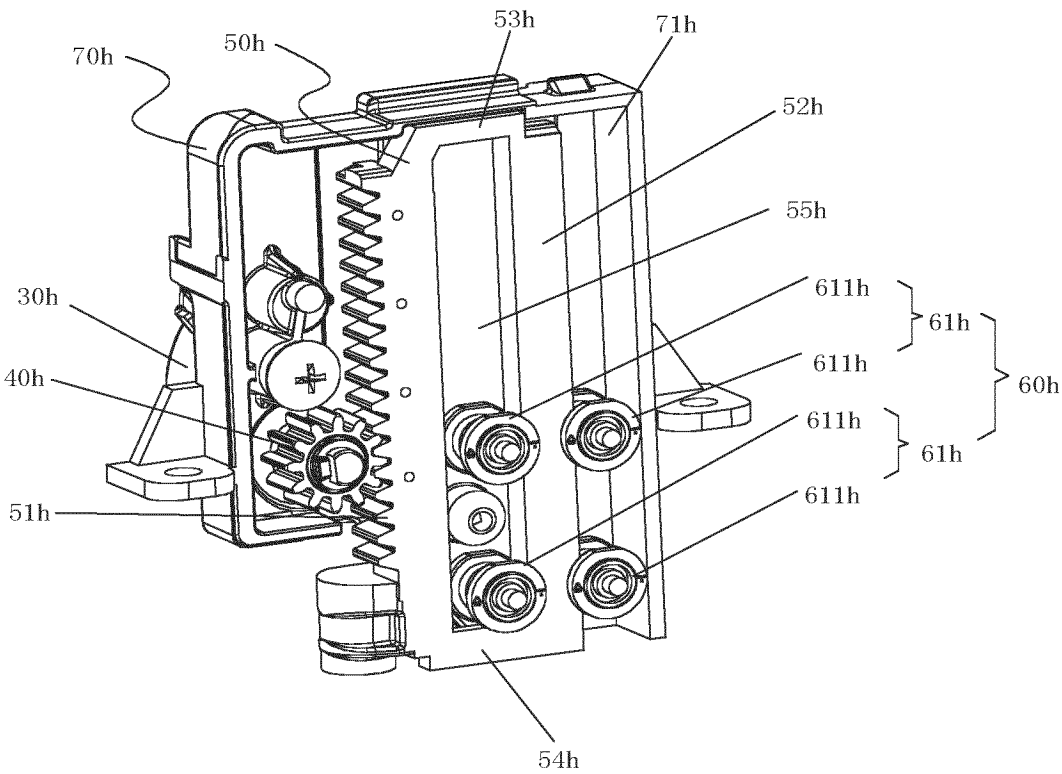


Figure 102

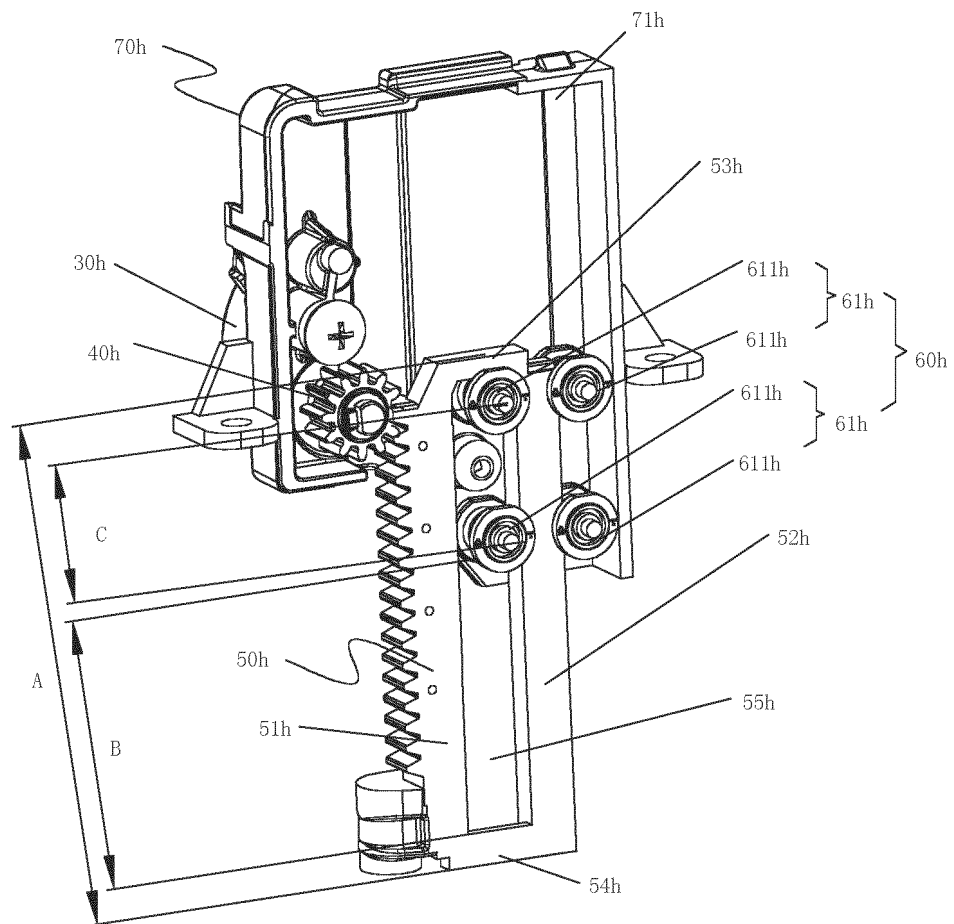


Figure 103

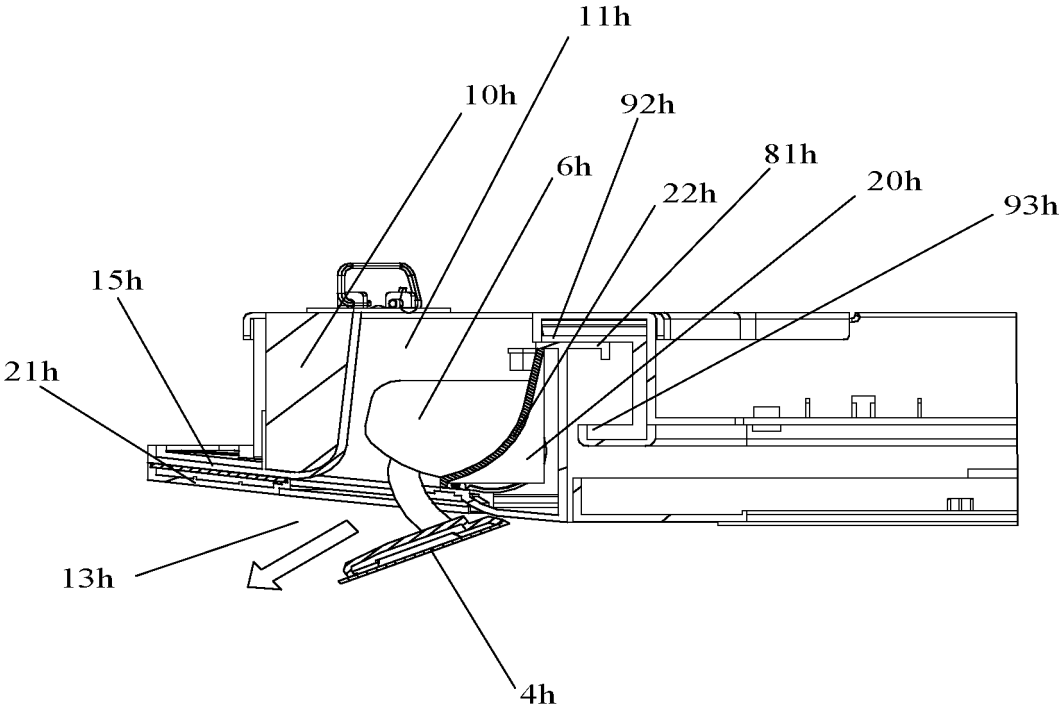


Figure 104

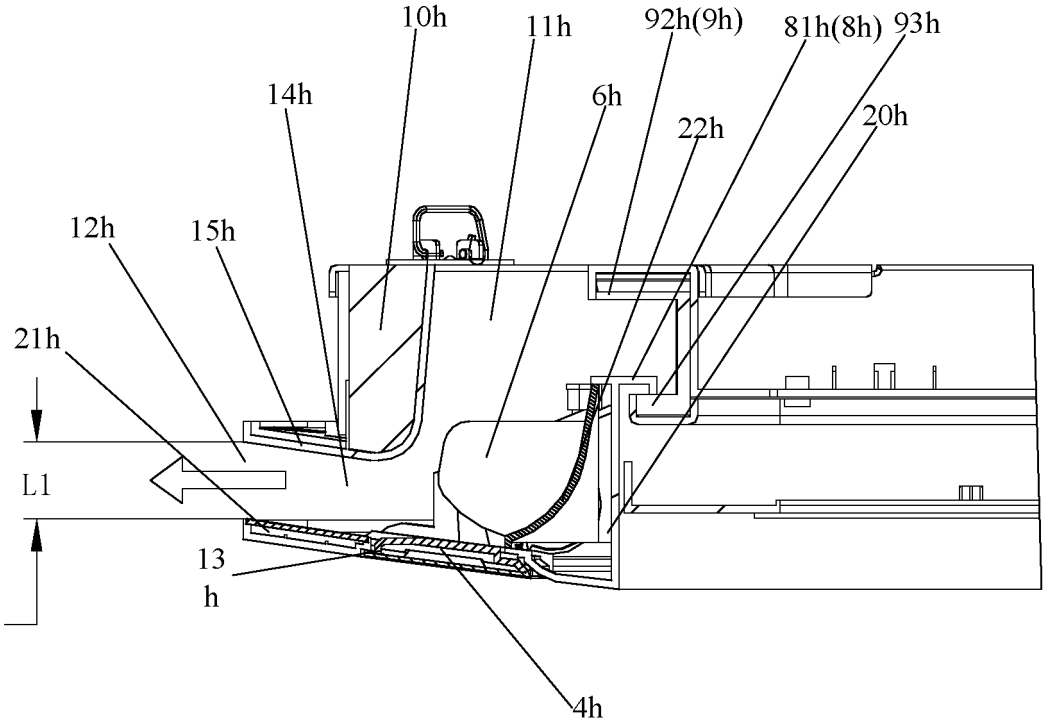


Figure 105

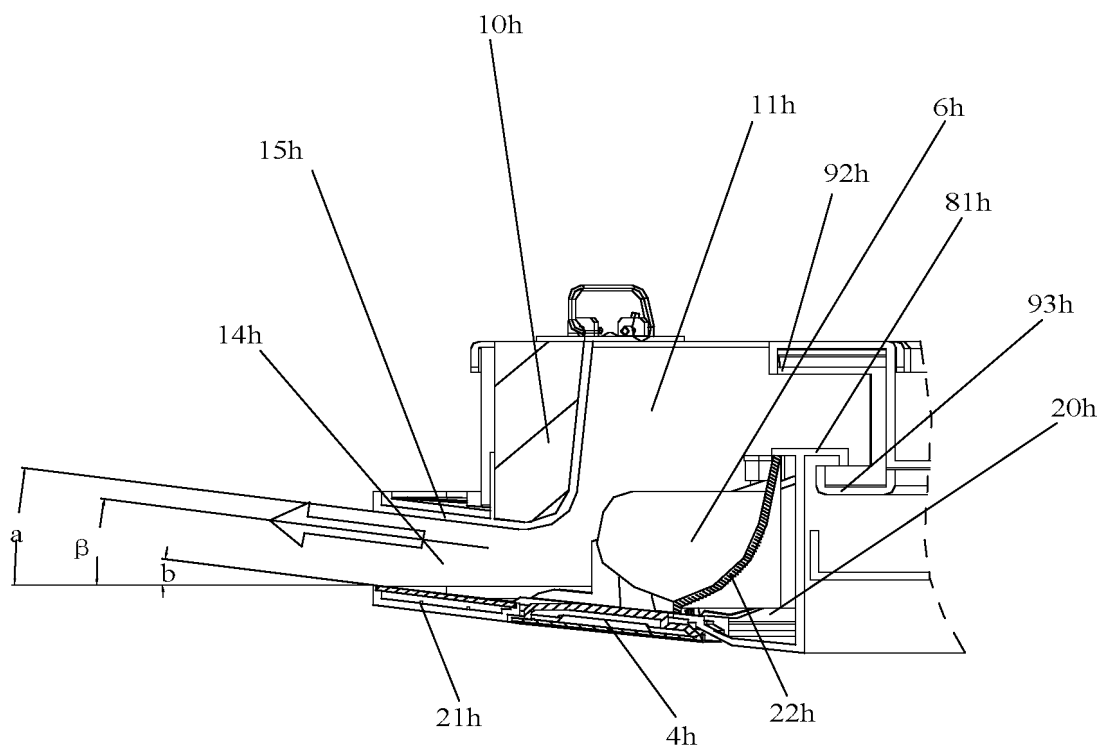


Figure 106

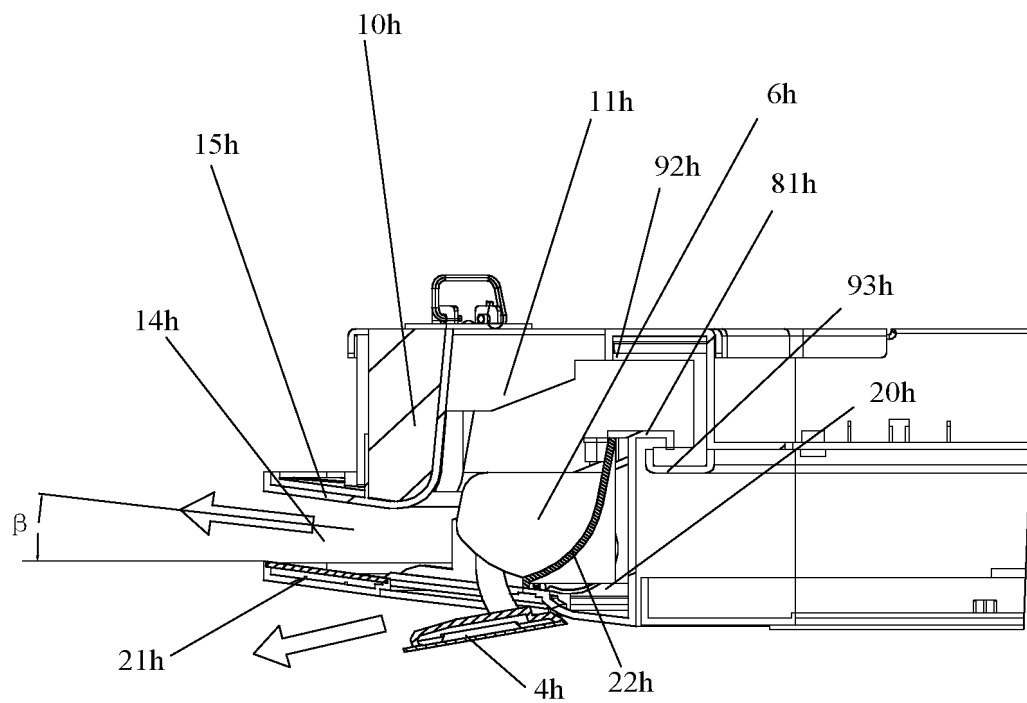


Figure 107

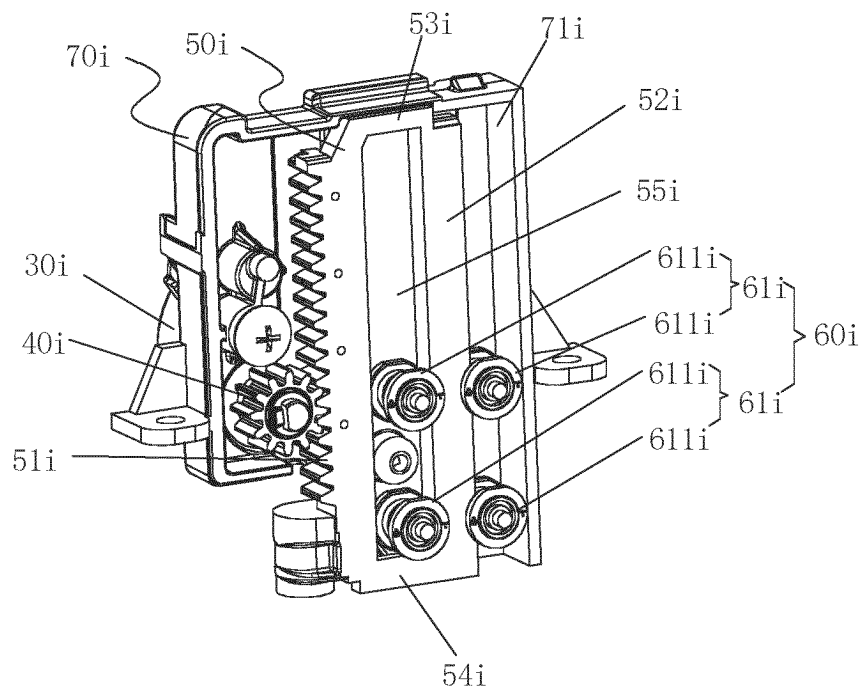


Figure 108

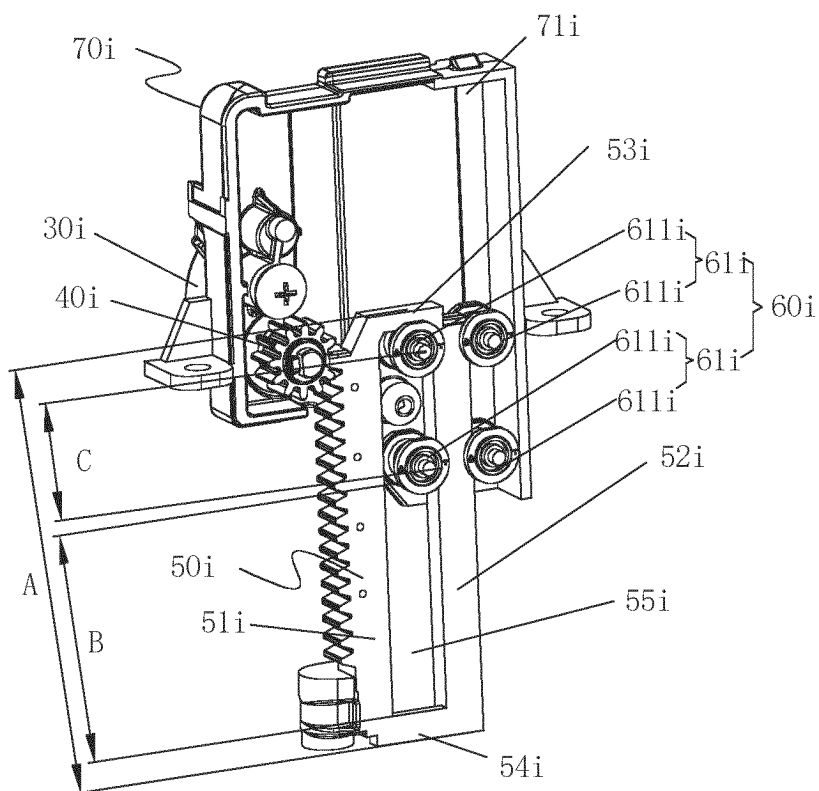


Figure 109

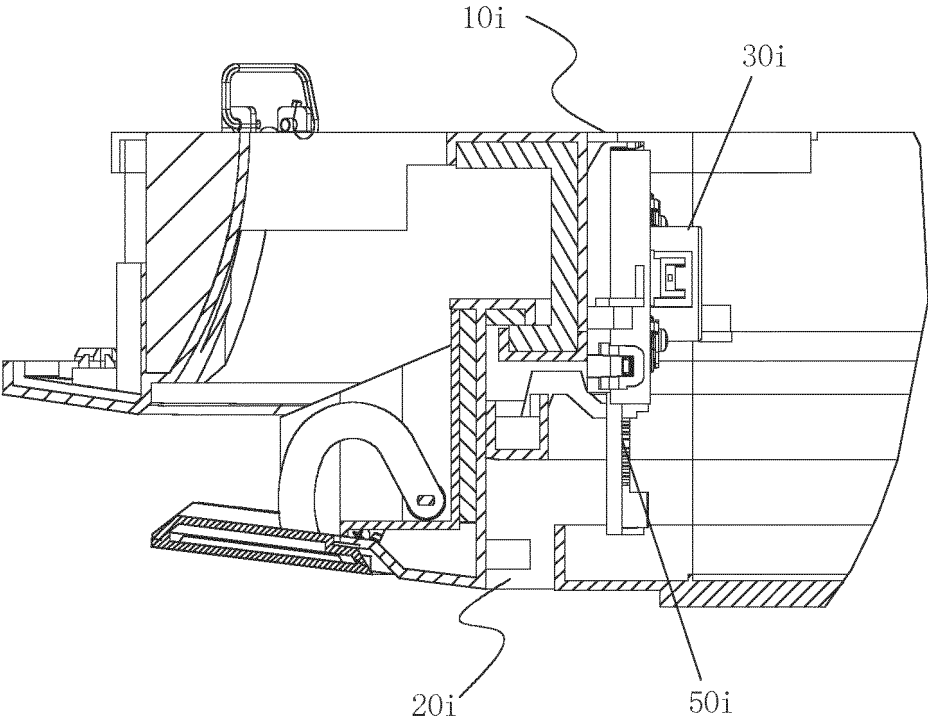


Figure 110

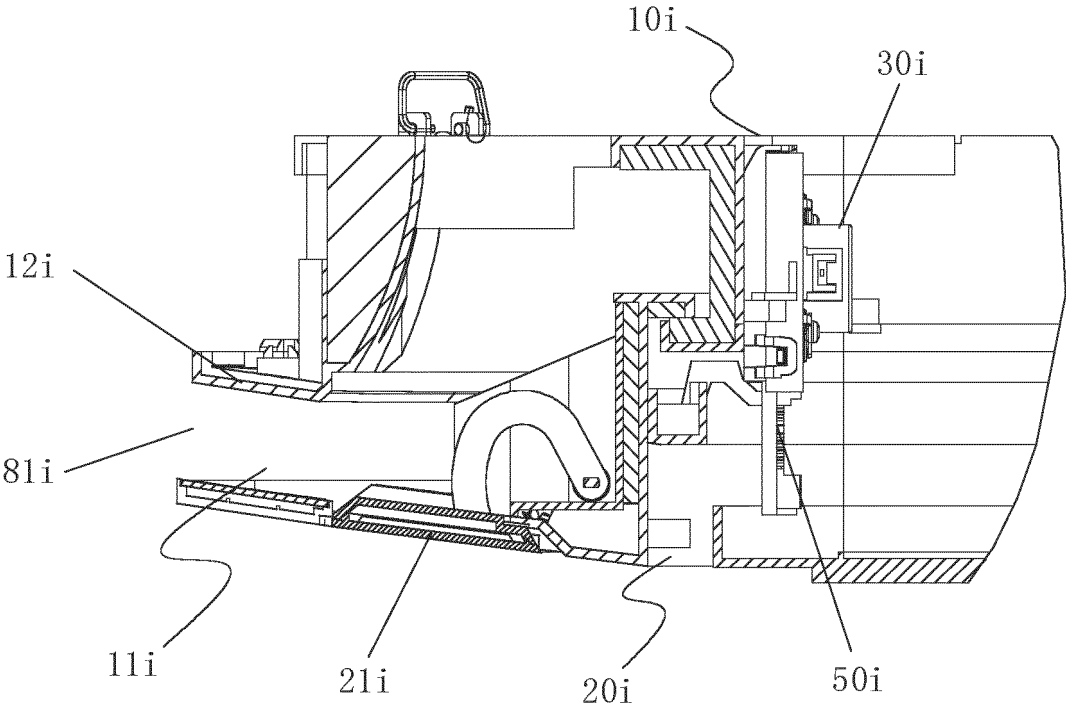


Figure 111

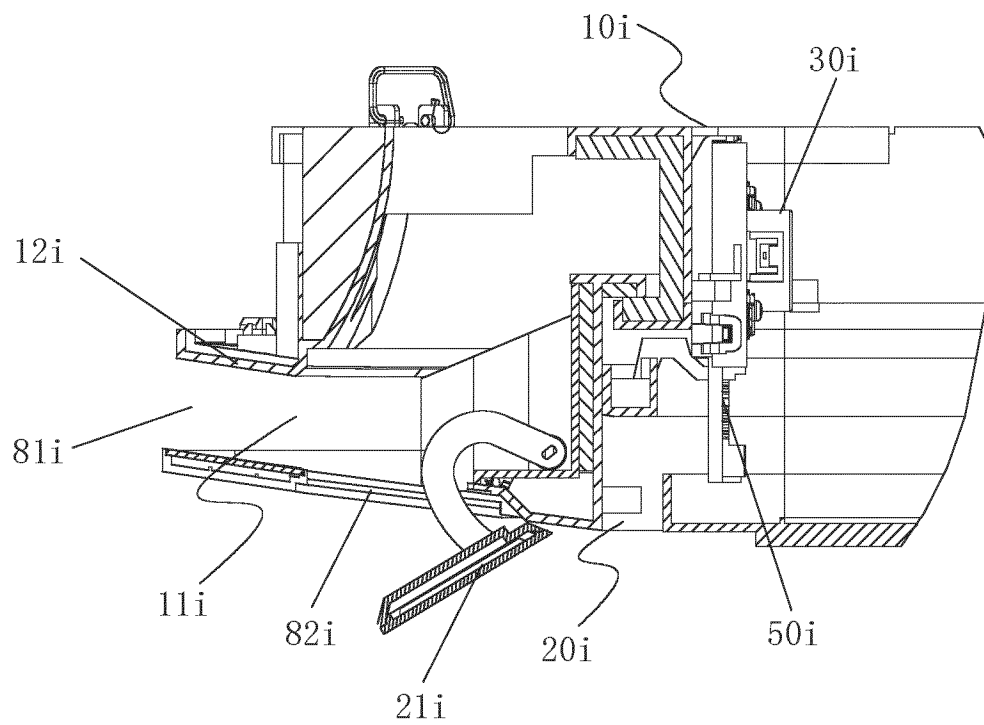


Figure 112

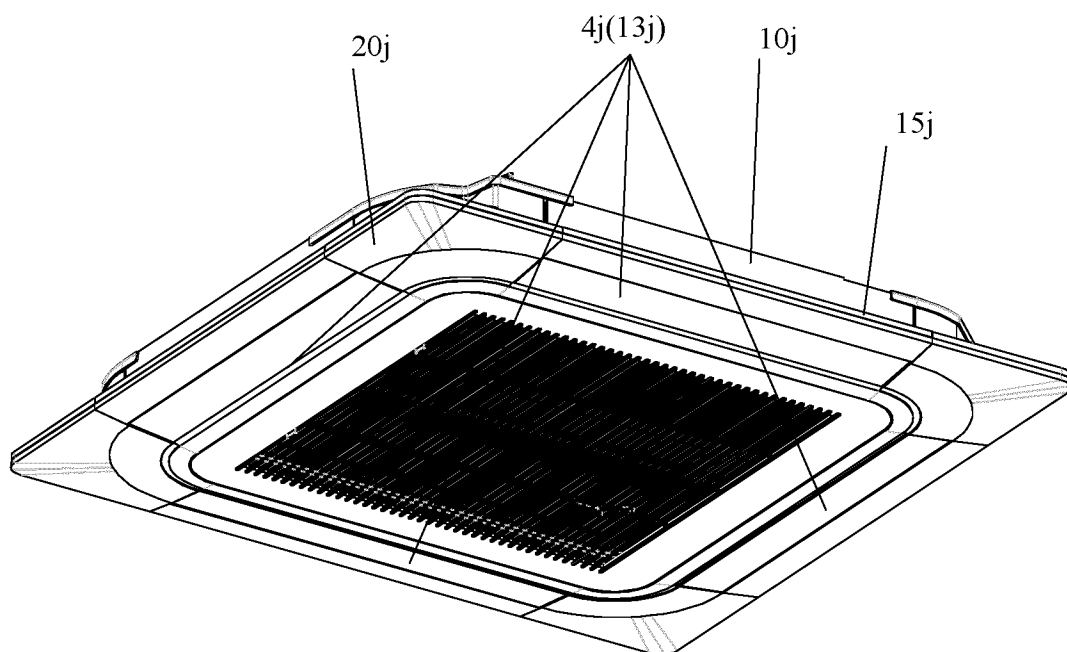


Figure 113

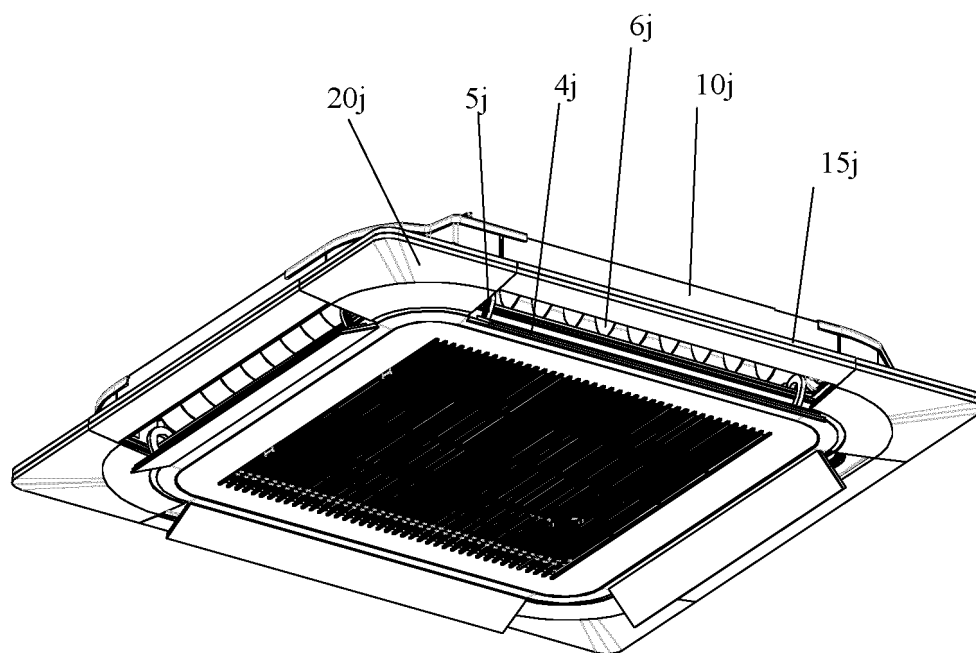


Figure 114

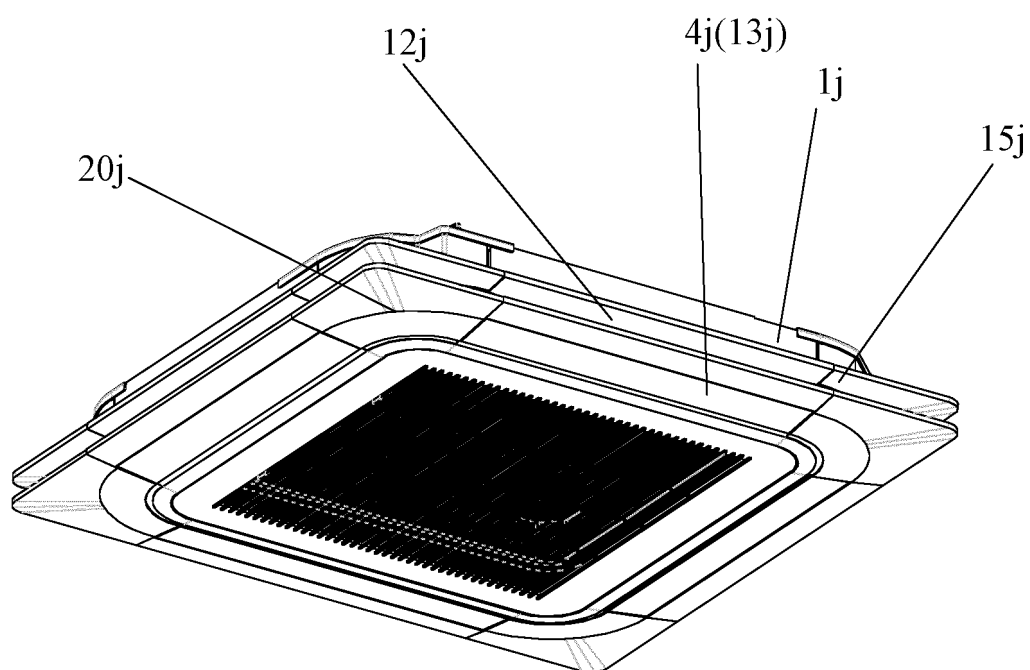


Figure 115

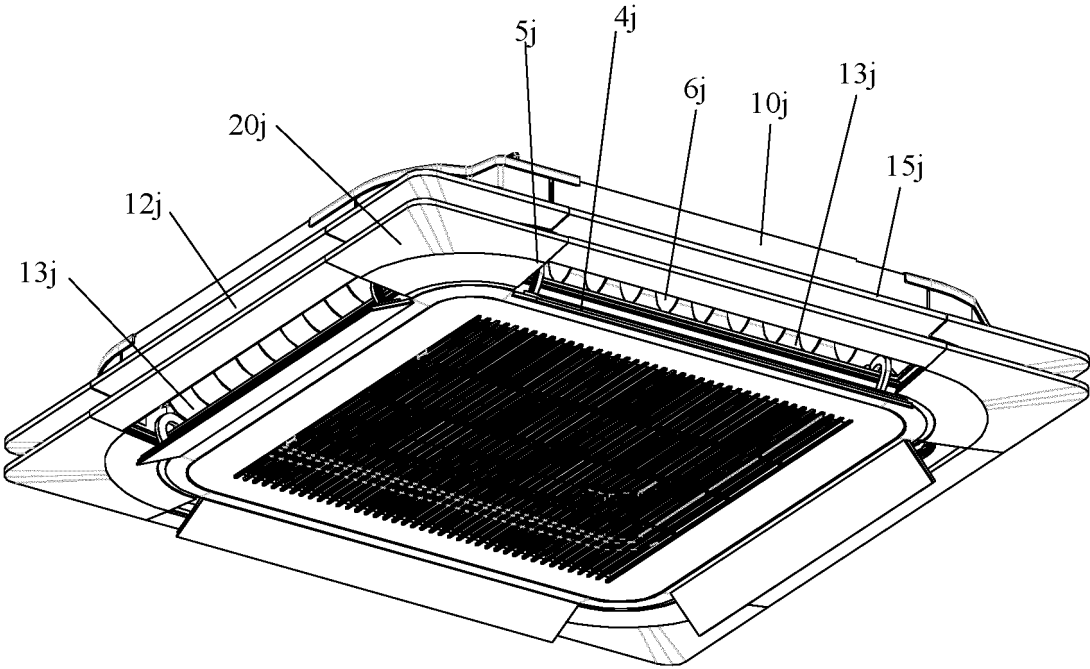


Figure 116

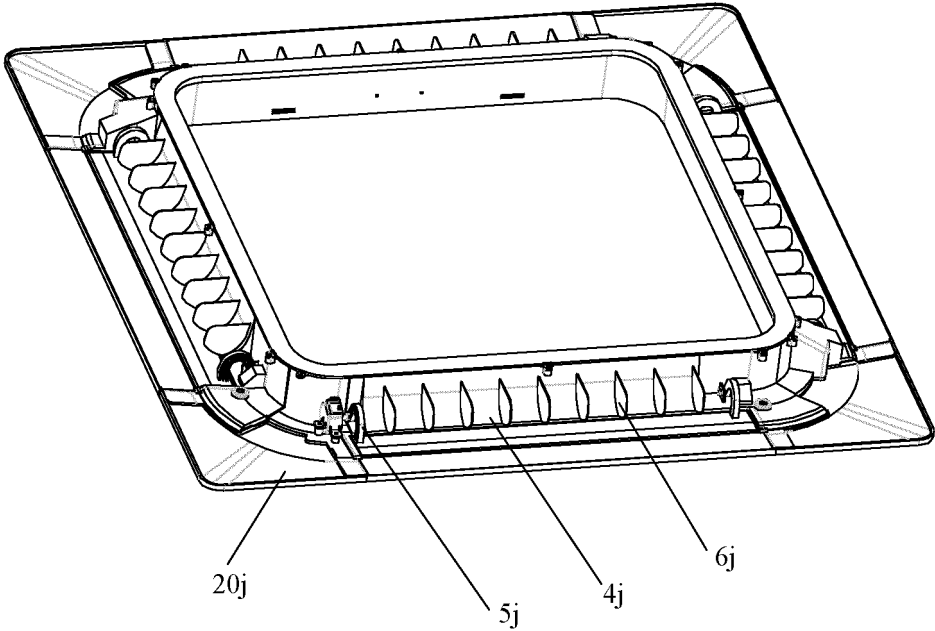


Figure 117

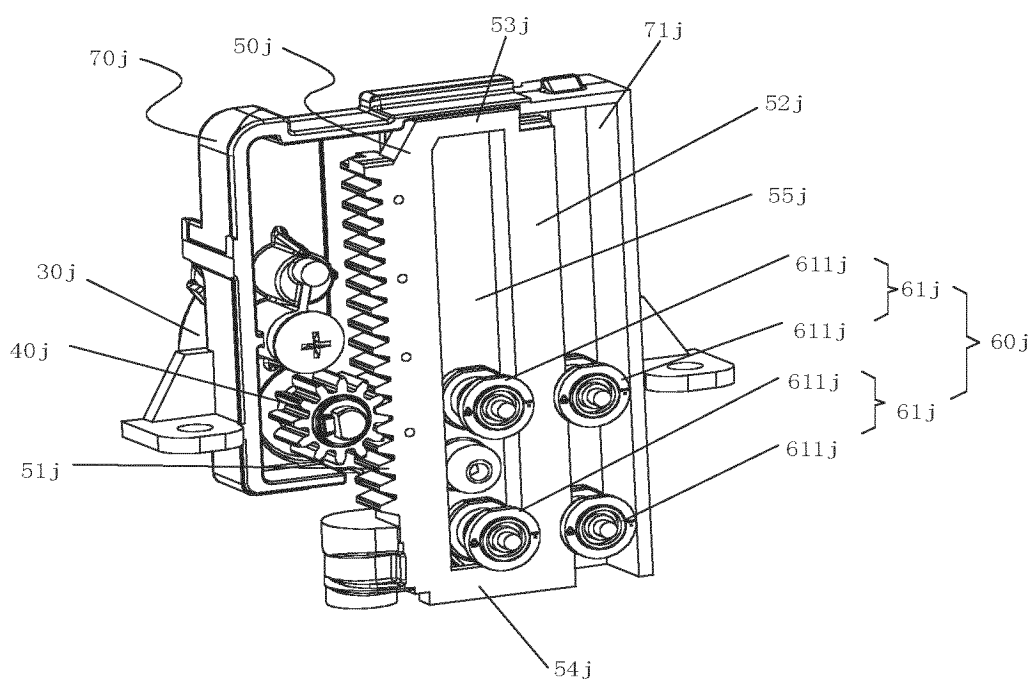


Figure 118

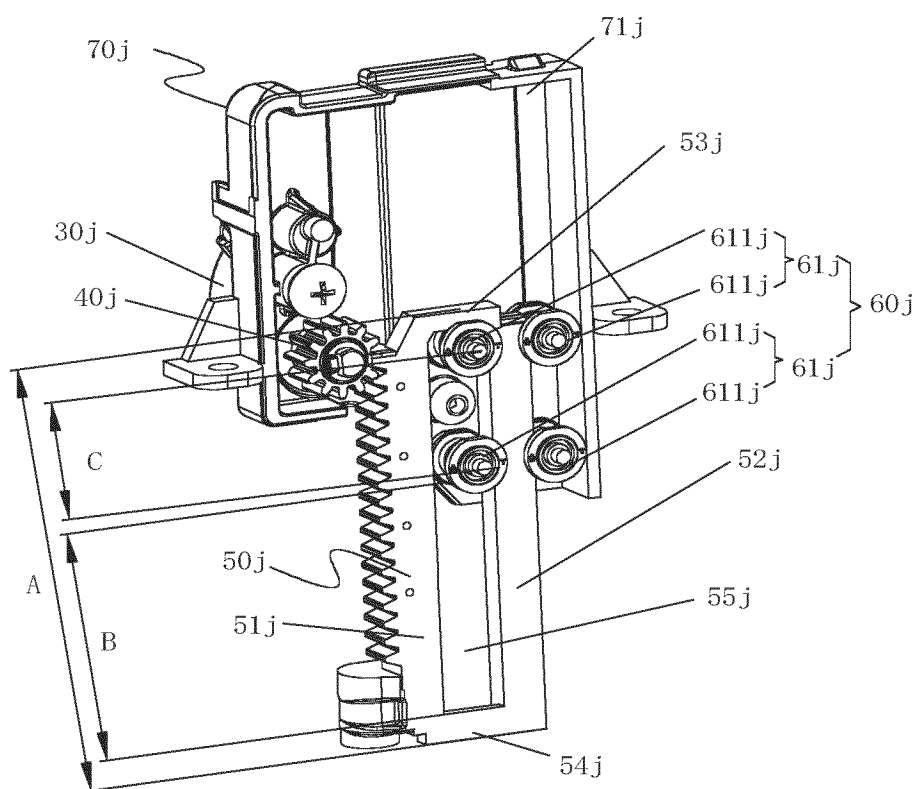


Figure 119

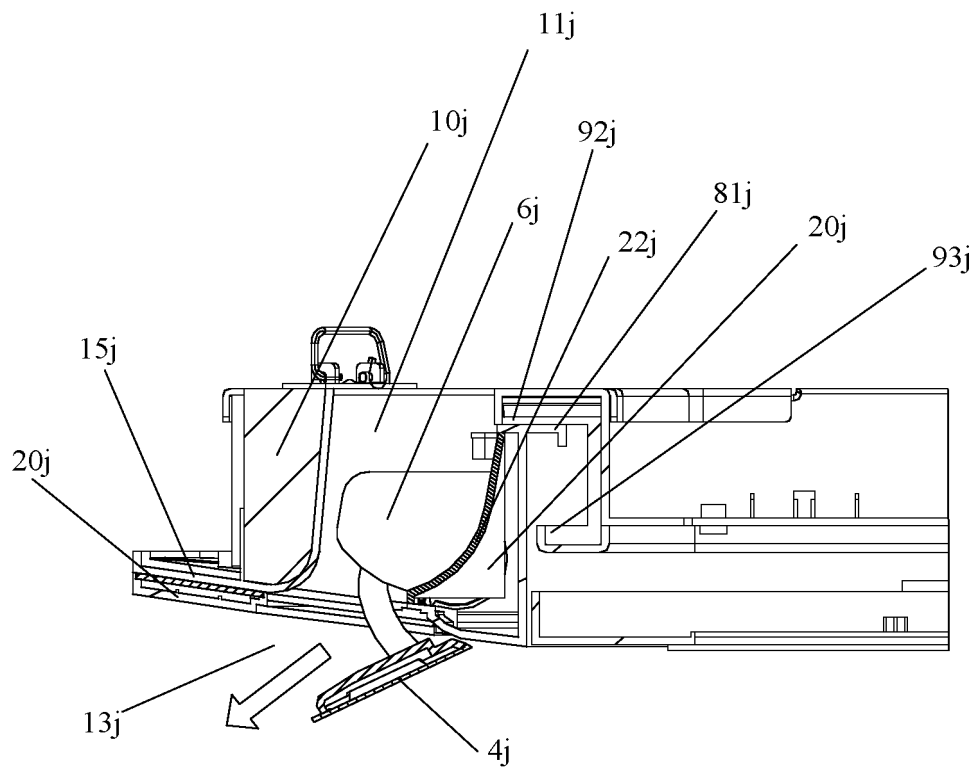


Figure 120

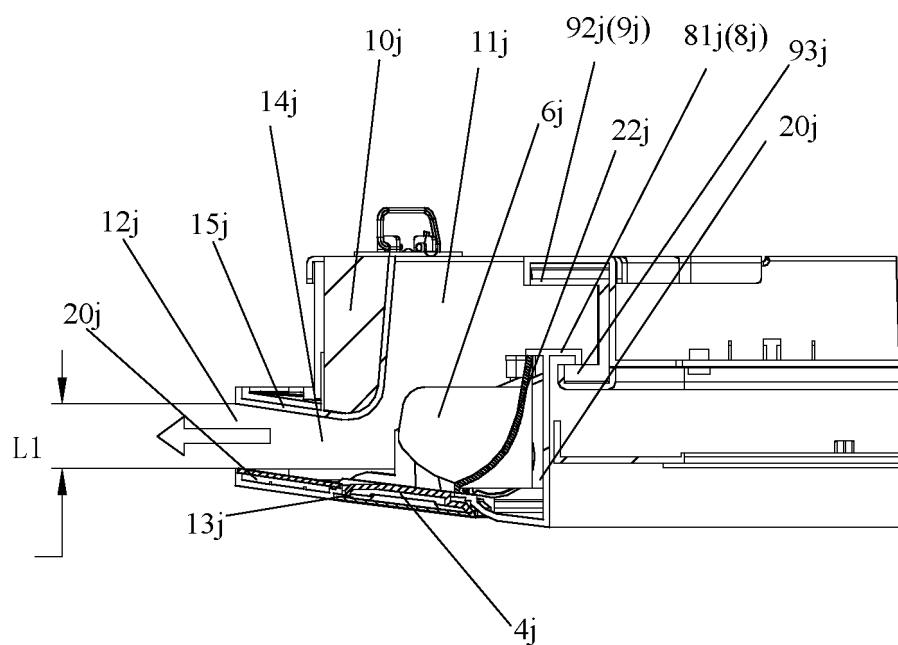


Figure 121

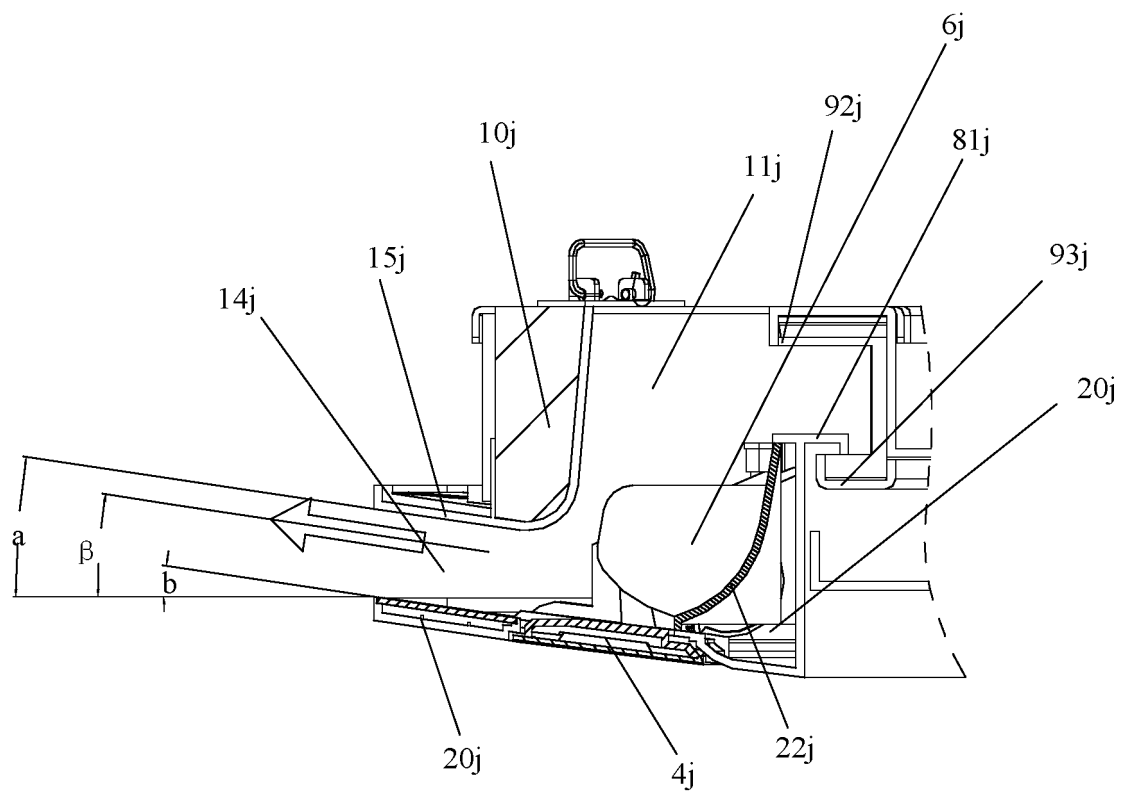


Figure 122

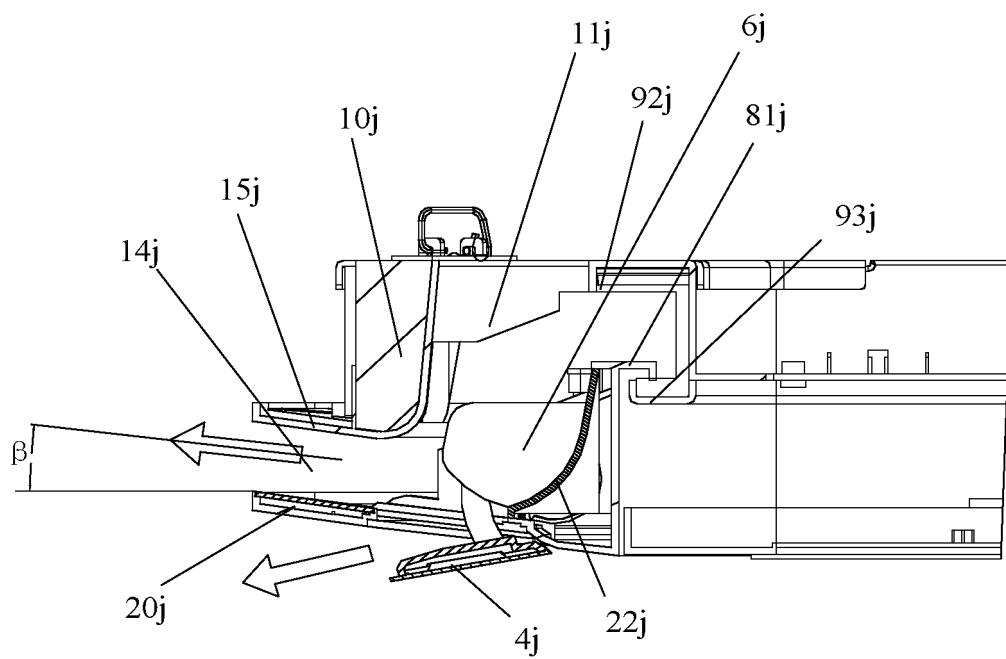


Figure 123

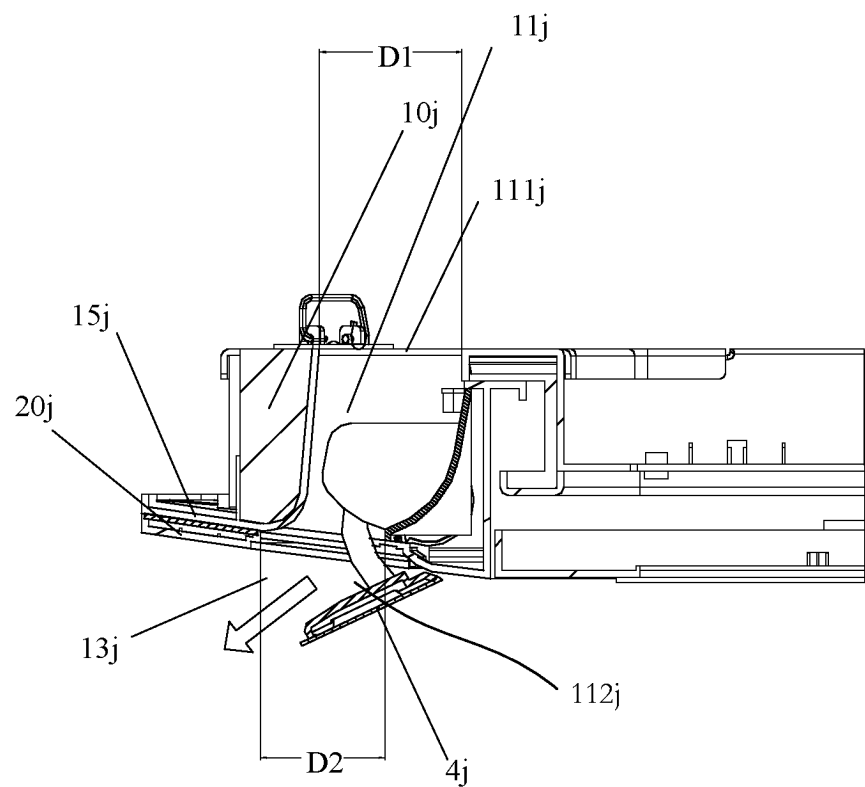


Figure 124

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/088105

A. CLASSIFICATION OF SUBJECT MATTER

F24F11/36(2018.01)i; F24F1/0011(2019.01)i; F24F1/0047(2019.01)i; F24F11/65(2018.01)i; F24F11/74(2018.01)i; F24F13/06(2006.01)i; F24F13/20(2006.01)i; F24F13/32(2006.01)i; F24F11/61(2018.01)i; F24F11/79(2018.01)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)

IPC: F24F

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; CNTXT; ENTXTC; VEN; CNKI; USTXT; EPTXT; WOTXT; 空调, 室内机, 天井机, 天花板机, 风机盘管, 嵌入, 出风口, 送风口, 吹出口, 导风, 扫风, 水平, 垂直, 升降, 伸缩, 上下, 高度, 角度, 面积, air conditioner, indoor, cassette, ceiling, outlet?, blade, up, down, lift, angle, height

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 218119912 U (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 23 December 2022 (2022-12-23) description, paragraphs [0037]-[0064], and figures 1-9	1-10, 48-62
PX	CN 217763654 U (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 08 November 2022 (2022-11-08) description, paragraphs [0029]-[0066], and figures 1-3	11-24
PX	CN 217737355 U (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 04 November 2022 (2022-11-04) description, paragraphs [0021] and [0043], and figure 1	25-36
PX	CN 218119913 U (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 23 December 2022 (2022-12-23) description, paragraphs [0035]-[0062], and figures 1-6	37-47
PX	CN 217763655 U (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 08 November 2022 (2022-11-08) description, paragraphs [0027]-[0048], and figures 1-3	63-73

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

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“D” document cited by the applicant in the international application

“E” earlier application or patent but published on or after the international filing date

“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)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“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

“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

“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

“&” document member of the same patent family

Date of the actual completion of the international search

29 June 2023

Date of mailing of the international search report

13 July 2023

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
CN)
China No. 6, Xitucheng Road, Jimenqiao, Haidian District,
Beijing 100088

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/088105

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 115406001 A (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 29 November 2022 (2022-11-29) description, paragraphs [0047]-[0099], and figures 1-8	74-83
PX	CN 217763835 U (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 08 November 2022 (2022-11-08) description, paragraphs [0036]-[0059], and figures 1-5	84-93
PX	CN 217952598 U (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 02 December 2022 (2022-12-02) description, paragraphs [0034]-[0064], and figures 1-5	94-112
PX	CN 217952597 U (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 02 December 2022 (2022-12-02) description, paragraphs [0069]-[0144], and figures 1-12	113-134
X	CN 210179765 U (QINGDAO HAIER AIR CONDITIONER ELECTRIC CO., LTD. et al.) 24 March 2020 (2020-03-24) description, paragraphs [0037]-[0059], and figures 1-9	84-109, 112
Y	CN 210179765 U (QINGDAO HAIER AIR CONDITIONER ELECTRIC CO., LTD. et al.) 24 March 2020 (2020-03-24) description, paragraphs [0037]-[0059], and figures 1-9	74-83, 110, 111, 113-123, 128-130, 133, 134
Y	CN 108954506 A (GUANGDONG MIDEA REFRIGERATION EQUIPMENT CO., LTD. et al.) 07 December 2018 (2018-12-07) description, paragraphs [0045]-[0068], and figures 1-13	74-83, 110, 111, 113-123, 128-130, 133, 134
A	CN 107250674 A (SAMSUNG ELECTRONICS CO., LTD.) 13 October 2017 (2017-10-13) description, paragraphs [0045]-[0156], and figures 1-10	1-134
A	CN 206959284 U (GUANGDONG MIDEA REFRIGERATION EQUIPMENT CO., LTD. et al.) 02 February 2018 (2018-02-02) description, paragraphs [0040]-[0078], and figures 1-8	1-134

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/088105

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Claims 1-10 relate to a ceiling cassette air conditioner with the range of the ratio of the height h_1 of an air outlet to the width h_2 of a first end of an air output duct being $1/3 \leq h_1/h_2 \leq 3/5$.

Claims 11-24 relate to a ceiling cassette air conditioner with the range of an angle b between an air output direction of an air outlet and an air output direction of an air output duct being $130^\circ \leq b \leq 150^\circ$.

Claims 25-36 relate to a ceiling cassette air conditioner with the range of the height h_1 of an air outlet being $20 \text{ mm} \leq h_1 \leq 36 \text{ mm}$.

Claims 37-45 relate to a ceiling cassette air conditioner with the range of an angle c between a plane where a first air deflector is located and a mounting planar face of a main body frame being $-10^\circ \leq c \leq 10^\circ$ and the range of the descending height h of an air output assembly being $20 \text{ mm} \leq h \leq 36 \text{ mm}$.

Claims 46 and 47 relate to a ceiling cassette air conditioner with the range of an angle c between a plane where a first air deflector is located and a mounting planar face of a main body frame being $-10^\circ \leq c \leq 10^\circ$.

Claims 63-73 relate to a ceiling cassette air conditioner with the range of the ratio of the flow area S_1 of an air outlet to the flow area S_2 of a first end being $0.7 \leq S_1/S_2 \leq 1.27$.

Claims 74-83 relate to a control method for a ceiling cassette air conditioner with a first air outlet and a second air outlet opened at the same time during rapid cooling.

Claims 84-93 relate to a ceiling cassette air conditioner having a load bearing component and a lap joint component.

Claims 94-112 relate to an embedded air conditioner having a driving device, a transmission mechanism and a guide mechanism.

Claims 113-134 relate to a ceiling cassette air conditioner having a first air outlet and a second air outlet in communication with an air output duct.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2023/088105

5

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	218119912	U	23 December 2022	None			
CN	217763654	U	08 November 2022	None			
CN	217737355	U	04 November 2022	None			
CN	218119913	U	23 December 2022	None			
CN	217763655	U	08 November 2022	None			
CN	115406001	A	29 November 2022	None			
CN	217763835	U	08 November 2022	None			
CN	217952598	U	02 December 2022	None			
CN	217952597	U	02 December 2022	None			
CN	210179765	U	24 March 2020	CN	110145800	A	20 August 2019
CN	108954506	A	07 December 2018	CN	208443021	U	29 January 2019
CN	107250674	A	13 October 2017	US	2020300501	A1	24 September 2020
				US	11359834	B2	14 June 2022
				US	2018038613	A1	08 February 2018
				US	10718545	B2	21 July 2020
				JP	2016153717	A	25 August 2016
CN	206959284	U	02 February 2018	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 202210384810 [0001]
- CN 20221077060 [0001]
- CN 20221077067 [0001]
- CN 20221077107 [0001]
- CN 20221077108 [0001]
- CN 202210777069X [0001]
- CN 202211048419 [0001]
- CN 202210260142 [0001]
- CN 20221077040 [0001]
- CN 20221077084 [0001]