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(54) **REAR COVER APPARATUS AND CLOTHING TREATMENT DEVICE**

(57) A rear cover apparatus and a clothing treatment device. The rear cover apparatus (7) comprises an inner cover (71) and an outer cover (72). An airflow channel (71a) is formed in the inner cover (71); the inner cover (71) comprises a first side plate (711) and a plurality of protrusions (713) protruding out of a surface of the first side plate (711); and the airflow channel (71a) and the protrusions (713) are located on two opposite sides of the first side plate (711). The outer cover is arranged on the side of the inner cover (71) away from the airflow channel (71a); a silencing cavity (7a) is defined by the outer cover (72) and the inner cover (71); the protrusions (713) are located in the silencing cavity (7a); the inner cover (71) is provided with sound absorption holes (71b) enabling the airflow channel (71a) to be in communication with the silencing cavity (7a); and at least some of the sound absorption holes (71b) penetrate the first side plate (711) and the protrusions (713). In the rear cover apparatus (7), the first side plate (711) serves as a perforated thin plate, air in the sound absorption holes (71b) generates friction with the hole wall due to resonance, such that sound energy is lost, and noise radiated by the rear cover apparatus (7) is reduced; and the protrusions (713) can increase the thickness of air columns in the sound absorption holes (71b), that is, flow paths of an airflow in the sound absorption holes (71b) are increased,

such that the effect of sound absorption of low-frequency component noise is improved.

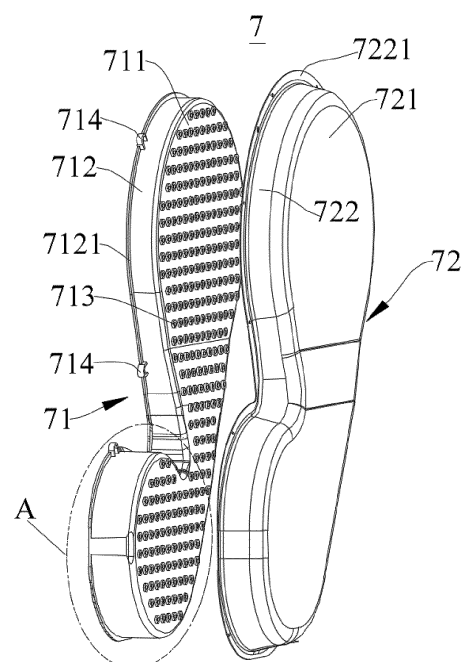


FIG. 6

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is filed based on and claims priority to Chinese Patent application No. 202110394536.6 filed on April 13, 2021 and Chinese Patent application No. 202120745756.4 filed on April 13, 2021, the contents of which are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

[0002] The application relates to the technical field of clothing care, and in particular to a rear cover apparatus and a clothing treatment device.

BACKGROUND

[0003] With the improvement of living standards, a clothing treatment device is used as a clothes drying tool and is favored by more and more users.

[0004] The clothing treatment device brings convenience to the user, while noise radiated by the clothing treatment device to its surrounding environment in a clothes drying process is a big problem puzzling the user. Taking a clothes dryer as an example, aerodynamic noise is a main noise source of the clothes dryer, here, a rear cover apparatus radiates a high aerodynamic noise outwards, and there is a large difficulty to reduce such noise.

SUMMARY

[0005] In view of this, embodiments of the application are desired to provide a rear cover apparatus with a good noise reduction effect and a clothing treatment device.

[0006] An embodiment of the application provides a rear cover apparatus, the rear cover apparatus is applied to a clothing treatment device, and includes an inner cover and an outer cover.

[0007] The inner cover is formed with an airflow channel, and includes a first side plate and multiple protrusions protruding from a surface of the first side plate, the airflow channel and the protrusions are located on two opposite sides of the first side plate.

[0008] The outer cover is arranged at a side of the inner cover away from the airflow channel, and defines, with the inner cover, a silencing cavity where the protrusions are located, the inner cover is provided with sound absorption holes communicating the airflow channel to the silencing cavity, and at least a part of the sound absorption holes penetrate the first side plate and the protrusions.

[0009] In some implementations, a protrusion thickness of the protrusion on the first side plate may be 2 mm to 5 mm.

[0010] In some implementations, a hole depth of the

sound absorption hole penetrating the first side plate and the protrusions may be 4 mm to 9 mm.

[0011] In some implementations, an equivalent diameter of the sound absorption hole may be 2.5 mm to 10 mm.

[0012] In some implementations, the outer cover may be a metal member; and/or, the inner cover may be a plastic member.

[0013] In some implementations, the outer cover may include a second side plate, the second side plate is arranged to be stacked with the first side plate at an interval, and a protrusion thickness of the protrusion on the first side plate is 0.1 to 0.3 times of a distance between the first side plate and the second side plate.

[0014] In some implementations, the outer cover may include a second side plate, the second side plate is arranged to be stacked with the first side plate at an interval, and a distance between the first side plate and the second side plate is 7 mm to 20 mm.

[0015] In some implementations, the rear cover apparatus may include a sound absorption material, the sound absorption material is arranged in the silencing cavity.

[0016] In some implementations, each of the sound absorption holes may penetrate the first side plate and a corresponding one of the protrusions, the sound absorption material includes a sound absorption film layer, and the sound absorption film layer covers an end of each of the protrusions away from the first side plate to block each of the sound absorption holes.

[0017] In some implementations, each of the sound absorption holes may penetrate the first side plate and a corresponding one of the protrusions, the sound absorption material includes a flexible sound absorption material, and the flexible sound absorption material is in a compressed state and blocks each of the sound absorption holes.

[0018] In some implementations, the outer cover may include a second side plate, the second side plate is arranged to be stacked with the first side plate at an interval, and the flexible sound absorption material is squeezed between the first side plate and the second side plate.

[0019] In some implementations, the outer cover may include a second side plate, the second side plate is arranged to be stacked with the first side plate at an interval; the rear cover apparatus may include a partition plate, the partition plate is arranged between the first side plate and the second side plate, the flexible sound absorption material is squeezed between the partition plate and the first side plate, and an air interlayer is formed between the partition plate and the second side plate.

[0020] In some implementations, a side of the inner cover away from the outer cover may be opened, the airflow channel includes an impeller mounting area and an air supply area, the air supply area is located downstream of the impeller mounting area in an airflow flowing direction, and the airflow channel sucks air from an opened part of the impeller mounting area and supplies air from an opened part of the air supply area.

[0021] An embodiment of the application provides a clothing treatment device, the clothing treatment device is provided with a circulation air passage, and includes a box body, a drum assembly arranged in the box body, and the rear cover apparatus of any embodiment of the application. The drum assembly is provided with a clothing treatment chamber, and the airflow channel and the clothing treatment chamber are located on the circulation air passage.

[0022] In some implementations, a rear side wall of the box body may be provided with an air outlet and an air inlet; the rear cover apparatus may be arranged outside the box body and located at a rear side of the rear side wall of the box body, and the airflow channel communicates the air outlet to the air inlet.

[0023] In some implementations, the clothing treatment device may include a base, an evaporator, a condenser and a wind wheel. The box body is arranged to cover above the base. The evaporator and the condenser are arranged on the base and located on the circulation air passage. The wind wheel is arranged in the airflow channel. Airflow from the clothing treatment chamber sequentially flows through the evaporator and the condenser, and then enters the airflow channel.

[0024] According to the rear cover apparatus of the embodiments of the application, the first side plate is used as a perforated thin plate and forms a perforated plate sound absorption structure with the silencing cavity behind it, air in the sound absorption hole generates friction with the hole wall due to resonance, so that sound energy is lost, and noise radiated by the rear cover apparatus is reduced. Furthermore, in case that wall thickness of the inner cover is unchanged, the protrusions of the embodiments of the application may increase thickness of an air column in the sound absorption hole, that is, increase an flow path of airflow in the sound absorption hole, so that a sound absorption effect of noise with low-frequency components is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a simplified schematic diagram of a clothing treatment device according to an embodiment of the application, in which arrows indicate an airflow flow path.

FIG. 2 is a schematic diagram of a rear cover apparatus cooperating with a rear side wall of a box body according to an embodiment of the application.

FIG. 3 is a rear view of FIG. 2.

FIG. 4 is a schematic exploded view of another perspective of the structure shown in FIG. 2.

FIG. 5 is a schematic diagram of another perspective

of the structure shown in FIG. 4.

FIG. 6 is a schematic structural diagram of a rear cover apparatus according to an embodiment of the application.

FIG. 7 is a partially enlarged schematic diagram at A of FIG. 6.

FIG. 8 is a schematic diagram of another perspective of the structure shown in FIG. 6.

FIG. 9 is a simplified cross-sectional view of a rear cover apparatus according to a first embodiment of the application.

FIG. 10 is a partially enlarged schematic diagram at B of FIG. 9.

FIG. 11 is a partial schematic diagram of a simplified cross-sectional view of a rear cover apparatus according to a second embodiment of the application, in which a position of the cross-section and a position of local representation are the same as those in FIG. 10.

FIG. 12 is a partial schematic diagram of a simplified cross-sectional view of a rear cover apparatus according to a third embodiment of the application, in which a position of the cross-section and a position of local representation are the same as those in FIG. 10.

FIG. 13 is a partial schematic diagram of a simplified cross-sectional view of a rear cover apparatus according to a fourth embodiment of the application, in which a position of the cross-section and a position of local representation are the same as those in FIG. 10.

FIG. 14 is a partial schematic diagram of a simplified cross-sectional view of a rear cover apparatus according to a second embodiment of the application, in which a position of the cross-section and a position of local representation are the same as those in FIG. 10.

DETAILED DESCRIPTION

[0026] Implementations of the application will be further described in detail below with reference to the drawings and embodiments. The following embodiments are intended to explain the application, and cannot be used to limit the scope of the application.

[0027] It should be noted that in descriptions of the embodiments of the application, orientation or positional relationships indicated by terms "front", "rear", "up", "down" or the like are based on orientation or positional

relationships shown in FIG. 1, and these terms are only intended to facilitate the descriptions of the embodiments of the application and simplify the descriptions, and are not intended to indicate or imply that a referred device or element must have a particular orientation, configure and operate in a particular orientation, and thus cannot be understood as limitation of the embodiments of the application. Furthermore, terms "first", "second" and "third" are used for the purpose of description only, and cannot be understood as indicating or implying relative importance.

[0028] An embodiment of the application provides a rear cover apparatus 7, the rear cover apparatus 7 is applied to a clothing treatment device, to guide flow of a circulation airflow of the clothing treatment device.

[0029] An embodiment of the application provides a clothing treatment device, the clothing treatment device is provided with a circulation air passage. With reference to FIG. 1, the clothing treatment device includes a box body 1, a drum assembly 2 arranged in the box body 1, and the rear cover apparatus 7 of any embodiment of the application

[0030] With continuous reference to FIG. 1, the drum assembly 2 is provided with a clothing treatment chamber 2a communicated with the circulation air passage, and an airflow channel 71a is located on the circulation air passage, that is, airflow in the circulation air passage flows through interior of the rear cover apparatus 7 and the clothing treatment chamber 2a.

[0031] Specific types of the clothing treatment device are not limited, for example, the clothing treatment device may be a clothes dryer, a washer-dryer, etc.

[0032] Exemplarily, in an embodiment where the clothing treatment device is the washer-dryer, the drum assembly 2 includes an outer tub and an inner tub rotatably arranged in the outer tub.

[0033] In an embodiment where the clothing treatment device is the clothes dryer, the drum assembly 2 is provided with the inner tub only, while is not provided with the outer tub. That is, in the embodiment, the clothing treatment device is provided with only one tub.

[0034] It should be noted that the rear cover apparatus 7 may be arranged in the box body 1, or may be arranged outside the box body 1.

[0035] Exemplarily, in an embodiment where the clothing treatment device is the washer-dryer, the rear cover apparatus 7 is arranged in the box body 1, that is, the rear cover apparatus 7 is hidden in the box body 1.

[0036] Exemplarily, in an embodiment where the clothing treatment device is the clothes dryer, the rear cover apparatus 7 is arranged outside the box body 1 and located at a rear side of a rear side wall 11 of the box body 1. Specifically, with reference to FIG. 3 to FIG. 5, the rear side wall 11 of the box body 1 is provided with an air outlet 1a and an air inlet 1b, and the airflow channel 71a communicates the air outlet 1a to the air inlet 1b. In the embodiment, the rear cover apparatus 7 is exposed outside the clothing treatment device, and noise generated

by the rear cover apparatus 7 directly radiates to its surrounding environment. Therefore, noise reduction treatment of the rear cover apparatus 7 becomes particularly important.

[0037] It should be noted that the clothing treatment device is provided with a condensing apparatus located on the circulation air passage outside the clothing treatment chamber 2a and configured to reduce temperature of the air and dehumidify the air, a heating member configured to heat the dehumidified air, and a wind wheel 6 configured to make airflow in the circulation air passage form a directional flow.

[0038] Clothes drying process and principle of the clothing treatment device are as follows. A dry hot airflow enters the clothing treatment chamber 2a from downstream of the circulation air passage; in the clothing treatment chamber 2a, the dry hot airflow flows through surfaces of wet clothes, exchanges heat and moisture with the wet clothes, and absorb moisture in the clothes to become a wet hot airflow; the wet hot airflow enters upstream of the circulation air passage, and is subjected to condensation and dehumidification in a condensation apparatus in the circulation air passage, to form a low-temperature dry airflow; the low-temperature dry airflow is heated by the heating member to form a dry hot airflow; the dry hot airflow enters the clothing treatment chamber 2a again. The above processes operate circularly, to achieve continuous and efficient drying of the clothes.

[0039] Exemplarily, in some embodiments, the clothing treatment device includes a base 5, an evaporator 3 and a condenser 4. The box body 1 is arranged to cover above the base 5. The evaporator 3 and the condenser 4 are arranged on the base 5 and located on the circulation air passage. Both the evaporator 3 and the condenser 4 are located on the circulation air passage, the evaporator 3 is located upstream of the condenser 4 in an airflow flowing direction. Airflow from the clothing treatment chamber 2a sequentially flows through the evaporator 3 and the condenser 4, and then enters the airflow channel 71a. The evaporator 3 and the condenser 4 are used as a part of a heat pump system, that is, the clothing treatment device of the embodiment condenses, dehumidifies and heats airflow by using a heat pump technology.

[0040] The evaporator 3 is used as a condensation apparatus to reduce temperature of airflow and dehumidify the airflow, and the condenser 4 is used as a member to heat airflow.

[0041] It should be noted that in the related art, the rear cover is made of a single-layer plate structure, and plate thickness of the rear cover generally does not exceed 4 millimeter (mm) based on factors such as manufacturing process, production cost or the like, that is, the rear cover belongs to a thin-walled member. In a process of airflow flowing through the rear cover, in terms of a boundary layer of a wall surface of the rear cover, flowing speed inside the boundary layer is reduced due to viscous block, and flowing speed of the airflow outside the boundary

layer is greater than the flowing speed in the boundary layer, so that pressure pulsation is generated between interior and exterior of the boundary layer, impacts the rear cover, and generates dipole noise. Furthermore, in an embodiment where an impeller is mounted in the rear cover, blades of the impeller cut the air periodically to generate rotation noise, while the accelerated air continuously impacts a volute tongue of the rear cover in pulse, to generate a dipole. Therefore, the wall surface of the rear cover in the related art is a noise radiation surface with a large area.

[0042] With reference to FIG. 6 and FIG. 8, the rear cover apparatus 7 includes an inner cover 71 and an outer cover 72. The inner cover 71 is formed with an airflow channel 71a, and it may be understood that the airflow channel 71a is located on the circulation air passage.

[0043] With reference to FIG. 6 and FIG. 7, the inner cover 71 includes a first side plate 711 and multiple protrusions 713 protruding from a surface of the first side plate 711. With reference to FIG. 9, the airflow channel 71a and the protrusions 713 are located on two opposite sides of the first side plate 711.

[0044] With reference to FIG. 9, the outer cover 72 is arranged at a side of the inner cover 71 away from the airflow channel 71a. The outer cover 72 defines a silencing cavity 7a with the inner cover 71, the protrusions 713 are located in the silencing cavity 7a. With reference to FIG. 10 to FIG. 14, the inner cover 71 is provided with sound absorption holes 71b communicating the airflow channel 71a to the silencing cavity 7a, and at least a part of the sound absorption holes 71b penetrate the first side plate 711 and the protrusions 713.

[0045] It should be noted that at least a part of the sound absorption holes 71b penetrating the first side plate 711 and the protrusions 713 includes two cases as follows. In a first case, only a part of the sound absorption holes 71b penetrate the first side plate 711 and the protrusions 713, and another part of the sound absorption holes 71b penetrate the first side plate 711 only and does not penetrate the protrusions 713. In a second case, each of the sound absorption holes 71b penetrates the first side plate 711 and a corresponding one of the protrusions 713.

[0046] According to the rear cover apparatus 7 of the embodiments of the application, the first side plate 711 is used as a perforated thin plate and forms a perforated plate sound absorption structure with the silencing cavity 7a behind it, air in the sound absorption hole 71b generates friction with the hole wall due to resonance, so that sound energy is lost, and noise radiated by the rear cover apparatus 7 is reduced. Furthermore, in case that wall thickness of the inner cover 71 is unchanged, the protrusions 713 of the embodiments of the application may increase thickness of an air column in the sound absorption hole 71b, that is, increase a flow path of airflow in the sound absorption hole 71b, so that a sound absorption effect of noise with low-frequency components is im-

proved.

[0047] Specific shapes of the protrusion 713 are not limited, such as a hollow cylinder, a hollow frustum, a hollow cuboid, etc.

[0048] It may be understood that an outer contour of the protrusion 713 may be a regular shape or an irregular shape.

[0049] In some embodiments, with reference to FIG. 10, a protrusion thickness d1 of the protrusion 713 on the first side plate 711 is 2 mm to 5 mm, such as 2 mm, 2.4 mm, 3 mm, 3.5 mm, 4 mm, 4.6 mm, 5 mm, etc. In the embodiment, in case of providing a noise reduction function, the protrusion thickness of the protrusion 713 does not excessively increase size of the rear cover apparatus 7 in a front-rear direction of the clothing treatment device.

[0050] In some embodiments, with reference to FIG. 10, in terms of the sound absorption hole 71b penetrating the first side plate 711 and the protrusion 713, a hole depth d3 of the sound absorption hole 71b is 4 mm to 9 mm, such as 4 mm, 4.5 mm, 5 mm, 5.4 mm, 6 mm, 6.6 mm, 7 mm, 7.3 mm, 7.8 mm, 8 mm, 8.5 mm, 9 mm, etc. According to the sound absorption hole 71b of the embodiment, in case that noise reduction is met, thickness of the air column in the sound absorption hole 71b may be controlled in a suitable range, so that airflow loses large sound energy in the sound absorption hole 71b.

[0051] With reference to FIG. 5, FIG. 8 and FIG. 9, a side of the inner cover 71 away from the outer cover 72 is opened, the airflow channel 71a includes an impeller mounting area 71a' and an air supply area 71a'', the air supply area 71a'' is located downstream of the impeller mounting area 71a' in the airflow flowing direction, and the airflow channel 71a sucks air from an opened part of the impeller mounting area 71a' and supplies air from an opened part of the air supply area 71a'.

[0052] With reference to FIG. 2, FIG. 4 and FIG. 5, the air outlet 1a on the rear side wall 11 of the box body 1 is aligned with the impeller mounting area 71a', and the air inlet 1b on the rear side wall 11 of the box body 1 is aligned with the air supply area 71a''.

[0053] After the rear cover apparatus 7 is assembled on the box body 1, the rear side wall 11 of the box body 1 closes the opened part of the inner cover 71, airflow enters the impeller mounting area 71a' of the airflow channel 71a from the air outlet 1a at the bottom of the rear side wall 11 of the box body 1, flows upward along the airflow channel 71a, and enters the box body 1 from the air inlet 1b at the top of the rear side wall 11 of the box body 1, and thus enters the clothing treatment chamber 2a.

[0054] Specific structural forms of the inner cover 71 are not limited. Exemplarily, with reference to FIG. 6 and FIG. 8, the inner cover 71 includes a first enclosing plate 712, the first enclosing plate 712 is connected to the first side plate 711, extends along an edge of the first side plate 711, and is located at a side of the first side plate 711 away from the second side plate 721, that is, the first enclosing plate 712 is located at a side of the first side

plate 711 facing the box body 1. The first side plate 711 defines the airflow channel 71a with the first enclosing plate 712.

[0055] It should be noted that a volute tongue is formed at a part of the first enclosing plate 712 close to an air outlet position of an impeller 6, that is, the first side plate 711 and the first enclosing plate 712 corresponding to the impeller mounting area 71a' form a volute, and the volute and the impeller 6 cooperate to form a structural form of a centrifugal fan.

[0056] Exemplarily, with reference to FIG. 6 and FIG. 7, an end of the first enclosing plate 712 away from the first side plate 711 is formed with a first flanging 7121. After the rear cover apparatus 7 is assembled on the box body 1, the first flanging 7121 is fitted to the rear side wall 11 of the box body 1. The first flanging 7121 may increase a contact area between the inner cover 71 and the rear side wall 11 of the box body 1, and improve fitting reliability of the inner cover 71 and the rear side wall 11.

[0057] Exemplarily, with reference to FIG. 6 and FIG. 7, the inner cover 71 includes multiple mounting lugs 714 arranged on the first flanging 7121, and the mounting lugs 714 are provided with first connection holes respectively. During assembly, the inner cover 71 is fitted onto the rear side wall 11, and screws pass through the first connection holes and are screwed into the rear side wall 11, so that the inner cover 71 may be mounted on the rear side wall 11 of the box body 1.

[0058] During operation of the rear cover apparatus 7, the inner cover 71 bears a large airflow impact, and the mounting lugs 714 may improve connection reliability of the inner cover 71 and the rear side wall 11 of the box body 1.

[0059] The inner cover 71 may be made of a split-type structure, for example, the inner cover 71 is formed by splicing multiple plates together; the inner cover 71 may also be made of an integrally molded structure, for example, the inner cover 71 is formed by integrated injection molding, or formed by a metal sheet through a cold working process.

[0060] Materials of the inner cover 71 are not limited, and the inner cover 71 may be made of a plastic material or a metal material. Exemplarily, the inner cover 71 is a plastic member, that is, the inner cover 71 is formed by injection molding of a plastic material, such as Acrylonitrile Butadiene Styrene (ABS), Polypropylene (PP), etc.

[0061] Specific structures of the outer cover 72 are not limited. Exemplarily, with reference to FIG. 6, FIG. 8 and FIG. 9, the outer cover 72 includes a second side plate 721, the second side plate 721 is arranged to be stacked with the first side plate 711 at an interval, that is, the first side plate 711 and the second side plate 721 are arranged in a face-to-face manner, the first side plate 711 and the second side plate 721 are arranged at an interval, and the silencing cavity 7a is located between the first side plate 711 and the second side plate 721.

[0062] Exemplarily, the outer cover 72 includes a second enclosing plate 722, the second enclosing plate 722

extends along an edge of the second side plate 721, and is located at a side of the second side plate 721 facing the first side plate 711, that is, the second enclosing plate 722 is located at a side of the second side plate 721 facing the box body 1. The second enclosing plate 722 surrounds the first enclosing plate 712, and after the rear cover apparatus 7 is assembled on the rear side wall 11 of the box body 1, the inner cover 71 is located in a space enclosed by the outer cover 72 and the rear side wall 11 together. In the related art, a side of the first side plate facing the box body 1 is provided with the second side plate, without providing the second enclosing plate 712. In the application, the second enclosing plate 722 is provided and surrounds the first enclosing plate 712, leakage of sound from side surfaces may be avoided, and influence of noise is reduced.

[0063] In some embodiments, with reference to FIG. 8, an end of the second enclosing plate 722 away from the second side plate 721 is formed with a second flanging 7221. After the rear cover apparatus 7 is assembled on the box body 1, the second flanging 7221 is fitted to the rear side wall 11 of the box body 1. The second flanging 7221 may increase a contact area between the outer cover 72 and the rear side wall 11 of the box body 1, and improve fitting reliability of the outer cover 72 and the rear side wall 11.

[0064] In some embodiments, the second flanging 7221 is provided with second connection holes. During assembly, the outer cover 72 is fitted onto the rear side wall 11 and covers around the inner cover 71, and screws pass through the first connection holes and are screwed into the rear side wall 11, so that the outer cover 72 may be mounted on the rear side wall 11 of the box body 1.

[0065] The outer cover 72 may be made of a split-type structure, for example, the outer cover 72 is formed by splicing multiple plates together; the outer cover 72 may also be made of an integrally molded structure, for example, the outer cover 72 is formed by integrated injection molding, or formed by a metal sheet through a cold working process.

[0066] Materials of the outer cover 72 are not limited, and the outer cover 72 may be made of a plastic material or a metal material. Exemplarily, the outer cover 72 is a sheet metal part, that is, the outer cover 72 is made of a metal material.

[0067] It may be understood that in some embodiments, the inner cover 71 is a plastic member, and the outer cover 72 is also an integrated injection molded plastic member. In some other embodiments, the inner cover 71 is a plastic member, and the outer cover 72 is a sheet metal part. In some other embodiments, the inner cover 71 is a sheet metal part, and the outer cover 72 is also a sheet metal part. In some other embodiments, the inner cover 71 is a sheet metal part, and the outer cover 72 is a plastic member.

[0068] In an embodiment where the inner cover 71 is a plastic member and the outer cover 72 is a sheet metal part, the inner cover 71 made of a plastic material is weak

in heat conduction capability and thus has good thermal insulation performance, heat loss of airflow in a process of flowing through the airflow channel 71a is small, and energy consumption of the clothing treatment device is reduced; and the outer cover 72 made of a metal material has excellent sound insulation performance. Therefore, thermal insulation performance and sound insulation performance may be simultaneously considered in the embodiment.

[0069] It should be noted that in some embodiments, the first enclosing plate 712 may also be provided with sound absorption holes.

[0070] In some embodiments, with reference to FIG. 10, a distance d2 between the first side plate 711 and the second side plate 721 is 7 mm to 20 mm, such as 7 mm, 8 mm, 9 mm, 10 mm, 11 mm, 12 mm, 13 mm, 14 mm, 15 mm, 16 mm, 17 mm, 18 mm, 19 mm, 20 mm. Depth of the silencing cavity 7a is related to a vibration absorption frequency, and it may be achieved by the distance range of the embodiment that the silencing cavity 7a has an appropriate depth, so that a resonant frequency moves to a low-frequency end in case that size of the rear cover apparatus 7 is controlled in a suitable range.

[0071] In some embodiments, with continuous reference to FIG. 10, the protrusion thickness d1 of the protrusion 713 on the first side plate 711 is 0.1 to 0.3 times of the distance d2 between the first side plate 711 and the second side plate 721. For example, it includes 0.1, 0.12, 0.15, 0.18, 0.2, 0.23, 0.25, 0.25, 0.3 times, etc. Specifically, the protrusion thickness d1 of the protrusion 713 on the first side plate 711 is d1, the distance between the first side plate 711 and the second side plate 721 is d2, and $d1 = d2 * (0.1-0.3)$. In the embodiment, the first size is much smaller than the second size, by considering the overall size of the rear cover apparatus 7 in the front-rear direction of the clothing treatment device.

[0072] Specific shapes of the sound absorption hole 71b are not limited, and may be circular, polygonal, elliptical, etc.

[0073] In some embodiments, an equivalent diameter of the sound absorption hole 71b is 2.5 mm to 10 mm, such as 2.5 mm, 3 mm, 3.5 mm, 4 mm, 4.5 mm, 5 mm, 5.5 mm, 6 mm, 6.5 mm, 7 mm, 7.5 mm, 8 mm, 8.5 mm, 9 mm, 9.5 mm, 10 mm. The size range facilitates processing and manufacturing in case of providing a sound absorption function.

[0074] It should be noted that when an aperture of the sound absorption hole 71b is too small, process complexity of the inner cover 71 may be increased, resulting in a high manufacturing cost of the rear cover apparatus 7. When the aperture of the sound absorption hole 71b is too large, airflow in the airflow channel 71a may enter the silencing cavity 7a from the sound absorption hole 71b, resulting in a large loss of air volume in the airflow channel 71a.

[0075] The equivalent diameter refers to a diameter of a circular sound absorption hole 71b which is the same as area of a non-circular sound absorption hole 71b when

the sound absorption hole 71b is non-circular.

[0076] In some embodiments, porosity of the first side plate 711 is 2% to 40%, such as 2%, 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, etc. The porosity in such range may be suitable for a frequency band of sound to be absorbed by the rear cover apparatus 7 of the embodiments of the application.

[0077] The porosity is a ratio of a sum of areas of all the sound absorption holes 71b on the first side plate 711 to area of the first side plate 711.

[0078] In some embodiments, with reference to FIG. 9 and FIG. 10, the silencing cavity 7a is an air cavity, that is, any sound absorption material is not provided in the silencing cavity 7a.

[0079] In some other embodiments, with reference to FIG. 11 to FIG. 14, the rear cover apparatus 7 includes a sound absorption material 73, the sound absorption material 73 is arranged in the silencing cavity 7a. Specific types of the sound absorption material 73 are not limited, and the sound absorption material 73 enables a sound wave passing through the sound absorption hole 71b to lose sound energy again, thereby further reducing noise of the rear cover apparatus 7 radiated to the environment.

[0080] Exemplarily, in an embodiment where each of the sound absorption holes 71b penetrates the first side plate 711 and a corresponding one of the protrusions 713, the sound absorption material 73 covers an end of each protrusion 713 away from the first side plate 711 to block each of the sound absorption holes 71b. It should be noted that "block" refers to the sound absorption material 73 forming a blocking effect on airflow entering the sound absorption hole 71b. The sound absorption material 73 may be a permeable material or an impermeable material.

[0081] In some embodiments, with reference to FIG. 11 and FIG. 12, the sound absorption material 73 includes a sound absorption film layer 731, and the sound absorption film layer 731 covers each of the sound absorption holes 71b. Each of the sound absorption holes 71b and the silencing cavity 7a behind it form a row of cavity resonators. The sound absorption film layer 731 may be a plastic film, a lacquer cloth, an artificial leather, etc. The sound absorption film layer 731 has characteristics of impermeability, softness, exhibiting elasticity under tension, or the like, and absorbs incident sound energy near the resonant frequency.

[0082] In some embodiments, with reference to FIG. 11, the silencing cavity 7a behind the sound absorption film layer 731 is an air cavity, that is, the sound absorption material 73 includes the sound absorption film layer 731 only.

[0083] In some other embodiments, with reference to FIG. 12, the sound absorption material 73 further includes a flexible sound absorption material 732 filled in the silencing cavity 7a behind the sound absorption film layer 731. A large number of micropores and/or gaps should be formed inside the flexible sound absorption material 732, and the micropores should be as fine as

possible and uniformly distributed inside the material. The micropores inside the material should be interpenetrated, rather than closed. The micropores are opened outwards, so that sound waves easily enter the micropores.

[0084] Specific types of the flexible sound absorption material 732 are not limited, and exemplarily, the flexible sound absorption material 732 includes one or more of an organic fiber material, a hemp cotton felt, an inorganic fiber material, glass wool, rock wool, mineral wool, urea-formaldehyde foamed plastic and carbamate foamed plastic.

[0085] In some embodiments, with reference to FIG. 13 and FIG. 14, in an embodiment where each of the sound absorption holes 71b penetrates the first side plate 711 and a corresponding one of the protrusions 713, the sound absorption material 73 includes a flexible sound absorption material 732, and the flexible sound absorption material 732 is in a compressed state and blocks each of the sound absorption holes 71b. That is, the flexible sound absorption material 732 is in a compressed and squeezed state, to minimize a flow rate of airflow passing through the sound absorption hole 71b and entering the silencing cavity 7a, thereby reducing flow rate loss of the airflow.

[0086] In the embodiments, in case of ensuring that plate thickness of the inner cover 71 is the same as the plate thickness in the related art, the hole depth of the sound absorption hole 71b is increased due to the protrusion 713, so that the flexible sound absorption material 732, especially a fibrous flexible sound absorption material 732 such as a sound absorption cotton, is not easy to enter the airflow channel 71a.

[0087] Specifically, the fibrous flexible sound absorption material is a relatively fluffy material, and may be deformed after it is compressed, to enter the sound absorption hole 71b. In the related art, when no protrusion is provided, the fibrous flexible sound absorption material may enter the airflow channel, thereby affecting the air volume and possibly interfering with the impeller.

[0088] It should be noted that compression and squeezing manners of the flexible sound absorption material 732 are not limited.

[0089] Exemplarily, in some embodiments, with reference to FIG. 14, the flexible sound absorption material 732 is squeezed between the first side plate 711 and the second side plate 721, that is, the silencing cavity 7a is filled with the flexible sound absorption material 732.

[0090] In another embodiment, with reference to FIG. 3, the sound absorption material 73 includes a partition plate 74, the partition plate 74 is arranged between the first side plate 711 and the second side plate 721, the flexible sound absorption material 732 is squeezed between the partition plate 74 and the first side plate 711, and an air interlayer is formed between the partition plate 74 and the second side plate 721.

[0091] It should be noted that the condenser 4 and the heating member may be located upstream of the airflow

channel 71a in the airflow flowing direction, or may be located downstream of the airflow channel 71a.

[0092] In the descriptions of the application, descriptions of reference terms "an embodiment", "some embodiments", "example", "specific example", or "some examples" or the like means that specific features, structures, materials or characteristics described in connection with the embodiment or example are included in at least one of the embodiments or examples of the application. In the application, schematic expressions of the above terms do not necessarily refer to the same embodiment or example. Furthermore, the described specific features, structures, materials or characteristics may be combined in any one or more embodiments or examples in a suitable manner. Furthermore, those skilled in the art may combine different embodiments or examples described in the application and features of different embodiments or examples, without mutual conflict.

[0093] The above descriptions are only preferred embodiments of the application, and are not intended to limit the application. For those skilled in the art, there may be various changes and variations in the application. Any modification, equivalent replacement, improvement, or the like made within the spirit and principle of the application should be included in the scope of protection of the application.

Claims

1. A rear cover apparatus, applied to a clothing treatment device, comprising:

an inner cover, formed with an airflow channel, and comprising a first side plate and a plurality of protrusions protruding from a surface of the first side plate, the airflow channel and the protrusions located on two opposite sides of the first side plate; and

an outer cover, arranged at a side of the inner cover away from the airflow channel, and defining, with the inner cover, a silencing cavity where the protrusions are located, the inner cover provided with sound absorption holes communicating the airflow channel to the silencing cavity, and at least a part of the sound absorption holes penetrating the first side plate and the protrusions.

2. The rear cover apparatus of claim 1, wherein a protrusion thickness of the protrusion on the first side plate is 2 mm to 5 mm.
3. The rear cover apparatus of claim 1, wherein a hole depth of the sound absorption hole penetrating the first side plate and the protrusions is 4 mm to 9 mm.
4. The rear cover apparatus of claim 1, wherein an

equivalent diameter of the sound absorption hole is 2.5 mm to 10 mm.

5. The rear cover apparatus of claim 1, wherein the outer cover is a metal member; and/or, the inner cover is a plastic member. 5
6. The rear cover apparatus of claim 1, wherein the outer cover comprises a second side plate arranged to be stacked with the first side plate at an interval, and a protrusion thickness of the protrusion on the first side plate is 0.1 to 0.3 times of a distance between the first side plate and the second side plate. 10
7. The rear cover apparatus of claim 1, wherein the outer cover comprises a second side plate arranged to be stacked with the first side plate at an interval, and a distance between the first side plate and the second side plate is 7 mm to 20 mm. 15
8. The rear cover apparatus of any one of claims 1 to 5, comprising a sound absorption material arranged in the silencing cavity. 20
9. The rear cover apparatus of claim 8, wherein each of the sound absorption holes penetrates the first side plate and a corresponding one of the protrusions, and the sound absorption material comprises a sound absorption film layer which covers an end of each of the protrusions away from the first side plate to block each of the sound absorption holes. 25
10. The rear cover apparatus of claim 8, wherein each of the sound absorption holes penetrates the first side plate and a corresponding one of the protrusions, and the sound absorption material comprises a flexible sound absorption material which is in a compressed state and blocks each of the sound absorption holes. 30
11. The rear cover apparatus of claim 10, wherein the outer cover comprises a second side plate arranged to be stacked with the first side plate at an interval, and the flexible sound absorption material is squeezed between the first side plate and the second side plate. 35
12. The rear cover apparatus of claim 10, wherein the outer cover comprises a second side plate arranged to be stacked with the first side plate at an interval; the rear cover apparatus comprises a partition plate arranged between the first side plate and the second side plate, the flexible sound absorption material is squeezed between the partition plate and the first side plate, and an air interlayer is formed between the partition plate and the second side plate. 40
13. The rear cover apparatus of any one of claims 1 to 45

7, wherein a side of the inner cover away from the outer cover is opened, the airflow channel comprises an impeller mounting area and an air supply area located downstream of the impeller mounting area in an airflow flowing direction, and the airflow channel sucks air from an opened part of the impeller mounting area and supplies air from an opened part of the air supply area.

14. A clothing treatment device, provided with a circulation air passage, and comprising a box body, a drum assembly arranged in the box body, and the rear cover apparatus of any one of claims 1 to 13, the drum assembly provided with a clothing treatment chamber, and the airflow channel and the clothing treatment chamber located on the circulation air passage. 50
15. The clothing treatment device of claim 14, wherein a rear side wall of the box body is provided with an air outlet and an air inlet; the rear cover apparatus is arranged outside the box body and located at a rear side of the rear side wall of the box body, and the airflow channel communicates the air outlet to the air inlet. 55
16. The clothing treatment device of claim 14, comprising:
 - a base, above which the box body is arranged to cover;
 - an evaporator and a condenser, arranged on the base and located on the circulation air passage; and
 - a wind wheel, arranged in the airflow channel, airflow from the clothing treatment chamber sequentially flowing through the evaporator and the condenser, and then entering the airflow channel.

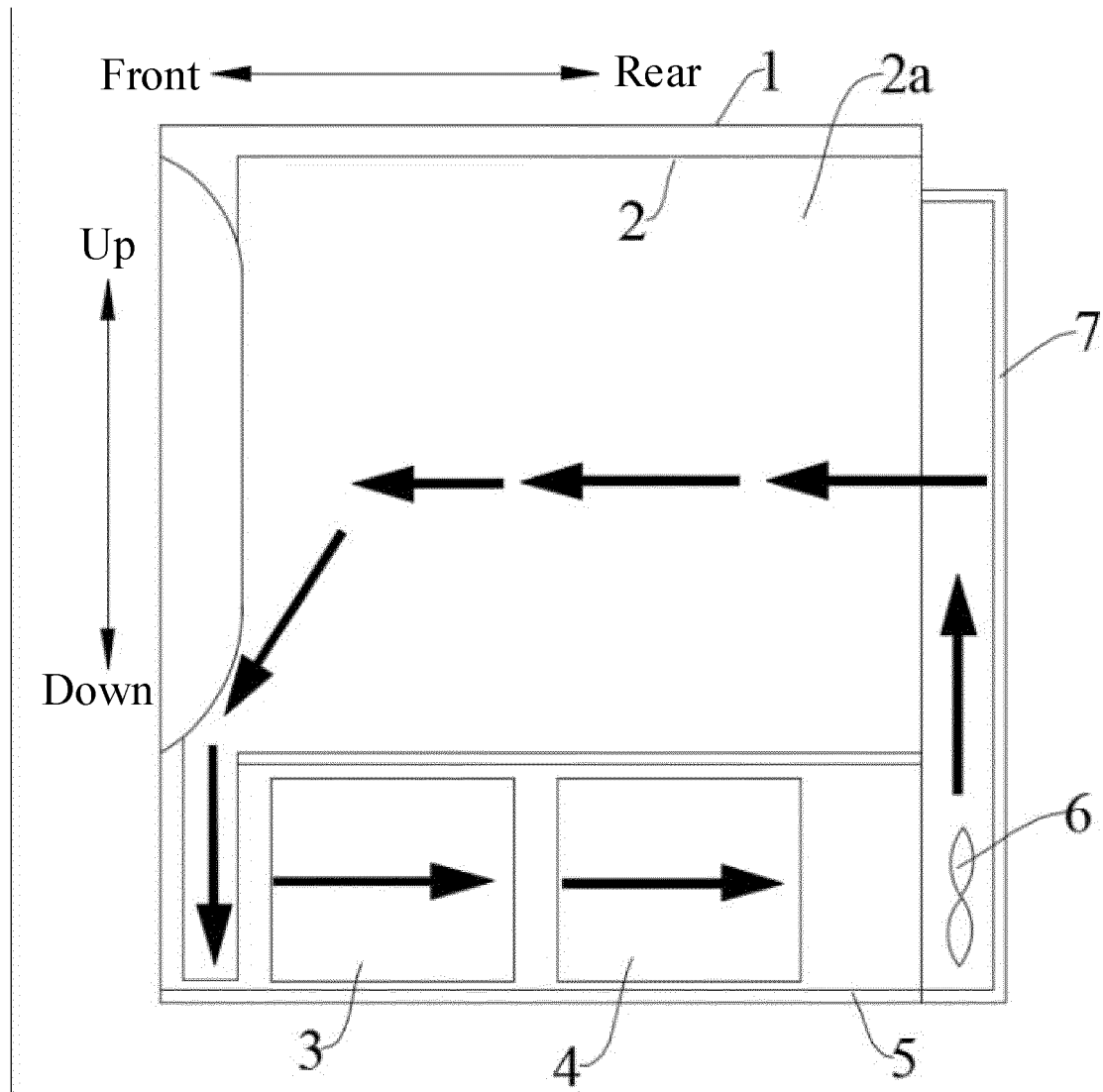


FIG. 1

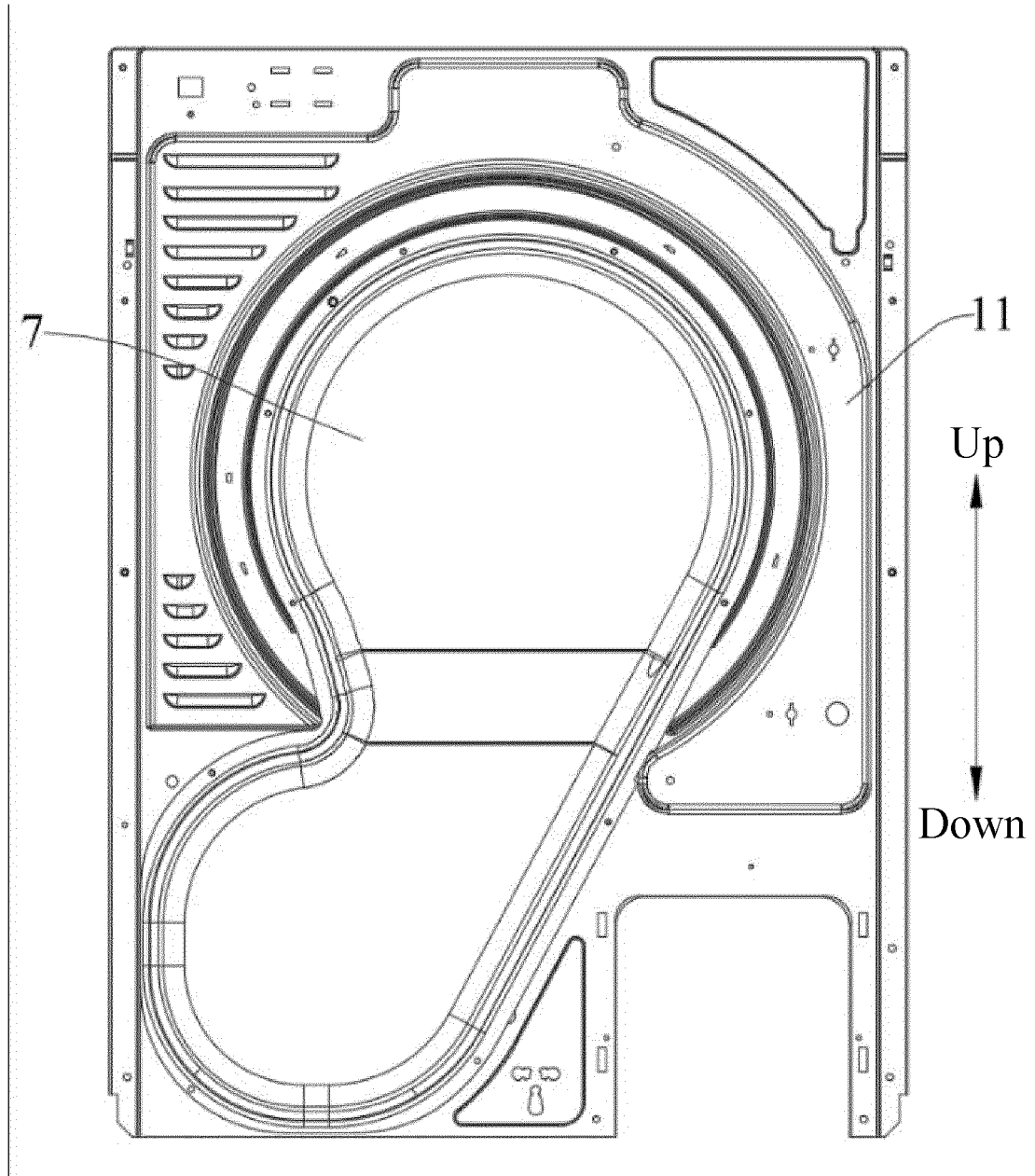


FIG. 2

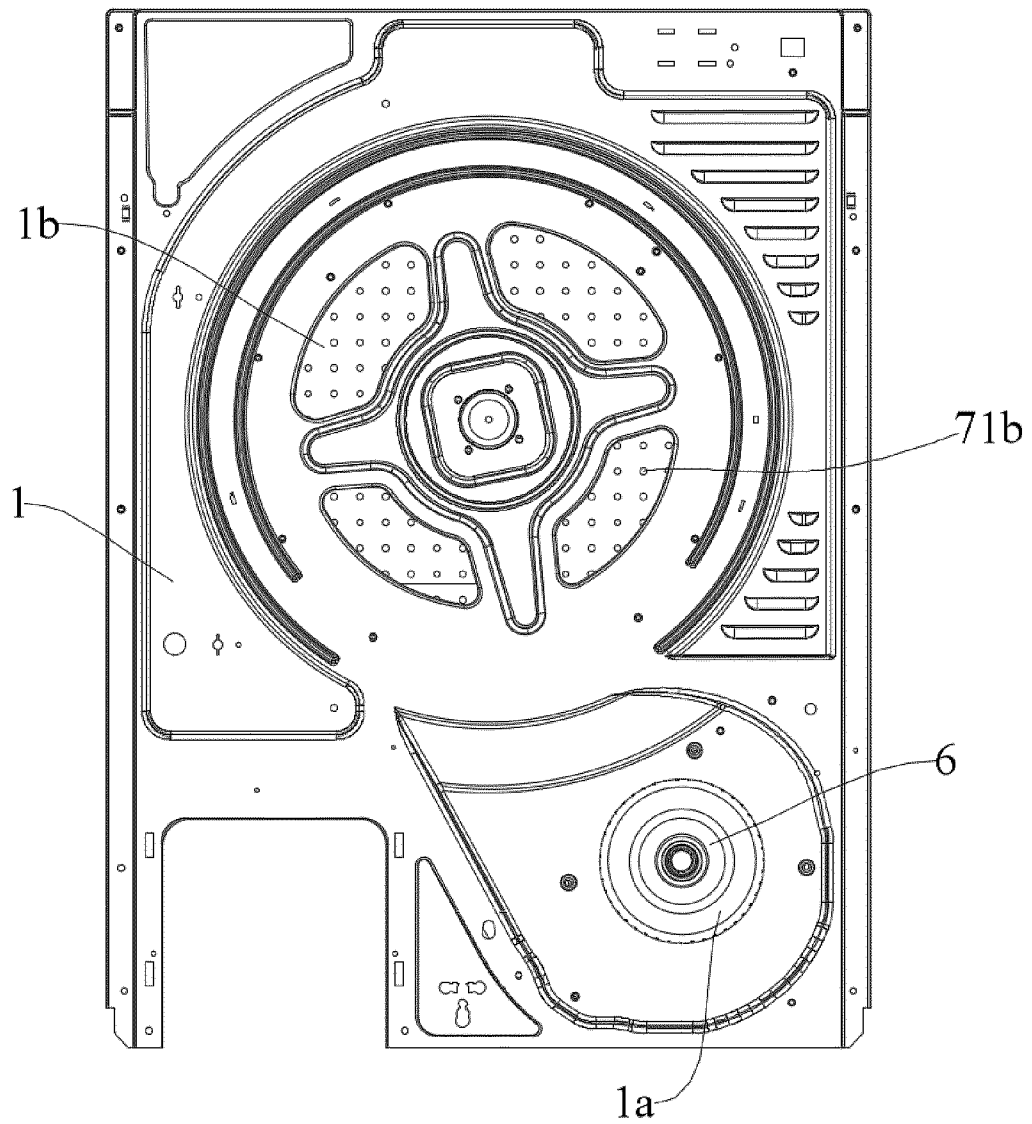


FIG. 3

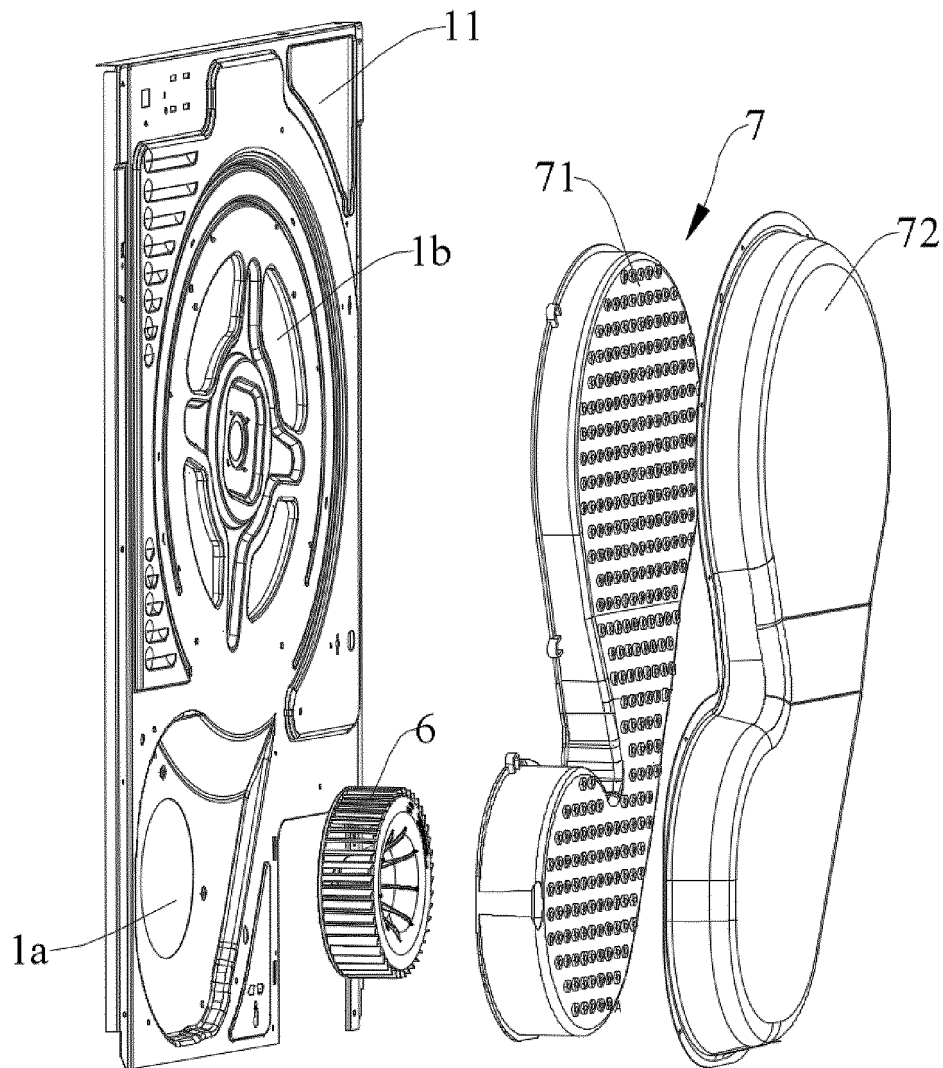


FIG. 4

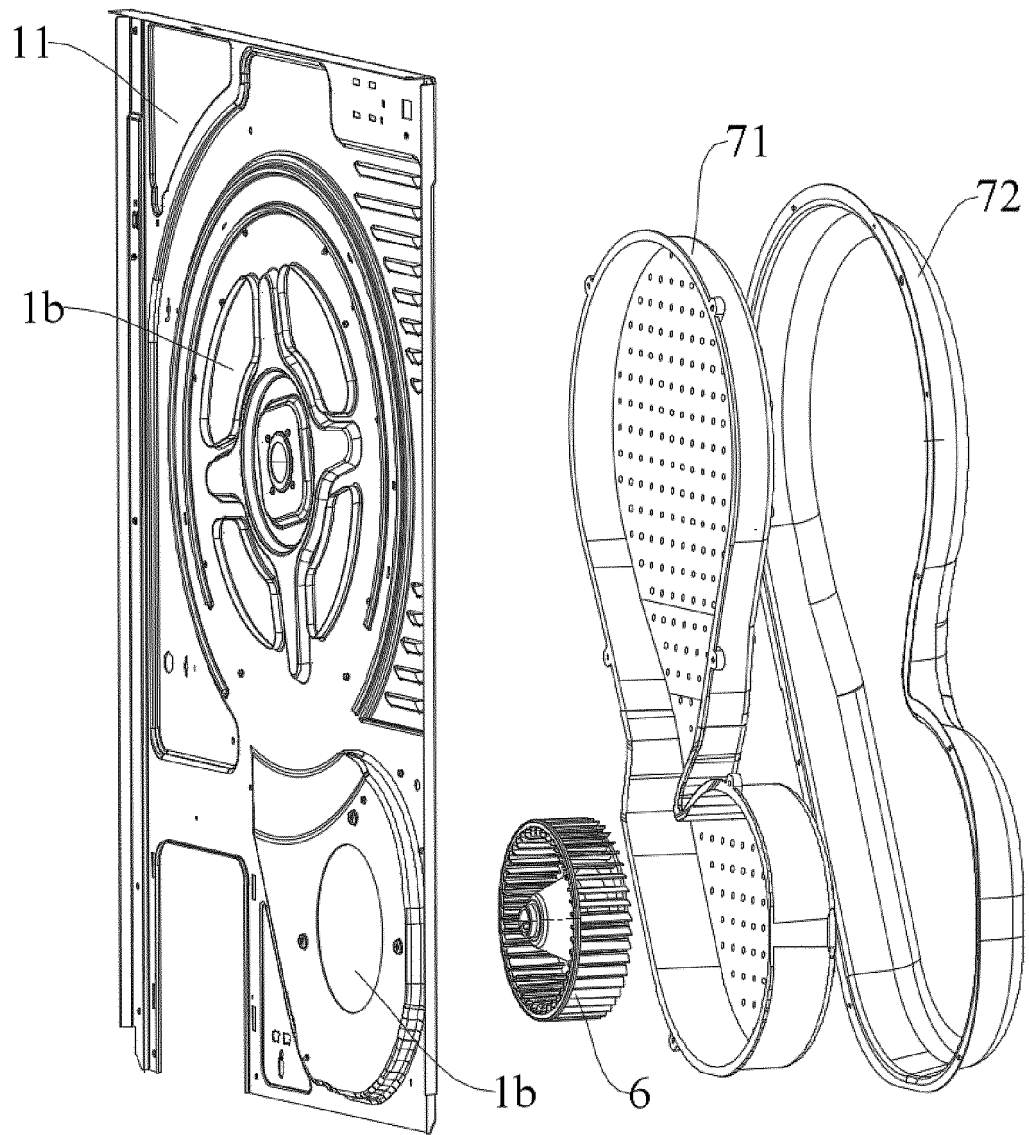


FIG. 5

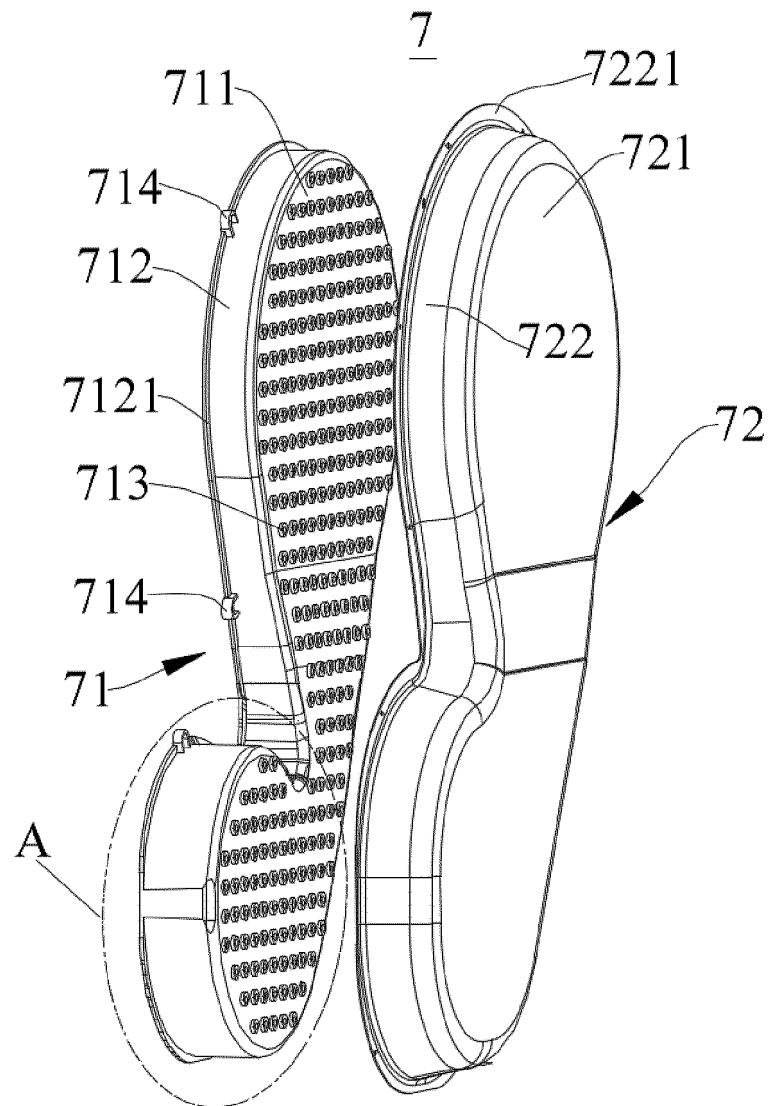


FIG. 6

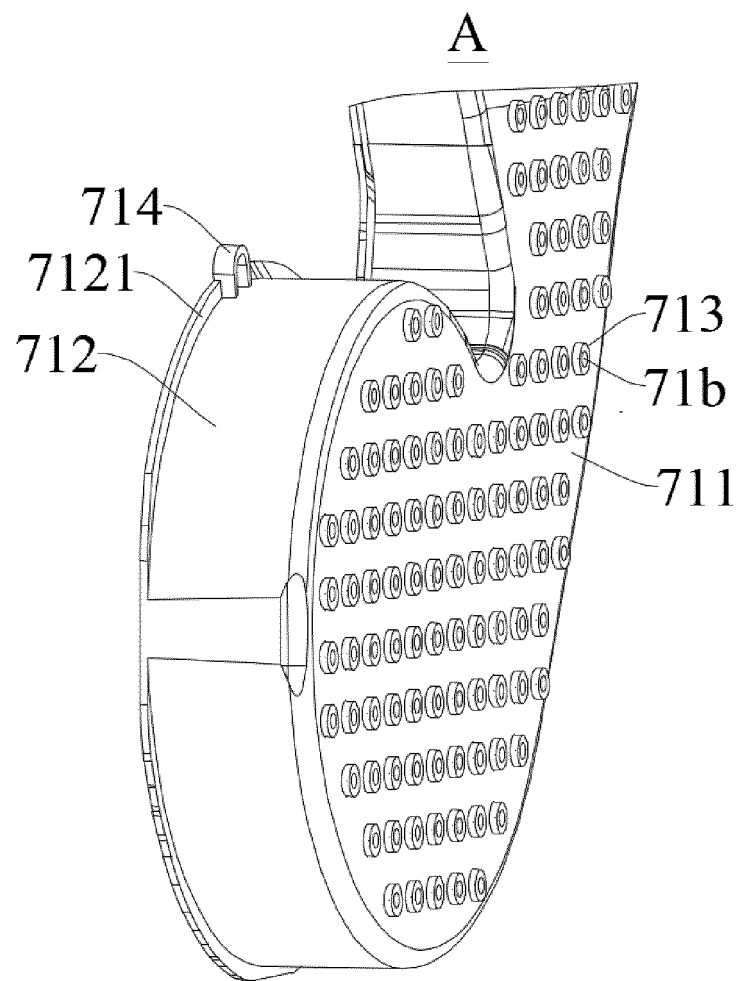


FIG. 7

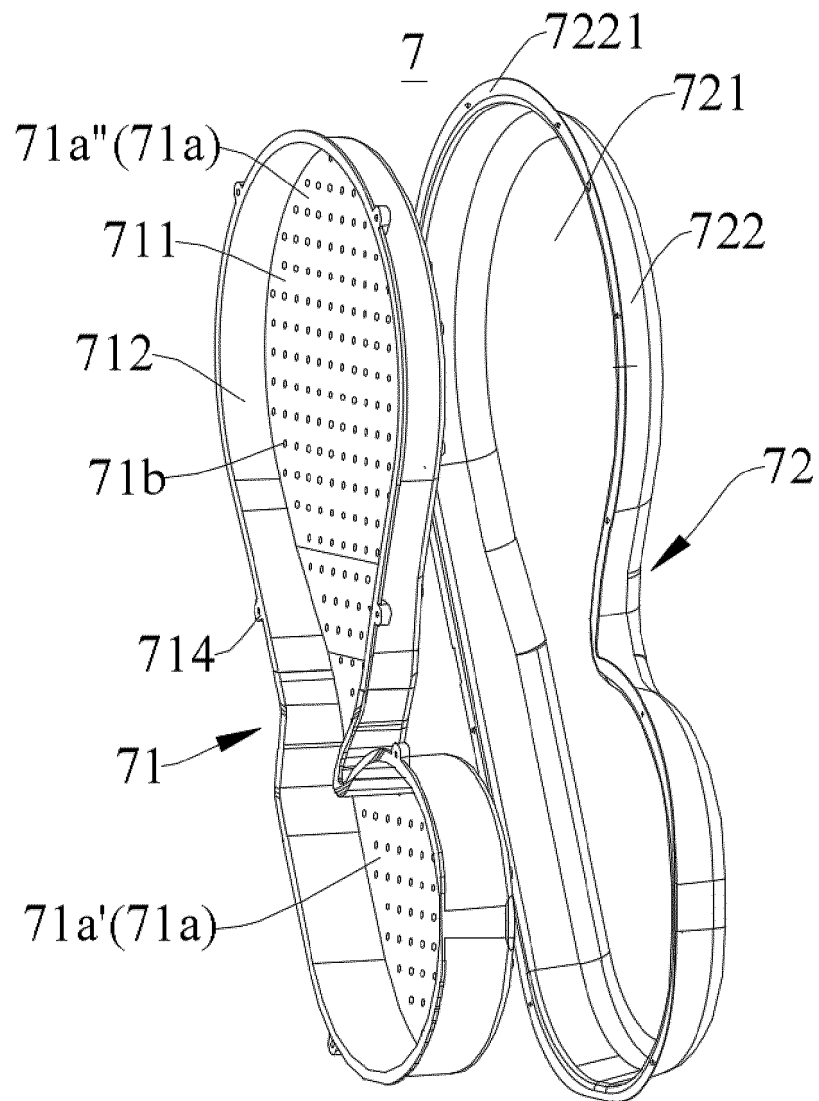


FIG. 8

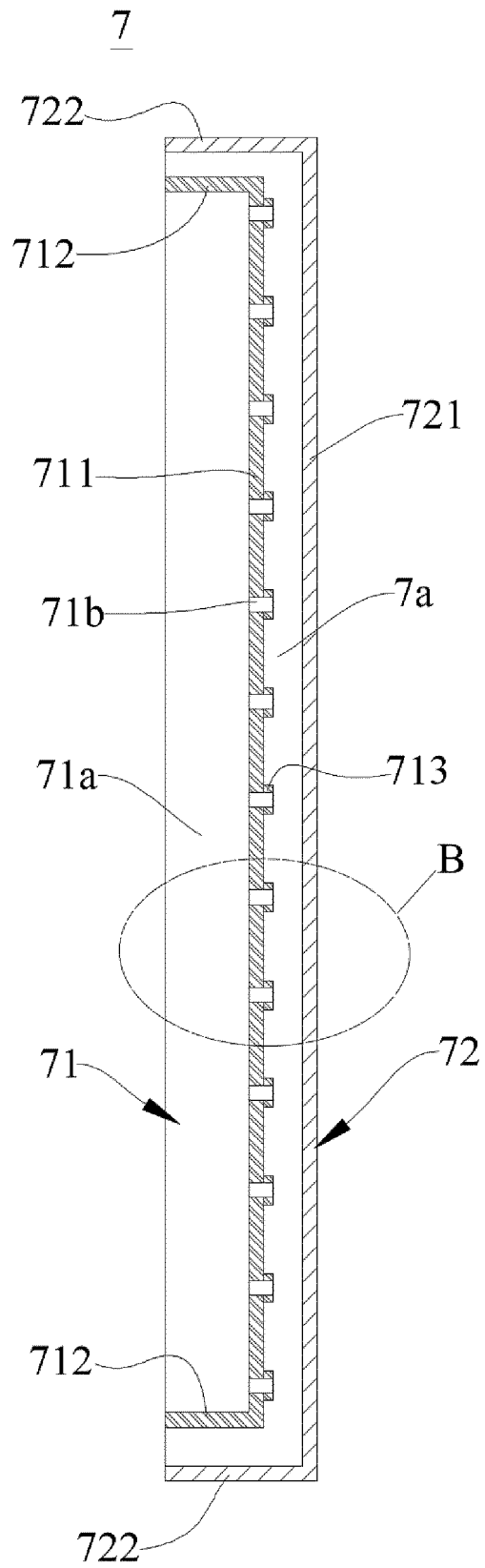


FIG. 9

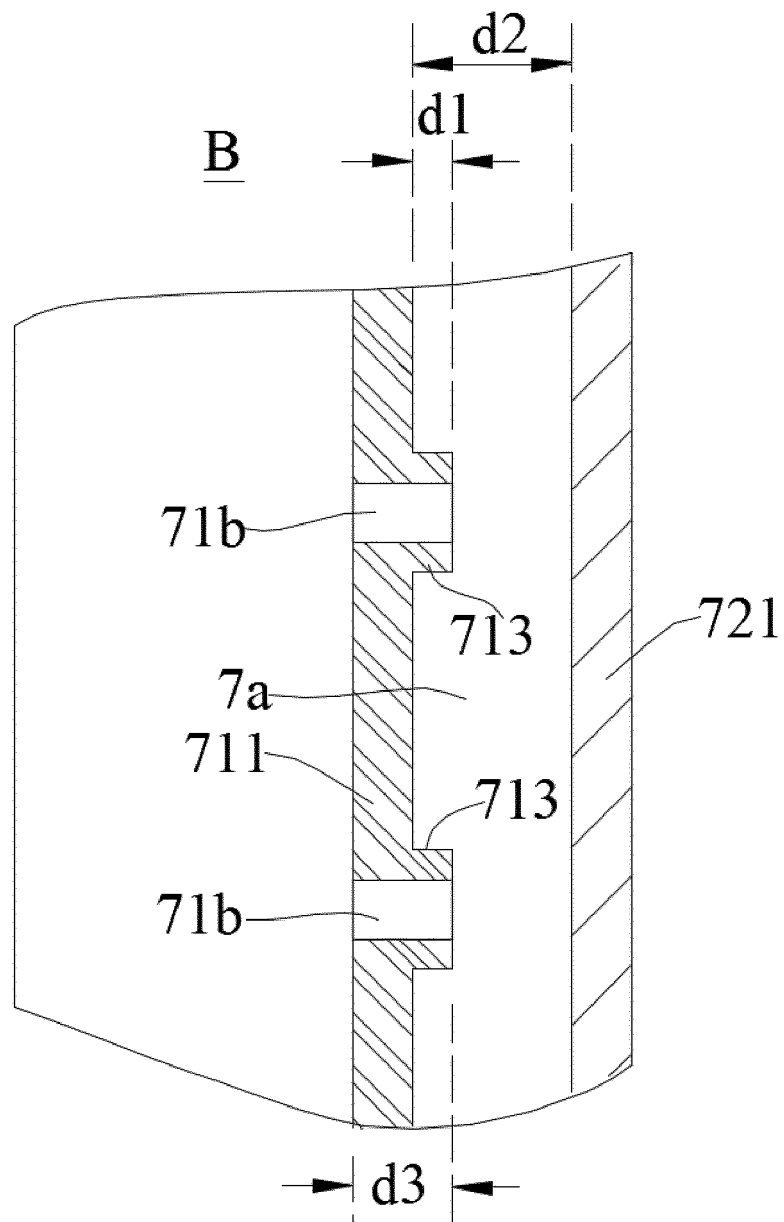


FIG. 10

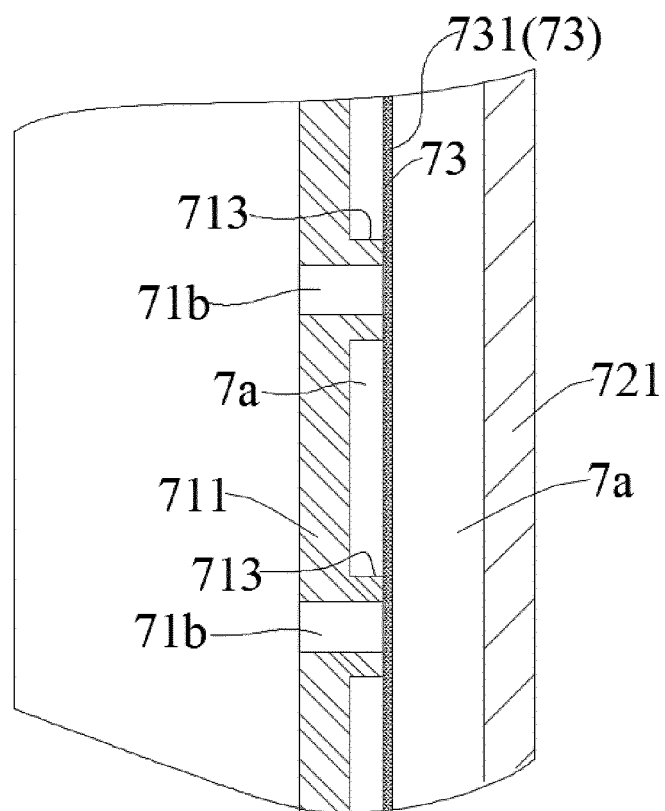


FIG. 11

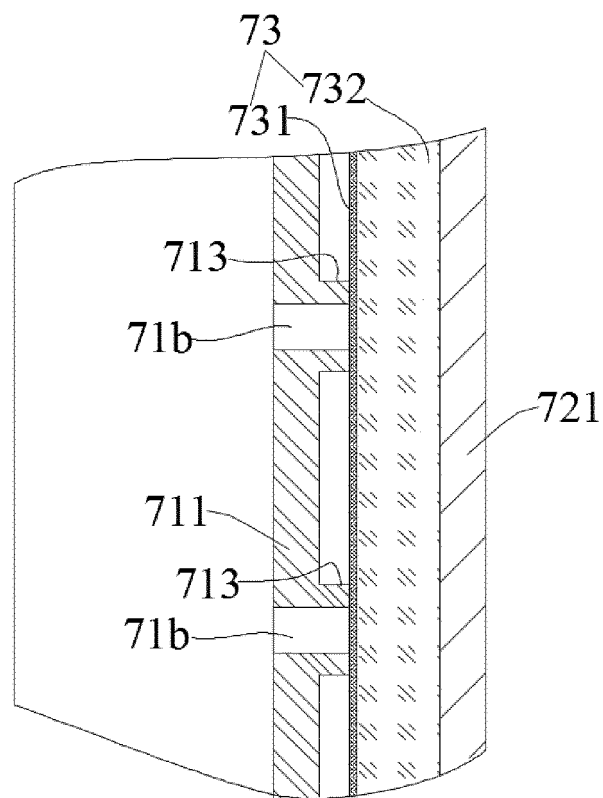


FIG. 12

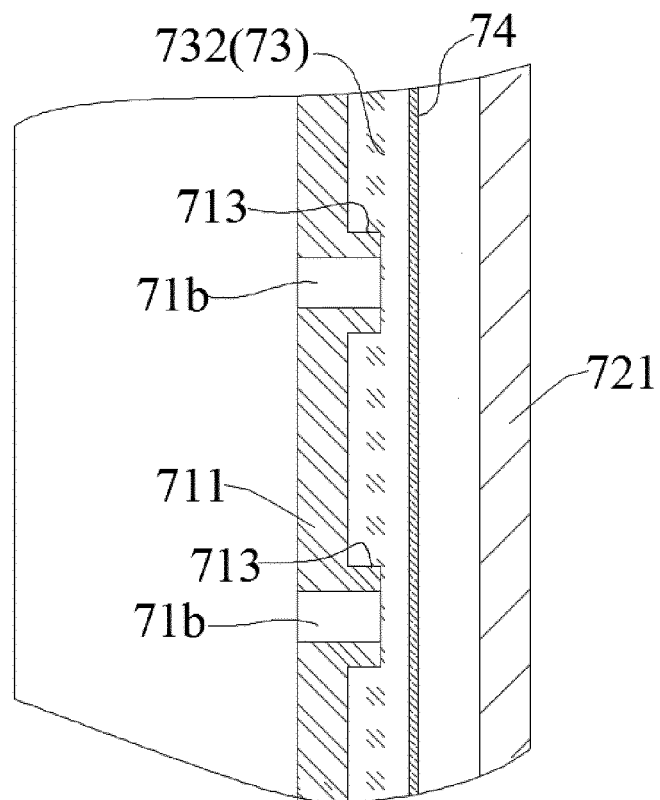


FIG. 13

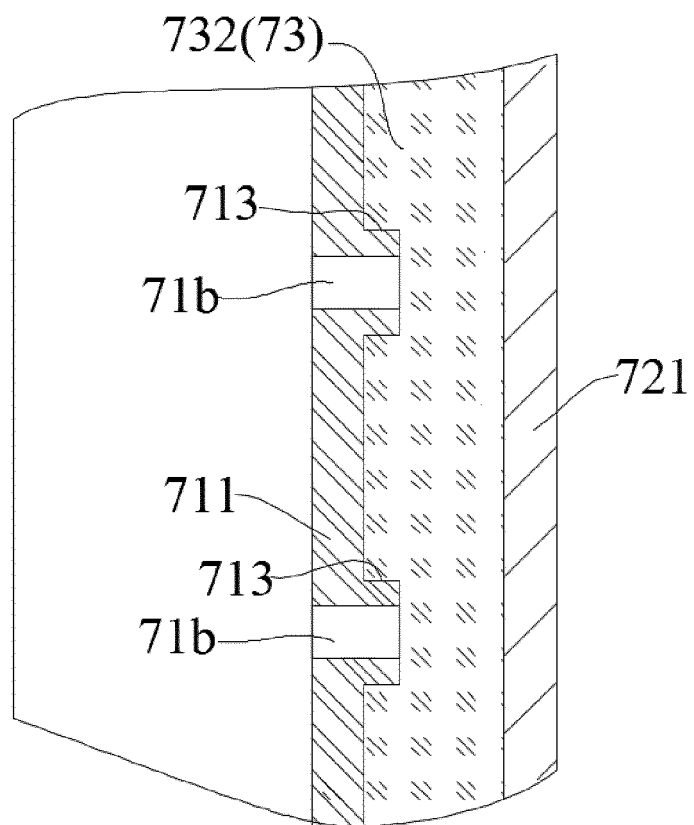


FIG. 14

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/123225

A. CLASSIFICATION OF SUBJECT MATTER D06F 58/20(2006.01)i; G10K 11/162(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC																					
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) D06F; E01B1; F01N13; G10K 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) CNTXT, DWPI, CNABS, SIPOABS, CNKI: 消音孔, 吸声孔, 消声孔, 吸音孔, 消音, 吸声, 消声, 吸音, 孔, 凸, 气柱, eliminat+, noise, reduc+, air????, gas????, hole?, pore?, opening?, aperture?, projection?, emboss+, protrusion?, protrud+, convex+																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT																					
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>CN 112309358 A (WUXI LITTLE SWAN ELECTRIC CO., LTD.) 02 February 2021 (2021-02-02) see paragraphs 0037-0050, and figures 1-7</td> <td>1-16</td> </tr> <tr> <td>Y</td> <td>CN 108866967 A (HISENSE (SHANDONG) REFRIGERATOR CO., LTD.) 23 November 2018 (2018-11-23) see paragraphs 0017-0020, 0025-0029, and figures 1-3</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>CN 210369396 U (GUANGXI CHENYU BUILDING MATERIAL SCIENCE & TECHNOLOGY CO., LTD.) 21 April 2020 (2020-04-21) entire document</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>US 2009038883 A1 (KIM, Y. O.) 12 February 2009 (2009-02-12) entire document</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>CN 110894669 A (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 20 March 2020 (2020-03-20) entire document</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>CN 2051253 U (MAANSHAN IRON & STEEL CORP.) 17 January 1990 (1990-01-17) entire document</td> <td>1-16</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	CN 112309358 A (WUXI LITTLE SWAN ELECTRIC CO., LTD.) 02 February 2021 (2021-02-02) see paragraphs 0037-0050, and figures 1-7	1-16	Y	CN 108866967 A (HISENSE (SHANDONG) REFRIGERATOR CO., LTD.) 23 November 2018 (2018-11-23) see paragraphs 0017-0020, 0025-0029, and figures 1-3	1-16	A	CN 210369396 U (GUANGXI CHENYU BUILDING MATERIAL SCIENCE & TECHNOLOGY CO., LTD.) 21 April 2020 (2020-04-21) entire document	1-16	A	US 2009038883 A1 (KIM, Y. O.) 12 February 2009 (2009-02-12) entire document	1-16	A	CN 110894669 A (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 20 March 2020 (2020-03-20) entire document	1-16	A	CN 2051253 U (MAANSHAN IRON & STEEL CORP.) 17 January 1990 (1990-01-17) entire document	1-16
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Date of the actual completion of the international search 08 December 2021	Date of mailing of the international search report 07 January 2022																				
Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/CN) No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China Facsimile No. (86-10)62019451	Authorized officer Telephone No.																				

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INTERNATIONAL SEARCH REPORT

International application No.

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Information on patent family members

International application No.

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