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(54) **ELECTROMAGNETIC HEATING MODULE AND CLOTHES TREATMENT DEVICE**

(57) An electromagnetic heating module and a clothing treatment device, wherein the electromagnetic heating module comprises: a first mounting disk (410), with a coil (401) disposed on an upper surface of the first mounting disk (410); a second mounting disk (420), disposed below the first mounting disk (410), with a magnet (402) disposed on a surface of the second mounting disk (420) that is opposite disposed to the first mounting disk (410). This electromagnetic heating module, by setting the first mounting disk and the second mounting disk and mounting the coil and the magnet on surfaces opposite to each other, can increase the distance between the two, which is conducive to the heat dissipation of the coil, and by applying it to a clothing treatment device, it can be used to heat a water container made of metal, so as to realize the contactless heating of the water, and the heat dissipation is good, and it is not easy to have overheating faults.

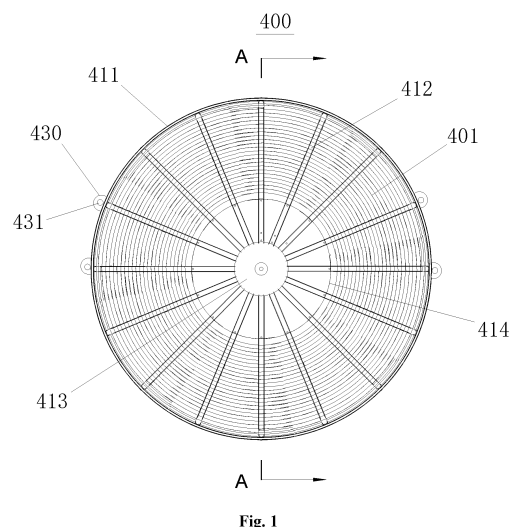


Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention belongs to the technical field of clothing treatment devices, and specifically, relates to an electromagnetic heating module and a clothing treatment device.

BACKGROUND

[0002] Most of the existing clothing treatment devices having a heating function, such as a washing machine, realize the purpose of heating washing water by setting a depression at the bottom of an outer drum and installing a heating device such as a heating tube in the depression. However, the heating device is provided inside the outer drum, which occupies space in the outer drum and affects the capacity of the washing machine. At the same time, the heating device is located inside the outer drum and is in direct contact with the washing water, so the sealing performance of the heating device is required to be very high. However, when the heating device is in operation, it is in a state of high temperature for a long period of time, which accelerates the aging of the sealing parts to a certain extent, and is prone to sealing failure, leading to the situation in which the washing water seeps into the interior of the heating device or seeps out of the mounting port of the heating device installed on the outer drum, which in turn causes a potential safety hazard.

[0003] On the other hand, during the heating process, the local ambient temperature near the heating device is relatively high, while the temperature of other locations inside the washing machine casing is relatively low, which is likely to produce condensation on the inner wall of the casing away from the heating device. There are wires installed on the inner wall of the washing machine casing, and if it is in a humid environment for a long time, it is easy to cause the aging of the insulation layer on the surface of the wires, which may result in the situation of ignition discharge, which may produce a burnt odor in the light case, or cause installation hazards in the heavy case.

[0004] In recent years, the washing machine industry has been carrying out the development of a washing machine with a non-porous inner drum, which is different from the traditional washing machine that holds water in the outer drum and clothes in the inner drum during the washing process, and no longer provides a dehydration hole in the inner drum, so that the inner drum can independently hold washing water during the washing process. The above method can avoid the situation of storing water between the inner and outer drums during the washing process, saving the amount of washing water, and also largely avoiding the accumulation of dirt between the inner and outer drums, thus avoiding the dirt between the inner and outer drums from entering the inner drum to contaminate the clothes, and realizing a

clean and hygienic washing. However, since there is no water between the inner and outer drums during the washing process, it is impossible to heat the washing water in the form of a heating tube in the outer drum of a conventional washing machine.

[0005] In order to solve the above series of problems, the prior art proposes a program of applying an electromagnetic heating module to heat washing water in a washing machine. However, the electromagnetic heating module itself has a high temperature when heating, and if effective heat dissipation cannot be realized, it is easy to cause the electromagnetic heating module to overheat and malfunction, affecting the use. At present, one solution to avoid overheating of the electromagnetic heating module is to set up a fan inside the electromagnetic heating module to strengthen air flow and improve heat dissipation efficiency. Another solution is to use high-frequency mica wire made of electromagnetic heating coil, due to high-frequency mica wire high temperature resistance performance is strong, can withstand higher working temperature, so as to avoid electromagnetic heating module overheating failure. However, the above two solutions will lead to electromagnetic heating module manufacturing cost increases, not conducive to the promotion and application.

[0006] In view of this, the present invention is proposed.

SUMMARY

[0007] The technical problem to be solved by the present invention is to overcome the deficiencies of the prior art and provide an electromagnetic heating module and a clothing treatment device.

[0008] In order to solve the above technical problems, a first object of the present invention is to provide an electromagnetic heating module having a good heat dissipation effect and not prone to overheating failure, specifically, the following technical solution is adopted:

An electromagnetic heating module comprising:

- a first mounting disk, a coil is provided on an upper surface of the first mounting disk;
- a second mounting disk, provided below the first mounting disk, a magnet is mounted on a surface of the second mounting disk opposite to the first mounting disk.

[0009] Further, the first mounting disk and the second mounting disk both have a circular outer contour, and the coil is spirally wound on the upper surface of the first mounting disk to form a number of concentric circles co-centered with the first mounting disk; the magnet is a bar magnet, and the bar magnet is disposed along the radial direction of the second mounting disk and mounted on the lower surface of the second mounting disk; Preferably, a plurality of bar magnets are spaced apart on the circumference of the second mounting disk.

[0010] Further, the first mounting disk has a circular outline, the first mounting disk comprising a first outer ring, and a plurality of coil support parts extending radially from the inner side of the first outer ring; hollows are provided between adjacent coil support parts.

[0011] Preferably, a first fixing disk is provided in a central portion of the first mounting disk and an extended end of the coil support part is connected to the first fixing disk.

[0012] Further, the coil support part is provided with a number of fixing grooves spaced apart in its extension direction, and the coil is provided in the fixing grooves.

[0013] Preferably, the coil support part comprises a bottom wall of the support part extending in a radial direction, and a side wall of the support part formed by extending upwardly from both sides of the bottom wall of the support part, the fixing grooves passing through from the upper edges of both sides of the side wall of the support part to the bottom wall of the support part.

[0014] More preferably, one end of the bottom wall, near the first outer ring, of the support part extends upwardly to form an end wall of the support part, said end wall of the support part being connected to an inner surface of said first outer ring.

[0015] Further, said first mounting disk further comprises a reinforcing portion connected to the plurality of coil support parts.

[0016] Preferably, said reinforcing portion is a ring reinforcement that is co-circular with said first outer ring, and the central portion of the plurality of coil support parts are connected as one by said reinforcement ring reinforcement.

[0017] More preferably, said ring reinforcement is formed by extending downwardly from the lower surface of said coil support part.

[0018] Further, said second mounting disk has a circular outline, the second mounting disk comprising a second outer ring, and a plurality of magnet mounting portions extending radially from the inner side of said second outer ring; and hollows are provided between the adjacent magnet mounting portions.

[0019] Preferably, a second fixing disk is provided in a central portion of said second mounting disk and an extended end of said magnet mounting portion is connected to said second fixing disk.

[0020] Preferably, said magnet mounting portion comprises a bottom wall of the mounting portion extending in a radial direction, and side walls of the mounting portion formed by extending downwardly from the edges of said bottom wall of the mounting portion on both sides, and said bar magnet is mounted in the space enclosed by said bottom wall of the mounting portion and the side walls of the mounting portion on both sides.

[0021] Further, the plurality of magnet mounting portions are provided at least partially overlapping with the coil support parts in a circumferential direction.

[0022] Preferably, the plurality of magnet mounting portions and the coil support parts overlap one-to-one in

the circumferential direction.

[0023] Further, said first mounting disk is provided with a connection hole and said second mounting disk is provided with a connection portion; or, said second mounting disk is provided with a connection hole and said first mounting disk is provided with a connection portion.

[0024] Said connecting portion is inserted in said connecting hole, connecting said first mounting disk with said second mounting disk.

[0025] Alternatively, said first mounting disk and said second mounting disk are integrally molded;

Preferably, a certain distance is provided between opposite surfaces of said first mounting disk and the second mounting disk.

[0026] More preferably, the lower surface of said first mounting disk is provided with an ring reinforcement formed by extending downwardly, said ring reinforcement abuts against the upper surface of said second mounting disk; or said first mounting disk is integrally connected to said second mounting disk by said ring reinforcement.

[0027] Further, a first shielding member provided above the first mounting disk for preventing the coil from being dislodged from the first mounting disk, and a second shielding member provided below the second mounting disk for preventing the magnet from being dislodged from the second mounting disk are also included.

[0028] Preferably, said first shielding member is an upper baffle covering the upper surface of said first mounting disk and said second shielding member is a lower baffle covering the lower surface of said second mounting disk.

[0029] More preferably, said electromagnetic heating module further comprises a sidewall connecting said upper baffle and lower baffle, said upper baffle, lower baffle and sidewall forming an encapsulation housing encasing the first mounting disk with the second mounting disk inside the encapsulation housing.

[0030] The present invention also provides a clothing treatment device comprising an electromagnetic heating module as described above;

preferably, the clothing treatment device includes an outer drum and an inner drum, said inner drum being provided within the outer drum, the wall of the inner drum being made of a metallic material that can generate eddy currents in an alternating magnetic field.

[0031] Preferably, said electromagnetic heating module is provided below the outer drum and connected to the drum wall of the outer drum.

[0032] More preferably, said electromagnetic heating module is provided on the wall of the outer drum in a region near the bottom of the drum of the outer drum.

[0033] A second object of the present invention is to provide an electromagnetic heating module, in which a heat dissipation structure is provided on the encapsulation housing to improve the heat dissipation efficiency, and at the same time, water is prevented from entering the interior of the encapsulation housing through the heat

dissipation structure by means of a water-blocking structure surrounding the heat dissipation structure, so as to enable the electromagnetic heating module to have a good heat dissipation and a water-proof performance at the same time, and, in particular, the following technical solution is adopted:

An electromagnetic heating module comprising a coil and an encapsulation housing encasing said coil, said encapsulation housing provided with a heat dissipation structure connecting the inner and outer spaces of the encapsulation housing, and a water retaining structure provided around said heat dissipation structure.

[0034] Further, said encapsulation housing has a lower surface, said heat dissipation structure being a heat dissipation hole provided on said lower surface; said lower surface being partially raised to form a water retaining structure surrounding the heat dissipation hole.

[0035] Further, a lower surface disposed around the periphery of said heat sink is raised downwardly to form said water retaining structure.

[0036] Further, said water retaining structure is a water retaining flange formed by projecting downwardly from the periphery of said lower surface.

[0037] Further, said water retaining flange is provided at an angle from the periphery of the lower surface to the inner side of the lower surface.

[0038] Further, said encapsulation housing comprises a first housing and a second housing, said second housing comprising a bottom wall, and a side wall surrounding said bottom wall, said first housing being connected to said side wall; said heat dissipation holes being provided through said bottom wall.

[0039] Further, a fixing portion is also provided on said first housing and/or second housing, said fixing portion being provided with a fixing hole.

[0040] Preferably, said fixing portion is provided projecting from said side wall.

[0041] Further, a first mounting disk is provided in said encapsulation housing, said coil being provided on a surface of said first mounting disk that is opposite to a heat dissipation hole; and

a second mounting disk is provided below said first mounting disk, and a magnet is mounted on the surface of said second mounting disk facing the heat dissipation hole.

[0042] Preferably, said first mounting disk is spaced apart from the second mounting disk.

[0043] Further, said first mounting disk and said second mounting disk both have a circular outer contour; the first mounting disk includes a plurality of coil support parts radially extending for securing said coil, and hollows are provided between the adjacent coil support parts.

[0044] The second mounting disk comprises a plurality of magnet mounting portions extending in a radial direction, said magnet is a bar magnet mounted on said magnet mounting portions, and hollows are provided between the adjacent magnet mounting portions.

[0045] Preferably, the plurality of magnet mounting

portions are provided at least partially overlapping with the coil support parts in a circumferential direction.

[0046] More preferably, the plurality of magnet mounting portions and the coil support parts overlap one-to-one in the circumferential direction.

[0047] The present invention also provides a clothing treatment device comprising an electromagnetic heating module as described above.

[0048] Preferably, the clothing treatment device includes an outer drum and an inner drum, said inner drum being provided within the outer drum, the drum wall of the inner drum being made of a metallic material that can generate eddy currents in an alternating magnetic field.

[0049] Preferably, said electromagnetic heating module is provided below the outer drum and connected to the drum wall of the outer drum.

[0050] More preferably, said electromagnetic heating module is provided on the drum wall of the outer drum in a region near the bottom of the outer drum.

[0051] A third object of the present invention is to provide an electromagnetic heating module, which reduces the leakage of the magnetic field and is conducive to improving the heating efficiency by providing an inner magnet that can shield the magnetic inductance inside the electromagnetic heating module, specifically, the following technical solution is adopted:

An electromagnetic heating module comprising a mounting bracket, and a coil provided on said mounting bracket, said coil being of a toroidal structure, the inner periphery of the coil being provided with an inner magnet that shields the coil from generating magnetic inductance, and said inner magnet filling the skeletonized area enclosed by the inner periphery of the coil.

[0052] Further, said inner magnet is a sheet structure having an outer contour matching said hollowed area.

[0053] Preferably, said inner magnet is mounted within said hollowed area, the upper surface of the inner magnet is flush with the upper surface of the coil.

[0054] Further, an isolation frame is provided between the inner periphery of said coil and the outer periphery of the inner magnet, said coil being spirally wound around the outer periphery of said isolation frame, the inner periphery of the coil is affixed to the outer periphery of the isolation frame.

[0055] Preferably, the outer periphery of said inner magnet is provided in apposition with the inner periphery of the isolation frame.

[0056] Preferably, said mounting bracket comprises a bottom wall and a side wall, said coil is provided in a holding groove surrounded by said bottom wall and side wall, and the outer periphery of said coil is affixed to the inner side of the side wall of the mounting bracket.

[0057] Further, said isolation frame has a certain length, said isolation frame is provided with a reinforcement inside, said reinforcement is provided along a direction extending perpendicular to the length of the isolation frame, and is connected to the isolation frame at both ends.

[0058] Preferably, said reinforcement separates the inner side of the isolation frame into at least two separate regions, and said inner magnets comprise at least two magnet sheets set respectively in said separate regions.

[0059] Preferably, said isolation frame is integrally molded with the reinforcement.

[0060] Further, both ends of said reinforcements have extension portions extending towards the bottom wall of the mounting bracket, and extended ends of the extension portions are provided with clamping jaws; and a slot is provided in the bottom wall of said mounting bracket corresponding to the clamping jaws.

[0061] Preferably, a strip through hole is provided in the bottom wall of said mounting bracket corresponding to said reinforcement, and said slots are provided at both ends of said strip through hole.

[0062] Further, a bottom magnet is also provided between said coil and the bottom wall of the mounting bracket, said bottom magnet being of sheet-like structure laid on the bottom wall of the mounting bracket; said extension portion penetrating said bottom magnet so that the clamping jaws snap to the slot.

[0063] Preferably, an isolation layer is provided between said coil and the bottom magnet, said isolation layer is provided with a through hole in the middle of said layer matching the hollowed area of the coil.

[0064] Preferably, said bottom magnet comprises a plurality of magnetic steel sheets laid on the bottom wall of the mounting bracket, two adjacent magnetic steel sheets having a gap between them, and said extension portion passing through said gap so that the jaws snap into the slot.

[0065] More preferably, said bottom wall is provided with a divider inserted in said gap, the divider having an avoidance notch in a region corresponding to the position of the reinforcement.

[0066] Further, the periphery of the coil is provided with an outer magnet that shields the coil from generating magnetic inductance.

[0067] Preferably, said mounting bracket is provided with a mounting groove on the side wall for mounting said outer magnet.

[0068] More preferably, said sidewall has a certain thickness, said mounting groove is provided between the inner and outer periphery of the sidewall, and the opening of the mounting groove is provided on the upper surface of the side wall.

[0069] The present invention also provides a clothing treatment device comprising an inner drum, at least a portion of said inner drum being made of a metallic material capable of generating eddy currents in an alternating magnetic field, and further comprising an electromagnetic heating module as described above.

[0070] Further, an outer drum is included, said inner drum is set inside the outer drum, and said electromagnetic heating module is set below the outer drum and connected to the drum wall of the outer drum.

[0071] Preferably, said outer drum is provided with a

convex rib on the drum wall of said drum, and said electromagnetic heating module is installed in the area surrounded by said convex rib.

[0072] More preferably, said bottom wall of said mounting bracket is provided with a mounting portion formed by extending in a peripheral direction toward a side wall of the mounting bracket, said mounting portion is provided with a mounting hole; a screw post corresponding to said mounting hole is provided in the area surrounded by said convex rib.

[0073] Further, said electromagnetic heating module has an upper surface facing the drum wall of the outer drum, said upper surface is a circular curved surface coaxial with the drum wall of said inner drum.

[0074] Preferably, the extension length of said electromagnetic heating module along the circumferential direction of the outer drum is greater than its extension length along the radial direction of the outer drum.

[0075] After adopting the above technical solution, the present invention has the following beneficial effects compared with the prior art.

[0076] In the present invention, the magnet on the second mounting disk can play the role of shielding the magnetic field, preventing the magnetic field from leaking and improving the heating efficiency. By setting the first mounting disk and the second mounting disk, and mounting the coil and the magnet on surfaces opposite to each other, the distance between the two can be increased, which is conducive to heat dissipation of the coil, and overheating faults of the electromagnetic heating module can be avoided. The first mounting disk and the second mounting disk both have a hollowed structure, which can increase the contact area between the coil and the air, and at the same time enhance the air flow inside the electromagnetic heating module, thereby improving the heat dissipation efficiency of the electromagnetic heating module. The ring-shaped reinforcement bar is provided so that the plurality of coil support parts are connected as one, improving the overall strength of the first mounting disk. The coil support part on the first mounting disk and the magnet mounting portion on the second mounting disk overlap in a circumferential direction, so that the first mounting disk and the skeletonized region of the second mounting disk overlap, which further enhances the air flow inside the electromagnetic heating module, thereby improving the heat dissipation efficiency. The first mounting disk and the second mounting disk are spaced apart so that air flow can exist between opposite surfaces of the two, and the heat dissipation effect is better.

[0077] In the present invention, the coil is set inside the encapsulation housing to prevent direct contact with washing water, and by setting the heat dissipation structure to connect the inside and outside space of the encapsulation housing, air circulation can exist inside the encapsulation housing, so as to realize effective heat dissipation of the coil. The water-blocking structure is provided around the heat dissipation structure to prevent

water from entering the interior of the encapsulation housing through the heat dissipation structure, which has a good waterproofing effect and avoids short-circuit failures caused by contact between the coil and water. The heat dissipation holes are set in the lower surface of the encapsulation shell, the risk of water entering from the heat dissipation holes is small, and the lower surface is partially raised to form a water-blocking structure, which is simple in structure and has a good effect of water-blocking. Located in the lower surface of the periphery of the heat dissipation hole protrudes to form a water-blocking structure, the water that may be present on the lower surface of the encapsulation case is blocked by the water-blocking structure and will not flow to the heat dissipation hole to enter the interior of the encapsulation case. The lower surface of the encapsulation shell is raised to form a water-blocking rim, and the water that may exist on the surface of the encapsulation shell can directly drip along the outer side of the water-blocking rim and will not flow to the lower surface where the heat sink is located, and thus will not enter the interior of the encapsulation shell through the heat sink, so that effective waterproofing can be realized.

[0078] In the present invention, an inner magnet shielding magnetic susceptibility lines is provided at the inner periphery of the coil, which can reduce the radiation of magnetic susceptibility lines in the hollowed region, so that the magnetic field generated by the electromagnetic heating module is concentrated to radiate in a direction perpendicular to the coil surface, thereby reducing the leakage of the magnetic field and improving the heating efficiency. The inner magnet fills the hollow area of the inner circumference of the coil, which can also play a homogenizing effect on the magnetic field, so that the hollow area generates a more uniform magnetic field and improves the heating effect. The sheet-like inner magnet fills the hollow area on the inside of the coil, providing a better shielding of the magnetic field and avoiding over-concentration of the magnetic field at the edges of the hollow area. The inner magnet is flush with the upper surface of the coil, so that the upper surface of the electromagnetic heating module is overall flat, and easier to be assembled in the clothing treatment device. The setting of the isolation frame avoids the contact between the inner magnet and the coil from causing any influence, and at the same time, it can also play a supporting role for the coil. The inner and outer periphery of the coil are attached to the outer periphery of the isolation frame and the side wall of the mounting bracket respectively, ensuring the maximization of the coil's area of application. The reinforcing rib inside the isolation frame prevents deformation of the isolation frame and makes its structure more stable. The isolation frame is fixed to the mounting bracket by the claws set on the extension portions at both ends of the reinforcements, which is not easy to fall off and the overall structure is stable. The bottom magnet is provided so that the magnetic field generated by the coil is concentrated to radiate to the surface of one side of

the coil, which is more concentrated, and the outer magnet provided at the outer periphery of the coil can play a shielding role for the magnetic inductance radiated to the outer peripheral side of the coil, which further reduces the leakage of the magnetic field, so that the generated magnetic field is concentrated to radiate to the heated device.

[0079] Specific embodiments of the invention are described in further detail below in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0080] The accompanying drawings are used as part of the present invention to provide a further understanding of the invention, and the schematic embodiments of the invention and their illustrations are used to explain the invention but do not constitute an undue limitation of the invention. Obviously, the accompanying drawings in the following description are only some of the embodiments, and other accompanying drawings may be obtained from these drawings without creative labor for those of ordinary skill in the art. In the accompanying drawings:

FIG. 1 is a top view structural schematic diagram of the electromagnetic heating module in Embodiment I of the present invention;

FIG. 2 is a schematic view of the A-A cross-section of FIG. 1 of the present invention;

FIG. 3 is a schematic diagram of the local structure of the electromagnetic heating module in Embodiment I of the present invention;

FIG. 4 is an enlarged schematic view at B in FIG. 3 of the present invention;

FIG. 5 is a schematic diagram of an elevation view structure of the electromagnetic heating module in Embodiment I of the present invention;

FIG. 6 is a schematic diagram of the structure of the clothing treatment device in Embodiment I of the present invention;

FIG. 7 is a schematic diagram of the structure of the electromagnetic heating module in embodiment II of the present invention;

FIG. 8 is a schematic diagram of the structure of another angle of the electromagnetic heating module in embodiment II of the present invention;

FIG. 9 is a schematic diagram of the sectional structure of the electromagnetic heating module in Example 2 of the present invention;

FIG. 10 is a schematic diagram of the structure of the clothing treatment device in embodiment II of the present invention;

FIG. 11 is a schematic diagram of the structure of the electromagnetic heating module in embodiment III of the present invention;

FIG. 12 is an exploded view of an electromagnetic heating module in embodiment III of the present in-

vention;

FIG. 13 is a schematic diagram of the structure of the isolation frame in embodiment III of the present invention;

FIG. 14 is a schematic diagram of the structure of the mounting bracket in embodiment III of the present invention;

FIG. 15 is a front view of the electromagnetic heating module in embodiment III of the present invention;

FIG. 16 is a schematic view of the C-C section of FIG. 15 of the present invention;

FIG. 17 is an enlarged schematic view at D in FIG. 16 of the present invention;

FIG. 18 is an exploded view of a washing machine in Example III of the present invention;

FIG. 19 is a schematic diagram of the bottom of an outer drum in Embodiment III of the present invention;

FIG. 20 is a schematic diagram of the present invention with the electromagnetic heating module removed in FIG. 19.

[0081] In the figure: 100, housing; 101, foot; 200, outer drum; 210, front part of the outer drum; 211, drain port; 220, rear part of the outer drum; 300, shock absorber; 400, electromagnetic heating module; 401, coil; 402, magnet; 410, first mounting disk; 411, first outer ring; 412, coil support part; 413, first fixing disk; 414, ring reinforcement; 415, bottom wall of the support part; 416, side wall of the support part; 417, fixing groove; 418, end wall of the support part; 420, second mounting disk; 421, second outer ring; 422, magnet mounting portion; 423, second fixing disk; 424, connection portion; 425, bottom wall of the mounting portion; 426, side wall of the mounting portion; 430, fixing portion; 431, fixing hole; 440, encapsulation housing; 441, first housing; 442, second housing; 443, heat dissipation hole; 444, water retaining flange; 445, bottom wall; 446, side wall; 500, outer drum; 510, drum wall; 511, convex rib; 512, screw post; 600, electromagnetic heating module; 601, coil; 602, bottom magnet; 603, inner magnet; 604, outer magnet; 610, mounting bracket; 611, bottom wall; 612, side wall; 613, slot; 614, strip through hole; 615, divider; 616, avoidance notch; 617, mounting groove; 618, mounting portion; 619, mounting hole; 620, isolation layer; 621, through-hole; 630, isolation frame; 631, reinforcement; 632, extension portion; 633, clamping jaws.

[0082] It is to be noted that these accompanying drawings and textual descriptions are not intended to limit in any way the scope of the present invention as conceived, but rather to illustrate the concepts of the invention for those skilled in the art by reference to particular embodiments.

DETAILED DESCRIPTION

[0083] In order to make the objects, technical solutions and advantages of the embodiments of the present in-

vention clearer, the technical solutions in the embodiments will be described clearly and completely in the following in conjunction with the accompanying drawings in the embodiments of the present invention, and the following embodiments are used to illustrate the present invention but are not used to limit the scope of the present invention.

[0084] In the description of the present invention, it is to be noted that the terms "top", "bottom", "front", "back", "left", "right", "vertical", "inside", "outside", etc. indicate an orientation. " and the like indicate orientations or positional relationships based on those shown in the accompanying drawings, and are intended only to facilitate the description of the present invention and to simplify the description, and are not intended to indicate or imply that the device or element referred to must have a particular orientation, be constructed and operated with a particular orientation, and therefore are not to be construed as a limitation of the present invention.

[0085] In the description of the present invention, it is to be noted that, unless otherwise expressly specified and limited, the terms "mounted", "connected", "connected" are to be understood in a broad sense, e.g., it may be a fixed connection, a removable connection, or a connection in one piece; it may be a mechanical connection or an electrical connection; it may be a direct connection or an indirect connection through an intermediate medium. For those of ordinary skill in the art, the specific meaning of the above terms in the context of the present invention may be understood in specific cases.

Embodiment I

[0086] As shown in FIGS. 1 to 6, this embodiment provides an electromagnetic heating module 400 and a clothing treatment device including the electromagnetic heating module 400.

[0087] As shown in FIGS. 1 to 5, the electromagnetic heating module 400 of this embodiment comprises:

a first mounting disk 410, said first mounting disk 410 being provided with a coil 401 on an upper surface of said first mounting disk 410;

a second mounting disk 420, provided below the first mounting disk 410, said second mounting disk 420 having a magnet 402 mounted on a surface of said second mounting disk 420 opposite to the first mounting disk 410.

[0088] In this embodiment, the coil 401 on the first mounting disk 410 may generate a high-frequency alternating magnetic field when a high-frequency alternating current is energized, and by installing it inside the clothing treatment device, it may stimulate an eddy current effect through the generated high-frequency alternating magnetic field in the clothing treatment drum or other water-containing containers made of metal to cause the clothing treatment drum or the other water-containing containers

to heat up themselves, thus realizing the heating of the water in a non-contact condition.

[0089] Both the first mounting disk 410 and the second mounting disk 420 are made of insulating material and are not affected by the magnetic field. The magnet 402 on the second mounting disk 420 has the function of shielding the magnetic field, which can block most of the downwardly radiating magnetic field, reducing the portion of the magnetic field generated by the coil 401 that penetrates the second mounting disk 420, so that almost all of the generated magnetic field is upwardly radiating. This can make the generated high-frequency alternating magnetic field more concentrated and improve its heating efficiency of the clothing treatment drum.

[0090] Mounting the coil 401 and the magnet 402 on surfaces opposite to each other of the first mounting disk 410 and the second mounting disk 420, respectively, can increase the distance between the two, which is conducive to heat dissipation of the coil 401 and avoids overheating faults of the electromagnetic heating module 400, which affects use.

[0091] In this embodiment, the first mounting disk 410 and the second mounting disk 420 both have a circular outer contour, and the coil 401 is helically wound on the upper surface of the first mounting disk 410 to form a plurality of concentric circles co-centered with the first mounting disk 410. The magnet 402 is a bar magnet 402, and the bar magnet 402 is disposed along a radial direction of the second mounting disk 420 and mounted on a lower surface of the second mounting disk 420.

[0092] Specifically, the coil 401 is formed by winding a copper conductor covered with an insulating layer on its surface, with two adjacent turns of the copper conductor coiled in contact or left finely spaced apart, with the outermost turn being close to the outer perimeter of the first mounting disk 410.

[0093] Preferably, a plurality of bar magnets 402 are spaced apart in a circumferential direction of the second mounting disk 420, the plurality of bar magnets 402 being uniformly distributed in the circumferential direction.

[0094] In the above-described embodiment, the coil 401 helically wound to form a plurality of concentric circles is conducive to generating a uniform magnetic field, so that uniform heating of the clothing treatment drum can be realized. The plurality of bar magnets 402 spaced apart at the circumference of the second mounting disk 420 can provide a uniform shielding effect under the coil 401, thereby making the magnetic field radiated to the clothing treatment drum more uniform.

[0095] In a further embodiment of the present embodiment, the first mounting disk 410 comprises a first outer ring 411, and a plurality of coil support parts 412 extending radially from an inner side of the first outer ring 411. adjacent coil support parts 412 are provided in a hollowed-out manner between each other.

[0096] In the above-described embodiment, the coil support part 412 is used to secure the coil 401, and the skeletonized structure between adjacent coil support

parts 412 makes the upper and lower surfaces of the portion of the coil 401 disposed between the two coil support parts 412 have direct contact with the air, which increases the contact area of the coil 401 with the air, and improves the heat dissipation efficiency.

[0097] In this embodiment, a first fixing disk 413 is provided in a central portion of the first mounting disk 410, and an extended end of the coil support part 412 is connected to the first fixing disk 413. By providing the first fixed disc 413 for supporting the extended end of the coil support part 412, the overall strength of the first mounting disk 410 is enhanced, and a situation in which the coil support part 412 is easy to break under an external force near the center of the first outer ring 411 is avoided.

[0098] Specifically, the first fixing disk 413 is co-circularly disposed with the first outer ring 411, and the diameter of the circumference where the extended end of the coil support part 412 is located is smaller than the diameter of the first fixing disk 413, i.e., the coil support part 412 extends to the interior of the first fixing disk 413. The upper surface of the first fixing disk 413 is connected to the bottom surface of the extended end of the coil support part 412, which has a larger contact area and a more solid connection compared to the connection method in which the end of the coil support part 412 is directly fixed to the outer circumference of the first fixing disk 413.

[0099] In this embodiment, in order to realize the fixation of the coil 401, a number of fixing grooves 417 (only the fixing grooves 417 close to the outer end portion is shown in the drawings) are provided at intervals on the coil support part 412 in the extension direction thereof, and the coil 401 is provided in the fixing grooves 417.

[0100] Preferably, the coil support part 412 includes a bottom wall of the support part 415 extending in a radial direction, and side wall of the support parts 416 formed by extending upwardly from two side edges of the bottom wall of the support part 415, and the fixing grooves 417 pass through from the upper edges of the side wall of the support parts 416 on both sides to the bottom wall of the support part 415.

[0101] More preferably, the bottom wall of the support part 415 extends upwardly near an end of the first outer ring 411 to form a end wall of the support part 418, the end wall of the support part 418 being coupled to an inner surface of the first outer ring 411.

[0102] In the above-described embodiment, the copper conductor forming the coil 401 is wound in a spiral shape and snaps into the fixing groove 417 when passing through the coil support part 412, thereby fixing it on the first mounting disk 410. To ensure the fixing effect on the coil 401, the fixing groove 417 may be an interference fit with the copper conductor forming the coil 401, i.e., the width of the fixing groove 417 in the radial direction is slightly smaller than the diameter of the copper conductor, so that the copper conductor may be firmly snapped into the fixing groove 417, and is not easy to fall off.

[0103] The cross-section of the coil support part 412 perpendicular to the radial direction is U-shaped, and the

insulation between two adjacent turns of copper conductors is realized by the insulating layer covered on the surface, so that there is no need to provide a spacer on the coil support part 412 to separate the two adjacent turns of copper conductors, that is, the interior of the coil support part 412 may be penetrated in an extension direction, and it is only necessary to provide a fixing groove 417 on the side wall 416 of the support part, so that the structure of the coil support part 412 is simpler.

[0104] The end wall of the support part 418 is provided at an end portion of the coil support part 412 near the first outer ring 411 for connecting with the inner surface of the first outer ring 411, using a face contact connection to increase the connection area and make the connection more solid.

[0105] In a further embodiment of the present embodiment, the first mounting disk 410 further comprises a reinforcing portion connected to the plurality of coil support parts 412.

[0106] Specifically, said reinforcing portion is a reinforcing reinforcement 414 co-centered with the first outer ring 411, and the central portion of the plurality of coil support parts 412 is connected as one by the reinforcing reinforcement 414.

[0107] Preferably, the ring reinforcement 414 is formed extending downwardly from the lower surface of the coil support part 412.

[0108] In the above-described embodiment, the provision of the ring reinforcement 414 connects the plurality of coil support parts 412 into a single unit, which provides support for the overhanging central portion of the coil support part 412, further improving the overall strength of the first mounting disk 410.

[0109] In this embodiment, the ring reinforcement 414 is co-circularly disposed with the first outer ring 411 between the first outer ring 411 and the outer periphery of the first fixing disk 413, so that both ends and the middle part of the coil support part 412 are supported, and the structure is more stable. The coil 401 is provided in the region between the first outer ring 411 and the ring reinforcement 414, and excluding the portion mounted on the coil support part 412, the upper and lower surfaces of the rest of the portion are exposed to the air, and the heat dissipation effect is good.

[0110] The structure of the second mounting disk 420 in this embodiment is similar to that of the first mounting disk 410. Specifically, the second mounting disk 420 includes a second outer ring 421, and a plurality of magnet mounting portions 422 extending radially from an inner side of the second outer ring 421. adjacent magnet mounting portions 422 are provided in a hollowed manner.

[0111] In the above-described embodiment, the second mounting disk 420 is also provided with a hollow structure, so that the electromagnetic heating module 400 is at least partially hollow, which is more conducive to air circulation and further improves the heat dissipation efficiency of the electromagnetic heating module 400.

[0112] In a preferred embodiment of this embodiment, the second mounting disk 420 is provided with a second fixing disk 423 at a central portion of the second mounting disk 420, and an extended end of the magnet mounting portion 422 is connected to the second fixing disk 423. Specifically, the second fixing disk 423 is provided co-circularly with the second outer ring 421, the magnet mounting portion 422 extends to the interior of the second fixing disk 423, and the lower surface of the second fixing disk 423 is connected to the top surface of the extended end of the magnet mounting portion 422. The use of face contact increases the contact area, and the connection is more solid.

[0113] In this embodiment, the magnet mounting portion 422 includes a bottom wall of the mounting portion 425 that extends in a radial direction, and a side wall of the mounting portion 426 formed by extending downwardly from the edges of both sides of the bottom wall of the mounting portion 425. the bar magnet 402 is mounted in the space enclosed by the bottom wall of the mounting portion 425 and the side wall of the mounting portions 426 on both sides.

[0114] The cross-section of the magnet mounting portion 422 perpendicular to the radial direction is U-shaped, and the bar-shaped magnet 402 is installed within the magnet mounting portion 422 so as to be radially distributed below the coil 401, and the shielding effect on the magnetic field is good. In order to ensure stable installation of the bar-shaped magnets 402, the bar-shaped magnets 402 may be provided in the magnet mounting portion 422 by means of an interference fit, i.e., the width of the bar-shaped magnets 402 is slightly larger than the width of the downward-facing opening of the magnet mounting portion 422.

[0115] In a further embodiment of the present embodiment, the plurality of magnet mounting portions 422 are provided at least partially overlapping in a circumferential direction with the coil support part 412.

[0116] Preferably, the plurality of magnet mounting portions 422 overlap with the coil support part 412 one-to-one in a circumferential direction.

[0117] The magnet mounting portion 422 and the coil support part 412 overlap circumferentially, i.e., the first mounting disk 410 and the hollow area on the second mounting disk 420 are overlapped set, so as to maximize the area of the area that is hollow from up and down in the electromagnetic heating module 400, which is more effective in enhancing the air circulation, and to provide better heat dissipation as much as possible.

[0118] In this embodiment, the first mounting disk 410 and the second mounting disk 420 may be provided separately and assembled as a single unit by a connection structure. Specifically, the first mounting disk 410 is provided with a connection hole, and the second mounting disk 420 is provided with a connection portion 424, and the connection portion 424 is inserted in said connection hole, connecting the first mounting disk 410 with the second mounting disk 420.

[0119] Preferably, said connection hole is provided at the center of the circle of the first fixing disk 413 and the connection portion 424 is inserted into said connection hole by projecting upwardly from the center of the circle of the second fixing disk 423.

[0120] In this embodiment, the setting positions of the connection hole and the connection portion can also be interchanged, i.e., the second mounting disk is provided with the connection hole and the first mounting disk is provided with the connection portion, and the connection of the first mounting disk to the second mounting disk can also be realized.

[0121] In another embodiment of the present embodiment, the first mounting disk 410 and the second mounting disk 420 are of a one-piece structure, such as the first mounting disk 410 and the second mounting disk 420 that are connected as a whole are made by means of one-piece injection molding.

[0122] In a further embodiment of the present embodiment, the first mounting disk 410 and the second mounting disk 420 have a spacing between their opposite surfaces. By spacing the first mounting disk 410 and the second mounting disk 420 with a gap between them that allows air to flow through, the heat dissipation efficiency of the electromagnetic heating module 400 can be further improved.

[0123] In this embodiment, the lower surface of the first mounting disk 410 is provided with the ring reinforcement 414 extending downwardly. If the first mounting disk 410 and the second mounting disk 420 are provided separately, when the first mounting disk 410 and the second mounting disk 420 are assembled as a single unit, the ring reinforcement 414 stops against the upper surface of the second mounting disk 420, restricts the second mounting disk 420 from moving, and ensures that there is a gap for air circulation between the first mounting disk 410 and the second mounting disk 420. When the first mounting disk 410 is assembled with the second mounting disk 420, the ring reinforcement 414 stops against the upper surface of the second mounting disk 420, restricting the second mounting disk 420 and ensuring that there is a gap for air circulation between the first mounting disk 410 and the second mounting disk 420.

[0124] If the first mounting disk 410 and the second mounting disk 420 are made by one-piece injection molding, the first mounting disk 410 and the second mounting disk 420 may be integrally connected by the reinforcing reinforcement 414, and the height of the reinforcing reinforcement 414 is the height of the gap between the first mounting disk 410 and the second mounting disk 420.

[0125] In this embodiment, a fixing portion 430 is provided on the outer periphery of the first mounting disk 410 and/or the second mounting disk 420, and a fixing hole 431 is provided on the fixing portion 430. The electromagnetic heating module 400 may be mounted inside the clothing treatment device, such as on the drum wall of the outer drum of the washing machine, through the

fixing hole 431 on the fixing portion 430, so as to stimulate the inner drum by passing in the high-frequency alternating current to produce an eddy current effect to thereby realizing the purpose of heating the washing water.

[0126] In the scheme of this embodiment, the electromagnetic heating module 400 includes a first mounting disk 410 and a second mounting disk 420 for mounting the coil 401 and the magnet 402, respectively, which are spaced apart and mount the coil 401 and the magnet 402 on opposite surfaces, so that air can flow under the coil 401, ensuring the heat dissipation effect of the coil 401. The first mounting disk 410 and the second mounting disk 420 have a hollow structure, which makes the upper part of the electromagnetic heating module 400 is hollow from the upper to lower parts of the region, which further improves the contact area between the coil 401 and the air, enhances the air flow effect, makes the electromagnetic heating module 400 have a high heat dissipation efficiency, and when applied to a washing machine for heating the washing water, it is not easy to overheat faults affecting the use of the washing machine, and improves the user experience. The user experience is improved.

[0127] The clothing treatment device described in this embodiment includes, but is not limited to, a washing machine, a washing and drying machine, and the like. As shown in FIG. 6, the clothing treatment device of the present embodiment comprises an outer drum 200 and an inner drum, said inner drum being provided within the outer drum 200, and the drum wall of the inner drum being made of a metal material that can generate eddy currents in an alternating magnetic field.

[0128] Preferably, the inner drum of the clothing treatment device of the present embodiment can hold washing water independently during washing. Specifically, the inner drum is not provided with a dehydration hole on the drum wall, and is sealed during the washing process, and can hold washing water independently. A drainage hole is provided on the wall of the inner drum, and the drainage hole is blocked by the sealing assembly during the washing process, and when the inner drum reaches a certain rotational speed, the sealing assembly can open the drainage hole under the action of centrifugal force to realize the discharge of the washing water. A drain port 211 is provided on the wall of the outer drum 200 in connection with the drainage structure, and the water discharged from the inner drum enters the outer drum 200, and is then discharged from the clothing treatment device through the drain port 211 and the drainage structure.

[0129] The drum wall of the inner drum is made of metal, and the outer drum 200 is made of a plastic material that does not excite eddy current effects in the magnetic field. The outer drum 200 is externally mounted with an electromagnetic heating module 400. As shown in FIGS. 1 and 6, after the clothing treatment device starts the heating program, the input voltage, such as 220V of the household alternating current, is transformed into direct current through a bridge rectifier, and then transformed

into a high-frequency alternating current through an IGBT power tube, which is input into the electromagnetic heating module 400, and then a high-frequency alternating magnetic field can be generated by the coil 401. The electromagnetic induction line of the said high-frequency alternating magnetic field can penetrate the outer drum 200 and act on the inner drum made of metal, so that the inner drum generates eddy current under the electromagnetic induction, and the eddy current overcomes the internal resistance of the inner drum to complete the conversion of electric energy to thermal energy when flowing, realizing the inner drum to heat up, so as to heat up the washing water therein.

[0130] During the heating process, the inner drum is controlled to rotate inside the outer drum 200, so that the inner drum is heated uniformly, so that the heat is uniformly transferred to the washing water contained in the inner drum, and the heating effect is better. A temperature sensor is provided at the bottom of the outer drum 200, and when the temperature detected by the temperature sensor reaches a set temperature, that is, when the washing water reaches a predetermined washing temperature, the heating program stops, and the electromagnetic heating module 400 stops heating.

[0131] In a preferred embodiment of the present embodiment, the electromagnetic heating module 400 is provided underneath the outer drum 200 and is connected to the drum wall of the outer drum 200. An elevation view of the clothing treatment device of the present embodiment is shown in FIG. 6, wherein the bottom region of the housing 100 is removed to show the internal structure of the clothing treatment device. The bottom feet 101 are provided at the corners of the bottom surface of the housing 100, and the outer drum 200 is supported inside the housing 100 by the shock absorber 300. A fixing portion 430 is provided at the outer periphery of the electromagnetic heating module 400, a fixing hole 431 is provided in the fixing portion 430, and the electromagnetic heating module 400 is mounted on the wall of the drum of the outer drum 200 by means of a screw passing through the fixing hole 431.

[0132] Since the washing water is located in the inner drum in the bottom region of the inner drum, i.e., the part of the inner drum rotated to the bottom is in direct contact with the washing water, the electromagnetic heating module 400 is installed below the outer drum 200, which can focus on heating the bottom region of the inner drum, thereby realizing the purpose of directly heating the washing water with higher heating efficiency. It also avoids the problem that the area of the inner drum being heated is not in contact with the washing water, and the temperature rises too quickly, which may easily cause the electromagnetic heating module 400 to overheat and fail.

[0133] In a further preferred embodiment of the present embodiment, the electromagnetic heating module 400 is provided in a region of the wall of the outer drum 200 near the bottom of the drum of the outer drum 200.

[0134] In this embodiment, the drum wall of the outer drum 200 includes an front part of the outer drum 210 near the side of the drum opening and an rear part of the outer drum 220 connected to the bottom of the drum. The drain port 211 is provided in the outer drum front part 210, and the electromagnetic heating module 400 is installed in the outer drum rear part 220. The above setup makes it possible that the electromagnetic heating module 400 and the drain port 211 can be provided in the lowest area on the drum wall of the outer drum 200 and the electromagnetic heating module 400 and the drain port 211 can interfere with each other. they do not interfere with each other.

[0135] As shown in FIGS. 1 to 6, in this embodiment, the electromagnetic heating module 400 is installed with the side on which the first mounting disk 410 is located facing the wall of the outer drum 200. When the electromagnetic heating module 400 operates, the coil 401 may generate a high frequency alternating magnetic field to excite the inner drum to generate an eddy current effect, which in turn generates heat to heat the washing water. The magnet 402 on the second mounting disk 420 may play a shielding role for the generated magnetic field, thereby preventing the magnetic field from leaking in the direction of the backward direction of the inner drum, so that the magnetic field generated by the coil 401 acts on the inner drum more efficiently and improves the heating efficiency.

[0136] The clothing treatment device of the present embodiment realizes the heating function of the washing water by setting the electromagnetic heating module 400, which realizes the purpose of heating the washing water of the clothing treatment device without water between the inner drum and the outer drum 200. The electromagnetic heating module 400 is provided below the outer drum 200, so that the clothing treatment device does not contact the washing water during its working period, which reduces the safety hazard brought about by the coil 401 contacting the washing water, and at the same time, it can heat the portion of the bottom of the inner drum that is in contact with the washing water, and the heating efficiency is higher.

Embodiment II

[0137] As shown in FIGS. 7 to 9, this embodiment is a further limitation of the above embodiment I. Said electromagnetic heating module 400 further comprises a first shielding member provided above the first mounting disk 410 for preventing the coil 401 from being dislodged from the first mounting disk 410, and a second shielding member provided below the second mounting disk 420 for preventing the magnet 402 from being dislodged from the second mounting disk 420.

[0138] Further, said first shielding member is an upper baffle covering the upper surface of the first mounting disk 410, and said second shielding member is a lower baffle covering the lower surface of the second mounting

disk 420.

[0139] In the above-described scheme, the upper and lower baffles correspondingly cover the first mounting disk 410 and the second mounting disk 420, so that the coil 401 is clamped between the upper baffle and the first mounting disk 410, and at the same time the magnet 402 is clamped between the second mounting disk 420 and the lower baffle, which serves as clamping and fixing for the coil 401 and the magnet 402 to avoid dislodging of the coil 401 or the magnet 402. The magnet 402 is clamped between the second mounting disk 420 and the lower baffle plate.

[0140] In this embodiment, said electromagnetic heating module 400 further comprises a side wall 446 connecting said upper baffle and lower baffle, said upper baffle, lower baffle and side wall 446 forming an encapsulation housing 440 encasing the first mounting disk 410 with the second mounting disk 420 inside the encapsulation housing 440.

[0141] Specifically, the encapsulation housing 440 comprises a first housing 441 and a second housing 442, the second housing 442 comprising a bottom wall 445, and a side wall 446 surrounding the bottom wall 445 in a circumferential manner. the first housing 441 is in the form of a plate covering above the first mounting disk 410, forming said upper baffle. The second shell 442 is provided below the second mounting disk 420 and has a bottom wall 445 forming said lower baffle. The first housing 441 is connected to the side walls 446 of the second housing 442 to enclose the first mounting disk 410 and the second mounting disk 420 internally.

[0142] In the above-described embodiment, the encapsulation housing 440 is made of an insulating material that is not excited by the magnetic field and does not affect the magnetic field generated by the coil 401. The setting of the encapsulation housing 440 on the one hand serves as a fixation for the coil 401 and the magnet 402, and on the other hand, it also wraps the coil 401 inside, reducing the risk of short-circuit failure caused by the coil 401 coming into contact with water.

[0143] In a further embodiment of the present embodiment, the encapsulation housing 440 is provided with a heat dissipation structure connecting the inner and outer spaces of the encapsulation housing 440, and a water-blocking structure provided around said heat dissipation structure. Said heat dissipation structure connects the inner and outer spaces of the encapsulation housing 440, so that air exchange can exist between the inner and outer spaces of the encapsulation housing 440, thereby improving the heat dissipation effect of the coil 401. This avoids a situation in which the presence of the encapsulation housing 440 makes it difficult for the coil 401 to dissipate heat, and prevents the electromagnetic heating module 400 from overheating. The water-blocking structure is provided around the heat dissipation structure, which can block water from the outside of the water-blocking structure, preventing water from entering the inside of the encapsulation housing 440 through the heat

dissipation structure, with good waterproofing effect, and avoiding a situation in which the coil 401 is in contact with water and causes a short-circuit failure.

[0144] Specifically, said heat dissipation structure is a heat dissipation hole 443 provided on the lower surface of the encapsulation housing 400, i.e., the bottom wall 445, the heat dissipation hole 443 being provided through the bottom wall 445. The bottom wall 445 is partially raised to form a water-blocking structure surrounding the heat dissipation holes 443. The heat dissipation holes 443 are preferably provided in a plurality, distributed on the bottom wall 445, which can further improve the heat dissipation efficiency.

[0145] In one embodiment of the present embodiment, a bottom wall located at the outer periphery of the heat dissipation holes projects downwardly to form said water-blocking structure. The downward projection of the outer periphery of each heat dissipation holes forms a plurality of independent water-blocking structures, enclosing each heat sink hole individually, so that if there is any water dripping onto the surface of the encapsulation housing, it may flow to the surface of the bottom wall, but will not flow further into the heat dissipation holes, and the waterproofing effect is good.

[0146] In another embodiment of this embodiment, said water-blocking structure is a water retaining flange 444 formed by projecting downwardly from the periphery of the bottom wall 445.

[0147] In the above program, the bottom wall 445 is raised to form a water retaining flange 444, when water drops to the surface of the encapsulation housing 440, the water flows to the periphery of the encapsulation housing 440, and then can flow directly downward along the outer side of the water retaining flange 444 and drop, and will not flow to the surface of the bottom wall 445 where the heat dissipation holes 443 are located, and then will not be entered into the inside of the encapsulation housing 440 through the heat dissipation holes 443, the structure is simple and can realize effective waterproofing. In the preferred embodiment of this embodiment, the water retaining flange 444 is provided at an angle from the outer periphery of the lower surface to the inner side of the lower surface, thereby reducing the area of the area enclosed by the lower edge of the water retaining flange 444, and decreasing the likelihood that dripping water will splash onto the surface of the bottom wall 445 from below.

[0148] When the electromagnetic heating module 400 of this embodiment is assembled, the first mounting disk 410 with the coil 401 mounted and the second mounting disk with the magnet 402 mounted are first secured integrally to the first housing 441 or secured inside the second housing 442, and then the first housing 441 is snapped together in the upper opening of the second housing 442, preferably at the connection of the side wall 446 of the first housing 441 and the second housing 442 is sealed.

[0149] In this embodiment, the fixing portion 430 may

be provided on the first housing 441 and/or the second housing 442. Specifically, the fixing portion 430 of the present embodiment is provided protruding from the side-wall 446. By setting the fixing portion 430 on the outer periphery of the encapsulation housing 440, the electromagnetic heating module 400 may be installed as close as possible to the mounting surface, such as as being installed as close as possible to the drum wall of the outer drum, and thus closer to the inner drum, thereby realizing a higher heating efficiency.

[0150] In this embodiment, by providing the encapsulation housing 440 to encase the first mounting disk 410 and the second mounting disk 420 as a whole inside, on one hand, the coil 401 and the magnet 402 play a role of auxiliary fixation to prevent the coil 401 and the magnet 402 from falling off from the first mounting disk 410 and the second mounting disk 420, and on the other hand, the coil 401 is wrapped in the inside of the encapsulation housing 440, avoiding a coil 401 contacting with water causing a short-circuit failure. Heat dissipation holes 443 are provided on the encapsulation housing 440 to realize air circulation inside and outside the encapsulation housing 440, thereby improving the heat dissipation effect of the coil 401 and preventing overheating failure. The encapsulation housing 440 is also provided with a water retaining flange 444, and the water retaining flange 444 is formed by protruding from the outer periphery of the lower surface of the encapsulation housing 440 to surround the heat dissipation holes 443 provided on the lower surface on the inside of the water retaining flange 444, preventing a situation in which washing water enters into the inside of the encapsulation housing 440 from the heat dissipation holes 443 and causes a short-circuit failure of the coil 401.

[0151] As shown in FIG. 10, the present embodiment also provides a clothing treatment device including the above-described electromagnetic heating module 400. The difference between the clothing treatment device described in the present embodiment and the above-described embodiment I is that the first mounting disk 410 and the second mounting disk 420 of the electromagnetic heating module 400 are encapsulated as a whole inside the encapsulation housing 440, and the electromagnetic heating module 400 is mounted on the outer drum 200 by means of the fixing portion 430 disposed on the encapsulation housing 440, and the other structures are the same as those of the embodiment one, and will not be further described.

[0152] Specifically, the electromagnetic heating module 400 is installed with the side on which the first housing 441 is located facing the wall of the outer drum 200. When the electromagnetic heating module 400 operates, the coil 401 may generate a high-frequency alternating magnetic field to excite the inner drum to generate an eddy current effect, which in turn generates heat to heat the washing water. The magnet 402 on the second mounting disk 420 may play a shielding role for the generated magnetic field, thereby preventing the magnetic field from

leaking in the direction of backwardly facing the inner drum, so that the magnetic field generated by the coil 401 acts on the inner drum more efficiently, and the heating efficiency is improved.

[0153] The heat dissipation holes 443 are provided on the surface of the encapsulation housing 440 opposite to the drum wall of the outer drum 200, so that even if water seepage occurs in the outer drum 200, the washing water is not easy to enter the interior of the encapsulation housing 440 through the heat dissipation holes 443. The water retaining flange 444 is raised downward from the lower surface of the encapsulation housing 440, and the washing water that drips onto the encapsulation housing 440 flows to the outer periphery, so that it can directly drip along the outer surface of the water retaining flange 444, and will not flow to the lower surface of the encapsulation housing 440 through the water retaining flange 444, thereby preventing the washing water from entering the inside of the encapsulation housing 440 through the heat dissipation holes 443, resulting in the short-circuit failure of the coil 401.

[0154] In the clothing treatment device of this embodiment, the electromagnetic heating module 400 is set below the outer drum 200, the clothing treatment device does not contact with the washing water during operation, and the encapsulation housing 440 wraps the coil 401, reducing the safety hazard brought about by the contact of the coil 401 with the washing water, and at the same time can heat the portion of the bottom of the inner drum that is in contact with the washing water, and the heating efficiency is higher. The lower surface of the encapsulation housing 440 is provided with heat dissipation holes 443 to improve the heat dissipation efficiency, and at the same time the washing water is prevented from flowing into the interior of the encapsulation housing 440 from the heat dissipation holes 443 by means of the water retaining flange 444, so that the electromagnetic heating module 400 has good heat dissipation and waterproof performance at the same time, and ensures the stable operation of the heating program of the clothing treatment device.

Embodiment III

[0155] As shown in FIGS. 11 to 17, this embodiment provides an electromagnetic heating module 600 for use in a clothing treatment device, comprising a mounting bracket 610, and a coil 601 disposed on the mounting bracket 610, the coil 601 being a toroidal structure, the inner periphery of the coil 601 being provided with an inner magnet 603 shielding the magnetic susceptibility lines generated by the coil 601, the inner magnet 603 filling the hollow part enclosed by the inner periphery of the coil 601 region enclosed by the inner circumference of the coil 601.

[0156] In this embodiment, when a high-frequency alternating current is supplied to the coil 601, the coil 601 can generate a high-frequency alternating magnetic field,

and when the electromagnetic heating module 600 is installed in the clothing treatment device, the generated high-frequency alternating magnetic field can stimulate an eddy current effect in a clothing treatment drum or other water container made of metal to cause the clothing treatment drum or other water container to heat itself, so as to realize the heating of the water in a non-contact condition.

[0157] The mounting bracket 610 is made of an insulating material, such as plastic, which is not excited by the magnetic field and does not affect the magnetic field generated by the coil 601. The inner magnet 603 is magnetic and can have a shielding effect on the magnetic field, and is provided on the inner peripheral side of the coil 601, which can reduce the magnetic inductance radiated from the inner periphery of the coil 601 to the skeletonized area, i.e., reduce the magnetic inductance radiated on the plane where the coil 601 is located. The leakage of the magnetic field is reduced by the provision of the inner magnet 603, thereby improving the heating efficiency of the electromagnetic heating module 600.

[0158] The inner magnet 603 is provided as a hollowed-out region filled with the inner periphery of the coil 601, which has a stronger shielding effect and can also play a homogenizing effect on the magnetic field. Compared to the above program, which only provides a ring of magnets at the edge of the hollowed-out region, the above program avoids excessive concentration of the magnetic field at the edge of the hollowed-out region, so that the entire range of the hollowed-out region can generate a more uniform magnetic field radiating in the up and down directions, thereby making the magnetic field generated by the electromagnetic heating module 600 more uniform, which is conducive to providing a uniform heating effect.

[0159] In a further embodiment of the present embodiment, the inner magnet 603 is a sheet structure having an outer contour matching said skeletonized region.

[0160] Preferably, the inner magnet 603 is match-mounted within said hollowed-out region, the upper surface of the inner magnet 603 being flush with the upper surface of the coil 601.

[0161] In the above-described embodiment, the sheet-like inner magnetic steel 603 fills the hollowed-out area on the inside of the coil 601, providing better shielding of the magnetic field. The inner magnet 603 is flush with the upper surface of the coil 601, so that the upper surface of the electromagnetic heating module 600 is overall flat without obvious bumps and depressions, and it is easier to be assembled in the clothing treatment device.

[0162] In this embodiment, an isolation frame 630 is also provided between the inner periphery of the coil 601 and the outer periphery of the inner magnet 603, and the coil 601 is spirally wound around the outer periphery of the isolation frame 630, and the inner periphery of the coil 601 is affixed to the outer periphery of the isolation frame 630.

[0163] Preferably, the outer periphery of the inner mag-

net 603 is provided in apposition with the inner periphery of the isolation frame 630.

[0164] In the above-described embodiment, the coil 601 is formed by winding a copper conductor whose surface is covered by an insulating layer, and the isolation frame 630 is set up to further avoid the influence of the inner magnetic steel 603 contacting with the copper conductor forming the coil 601, and at the same time, it can also play a supportive role for the coil 601 to ensure that the structure of the coil 601 is stabilized. The inner magnet 603 is provided within the range enclosed by the isolation frame 630, and fits with the inner periphery of the isolation frame 630, facilitating the positioning and fixing of the inner magnet 603.

[0165] In this embodiment, the mounting bracket 610 includes a bottom wall 611 and a side wall 612, and the coil 601 is provided in the holding groove surrounded by the bottom wall 611 and the side wall 612, and it is preferred that the outer periphery of the coil 601 is adhered to the inner side of the side wall 612 of the mounting bracket 610. The inner periphery and outer periphery of the coil 601 are affixed to the outer periphery of the isolation frame 630 and the side wall 612 of the mounting bracket 610, respectively, which can maximize the area of action of the coil 601, thereby further improving the heating efficiency of the electromagnetic heating module 600.

[0166] In a further embodiment of the present embodiment, the isolation frame 630 has a certain length, and the isolation frame 630 is provided with reinforcements 631 in the interior of the isolation frame 630, and the reinforcements 631 are provided along the direction of extension perpendicular to the length of the isolation frame 630, and are connected to the isolation frame 630 at both ends.

[0167] The isolation frame 630 in this embodiment is a plastic part, which is not affected by magnetic fields. The left and right ends of the isolation frame 630 are arc-shaped, and the front and rear sides have a certain extension length. In order to avoid the front and rear sides of the isolation frame 630 from being easily deformed due to the large extension length, a number of reinforcements 631 are provided between the front and rear sides for supporting the front and rear sides of the isolation frame 630, so as to make its structure more stable. The coil 601 is helically wound around the periphery of the isolation frame 630 to form a shape similar to a runway.

[0168] In a preferred embodiment of this embodiment, the reinforcement 631 separates the inner side of the isolation frame 630 into at least two separate regions, and the inner magnet 603 comprises at least two magnet sheets disposed respectively in said separate regions.

[0169] As shown in FIG. 13, in the above-described scheme, in order to ensure the effect of the reinforcements 631, the height of the reinforcements 631 is not lower than the height of the isolation frame 630, so that the upper edge to the lower edge of the isolation frame 630 are all supported by the reinforcements 631, so that

the area enclosed by the isolation frame 630 is separated by the reinforcements 631 into a plurality of independent regions that are not connected to each other. Accordingly, as shown in FIG. 12, the inner magnet 603 comprises a plurality of magnet sheets disposed respectively in said independent regions, which specifically include two magnet sheets having a circular arc-shaped outer contour disposed at the left and right ends on one side and two magnet sheets having an approximately rectangular shape disposed in the middle.

[0170] In this embodiment, the isolation frame 630 is integrally molded with the reinforcement 631, which is simple to manufacture.

[0171] In a further embodiment of this embodiment, the front and rear ends of the reinforcement 631 have extension portions 632 extending in the direction of the bottom wall 611 of the mounting bracket 610, and the extension ends of the extension portions 632 are provided with snap clamping jaws 633. A slot 613 is provided on the bottom wall 611 of the mounting bracket 610 corresponding to the location of the clamping jaws 633.

[0172] Fixed by clamping jaw 633 and slot 613, the isolation frame 630 can be fixed on the mounting bracket 610 and is not easy to fall off, and then the coil 601 and the inner magnet 603 are assembled, and the overall structure of the electromagnetic heating module 600 is more stable.

[0173] Preferably, the bottom wall 611 of the mounting bracket 610 is provided with strip through hole 614 corresponding to the reinforcements 631, and the slots 613 are provided at both ends of the strip through hole 614. The clamping jaws 633 are inserted into the strip through hole 614 and snap-fixed with the slots 613, so that the clamping jaws 633 are visible from below the mounting bracket 610, and when the electromagnetic heating module 600 needs to be disassembled for maintenance, the clamping jaws 633 can be toggled from below the mounting bracket 610 via the strip through hole 614 to disengage it from the slots 613, thereby removing the isolation frame 630.

[0174] In a further embodiment of the present embodiment, a bottom magnet 602 is also provided between the coil 601 and the bottom wall 611 of the mounting bracket 610, and the bottom magnet 602 is a sheet-like structure laid on the bottom wall 611 of the mounting bracket 610. The extension portion 632 penetrates the bottom magnet 602 so that the clamping jaws 633 snap to the slot 613.

[0175] Preferably, an isolation layer 620 is provided between the coil 601 and the bottom magnet 602, and the middle part of the isolation layer 620 has through holes 621 matching the hollowed out areas of the coil 601.

[0176] In the above-described scheme, the setting of the bottom magnets 602 plays a shielding effect on the magnetic inductance lines radiating toward the underside of the coil 601, so that the generated magnetic field concentrates on radiating toward the upper side, thereby further reducing the leakage of the magnetic field and im-

proving the heating efficiency. The sheet-like bottom magnets 602 spread the space below the coil 601, which strengthens the shielding effect on the magnetic field and further reduces the magnetic field leaking to the underside of the electromagnetic heating module 600. An isolation layer 620 made of an insulating composite material is provided between the bottom magnets 602 and the coils 601, and the coils 601 and the bottom magnets 602 are not in direct contact to avoid interference. Through holes 621 are provided in the middle of the isolation layer 620 without affecting the installation of the isolation frame 630.

[0177] In this embodiment, the bottom magnet 602 comprises a plurality of magnetic steel sheets laid on the bottom wall 611 of the mounting bracket 610, two adjacent magnetic steel sheets having a gap between them, and the extension portion 632 passes through said gap so that the clamping jaws 633 snap to the slot 613.

[0178] Preferably, the bottom wall 611 is provided with a divider 615 inserted in said gap, the divider 615 having an avoidance notch 616 in a region corresponding to the position of the reinforcement 631.

[0179] In the above-described embodiment, the bottom magnets 602 are provided as a plurality of independent magnetic steel sheets, and a gap for the extension portion 632 to pass through is left between two adjacent magnetic steel sheets during assembly, so as to eliminate the need for additional holes to be made in the bottom magnets 602 and simplify the manufacturing process. The divider 615 on the bottom wall 611 may assist in the positioning of the bottom magnets 602 during assembly, making assembly easier. Part of the divider 615 is provided with an avoidance notch 616 for the extension portion 632 to pass through.

[0180] In this embodiment, the bottom magnet 602 includes six magnetic steel sheets, specifically two magnetic steel sheets having a semicircular outline on one side set at the left and right ends, and four approximate rectangular magnetic steel sheets set in the middle. Dividers 615 are provided five at equal spacing on the bottom wall 611, and the middle three dividers 615 correspond in position to the reinforcements 631 on the isolation frame 630 and are provided with avoidance notches 616.

[0181] In a further embodiment of the present embodiment, the outer periphery of the coil 601 is provided with an outer magnet 604 that shields the magnetic inductance generated by the coil 601. Specifically, a mounting groove 617 for mounting the outer magnet 604 is provided on the side wall 612 of the mounting bracket 610, and the outer magnet 604 is placed in the mounting groove 617.

[0182] Preferably, the sidewall 612 has a certain thickness, the mounting groove 617 is provided between the inner and outer periphery of the sidewall 612, and the opening of the mounting groove 617 is provided on the upper surface of the sidewall 612.

[0183] In the above-described embodiment, the outer

magnet 604 provided at the periphery of the coil 601 may play a shielding role for the magnetic inductance lines radiating toward the peripheral side of the coil 601, further reducing the leakage of the magnetic field, and allowing the generated magnetic field to radiate toward the upper side of the electromagnetic heating module 600 in a more concentrated manner.

[0184] In this embodiment, the outer magnet 604 comprises a plurality of magnet steel blocks, specifically comprising a plurality of small magnet steel blocks encircling the circular arc outer contours of the left and right ends of the coil 601, and two bar-shaped magnet steel blocks set at the front and rear sides of the coil 601. To further facilitate processing, the two bar-shaped magnetic steel blocks may also be provided to comprise a plurality of magnetic steel blocks of shorter length. The mounting bracket 610 is provided with mounting grooves 617 that correspond one-to-one with the plurality of magnetic steel blocks.

[0185] In this embodiment, the terminal (not shown in the drawings) to which the coil 601 is connected is threaded out of the electromagnetic heating module 600 from the side wall 612 of the mounting bracket 610, and a wire outlet hole (not shown in the drawings) is opened at a corresponding position on the side wall 612, and accordingly, the outer magnet 604 is not mounted at a position corresponding to the wire outlet hole.

[0186] In a further embodiment of the present embodiment, the upper surface of the electromagnetic heating module 600 is a circular arc surface, and when it is applied to the clothing treatment device to heat the clothing treatment drum, it avoids the situation that the distance between the left and right ends of the electromagnetic heating module 600 and the middle part and the clothing treatment drum varies too much, which leads to different heating efficiencies, and is conducive to the realization of a more uniform heating effect.

[0187] Both the bottom magnet 602 and the inner magnet 603 are formed by combining a plurality of magnet sheets so that each magnet sheet can be approximated as a flat plate structure, and the plurality of flat plate structures are easier to process and shape compared to manufacturing a whole magnet sheet with a curvature.

[0188] In this embodiment, the bottom wall 611 of the mounting bracket 610 has a mounting portion 618 formed by extending in a peripheral direction toward the sidewall 612 of the mounting bracket 610, and the mounting portion 618 is provided with mounting holes 619. The mounting portion 618 extends from the connection between the arcuate section and the approximately straight section on the sidewall 612 toward the left and right ends, so that the whole of the bottom wall 611 is in the shape of an approximately rectangular shape. The electromagnetic heating module 600 may be mounted inside the clothing treatment device, such as on the drum wall of the outer drum of the washing machine, through the mounting holes 619 on the mounting portion 618, and thereby realizes the purpose of heating the washing water by stim-

ulating the inner drum to generate an eddy current effect through the passage of the high-frequency alternating current.

[0189] In this embodiment, the parts of the electromagnetic heating module 600 are machined by molds. Specifically, the mounting bracket 610, the isolation layer 620, and the isolation frame 630 are each integrally injection molded in a different mold.

[0190] The bottom magnet 602 requires two sets of processing molds for making the magnet steel sheets at each end and the plurality of magnet steel sheets in the middle. The inner magnet 603 requires two sets of processing molds for making the magnet steel pieces at each end and the two magnet steel pieces in the middle. The outer magnet 604 also requires two sets of processing molds for making a plurality of small magnetic steel pieces that surround the left and right ends, and two strips of magnetic steel pieces on the front and back sides.

[0191] The coil 601 can also be placed into the corresponding mold after the copper conductor winding is completed, and then injected into the encapsulation material for encapsulation, and after demolding, the annular one-piece structure in which the coil 601 is completely encapsulated by the encapsulation material is obtained, which facilitates the assembly in the later stage on the one hand, and on the other hand greatly improves the waterproof performance of the coil 601.

[0192] When assembled, the bottom magnets 602 are first laid on the bottom wall 611 of the mounting bracket 610, and the outer magnets 604 are placed one by one into each of the mounting grooves 617. Then the isolation layer 620 is placed on the bottom magnets 602 and the isolation frame 630 is installed, after which the coils 601 and the inner magnets 603 are placed on the outer and inner sides of the isolation frame 630, respectively, which completes the assembly of the electromagnetic heating module 600.

[0193] Further, the individual components of the electromagnetic heating module 600 in this embodiment are fixed to each other by gluing. Specifically, a silicone adhesive with an operating temperature range of about -50 to 200° C. is used to glue the various components, which can withstand the high temperature environment during the operation of the electromagnetic heating module 600, so as to make the connection between the various components in the electromagnetic heating module 600 more solid.

[0194] The electromagnetic heating module 600 of this embodiment is provided with magnets that can shield the magnetic field underneath the coil 601, on the inner peripheral side, and on the outer peripheral side. The bottom magnet 602, the inner magnet 603, and the outer magnet 604 cooperate with each other, which can play a role in effectively preventing leakage of the magnetic field, so that the magnetic field generated by the coil 601 is centrally radiated to the upper part of the electromagnetic heating module 600, in order to improve the heating efficiency. Through the structural design of the electro-

magnetic heating module 600, the overall structure of the electromagnetic heating module 600 is made more stable, and the magnetic field generated is more uniform, which is conducive to providing a uniform heating effect.

[0195] As shown in FIGS. 11 to 20, this embodiment also provides a clothing treatment device including the electromagnetic heating module 600 described above.

[0196] Clothing treatment devices described in this embodiment include, but are not limited to, washing machines, washing and drying machines and the like. Specifically, said clothing treatment device comprises an inner drum (not shown in the drawings), at least a portion of said inner drum being made of a metallic material that can generate eddy currents in an alternating magnetic field.

[0197] In detail, the electromagnetic heating module 600 is provided below the inner drum, the drum wall of the inner drum is at least partially made of metal material, and the part of the drum wall made of the metal material generates heat by eddy current effect under the excitation of the electromagnetic heating module 600, thereby heating the washing water in the inner drum. Preferably, all of the drum walls of the inner drum are made of metal material, so that during the rotation of the inner drum, each part of the drum wall can be excited and heated by the electromagnetic heating module 600 when the drum wall is rotated to a position close to the electromagnetic heating module 600, so as to realize a higher heating efficiency.

[0198] In another embodiment of the present embodiment, the wall of the inner drum may be made of an insulating material, while a lifting bar or other additional module made of a metal material is provided on the wall of the inner drum, and said lifting bar or other additional module is heated by the excitation of the electromagnetic heating module 600, and heats the washing water in the inner drum.

[0199] The clothing treatment device of the present embodiment further comprises an outer drum 500, said inner drum being provided within the outer drum 500. Preferably, the inner drum of the clothing treatment device of the present embodiment can independently hold washing water during washing. Specifically, the inner drum is not provided with a dehydration hole on the wall of the drum, and is in a closed state during the washing process, and can hold washing water independently. A drainage hole is provided on the wall of the inner drum, and the drainage hole is blocked by the sealing assembly during the washing process, and when the inner drum reaches a certain rotational speed, the sealing assembly can open the drainage hole under the action of centrifugal force to realize the discharge of the washing water. The outer drum 500 is connected to the drainage structure, and the water discharged from the inner drum enters the outer drum 500 and is then discharged from the clothing treatment device via the drainage structure.

[0200] In this embodiment, the drum wall of the inner drum is composed of a metal material, and the outer drum

500 is made of a plastic material that does not excite eddy current effects in the magnetic field. An electromagnetic heating module 600 is mounted on the outside of the outer drum 500, and a high-frequency alternating magnetic field may be generated by passing a high-frequency alternating current to a coil 601 inside thereof. The electromagnetic induction line of the said high frequency alternating magnetic field can penetrate the outer drum 500 and act on the wall of the inner drum made of metal, so that the wall of the inner drum generates eddy currents under the effect of electromagnetic induction, and the eddy currents overcome the internal resistance of the wall of the inner drum to complete the conversion of electric energy to thermal energy, so as to realize the heat generation of the wall of the inner drum, thereby heating the washing water therein.

[0201] In a further embodiment of the present embodiment, the electromagnetic heating module 600 is provided below the outer drum 500 and connected to the drum wall 510 of the outer drum 500.

[0202] Preferably, convex ribs 511 are provided on the drum wall 510 of the outer drum 500, and the electromagnetic heating module 600 is installed in the area enclosed by the convex ribs 511. Specifically, the convex rib 511 encloses a rectangular region at the bottom of the drum wall 510 of the outer drum 500 for mounting the electromagnetic heating module 600.

[0203] In the above-described scheme, the electromagnetic heating module 600 is provided below the outer drum 500, so that the clothing treatment device does not come into direct contact with the washing water during the working period, which reduces the safety hazard brought about by the contact of the coil 601 with the water. On the other hand, the electromagnetic heating module 600 can focus on heating the bottom region of the inner drum, that is, the part where the washing water is concentrated, and the heating efficiency is higher.

[0204] The mounting bracket 610 of the electromagnetic heating module 600 is provided with a mounting portion 618, and the mounting portion 618 is provided with mounting holes 619. The screw posts 512 corresponding to the mounting holes 619 on the electromagnetic heating module 600 are provided in the area surrounded by the convex rib 511, and the screw posts 512 are specifically provided at four top corners of the inner area of the convex rib 511, and are screwed into the screw posts 512 through the mounting holes 619, and the electromagnetic heating module 600 is fixed to the drum wall 510 of the outer drum 500.

[0205] In a further embodiment of the present embodiment, an upper surface of the electromagnetic heating module 600 is mounted towards the drum wall 510 of the outer drum 500, said upper surface being a circular arc surface co-axial with the drum wall of the inner drum. This can make the distance between each place on the upper surface of the electromagnetic heating module 600 and the drum wall of the inner drum equal, and thus make the drum wall of the inner drum uniformly heated.

[0206] In a preferred embodiment of this embodiment, the electromagnetic heating module 600 extends along the circumferential direction of the outer drum 500 for a length greater than its extension length along the radial direction of the outer drum 500. The electromagnetic heating module 600 eliminates the need to occupy a larger area in the radial direction of the outer drum 500 by extending along the circumferential direction of the outer drum 500 to increase the heating area.

[0207] In this embodiment, the electromagnetic heating module 600 is installed at the lowest point of the drum wall 510 of the outer drum 500 to achieve an optimal heating effect, and some other structures, such as a drain port on the outer drum 500, also need to be set at the lowest point of the drum wall 510. By reducing the extension length of the electromagnetic heating module 600 along the radial direction of the outer drum 500, it can be avoided that it occupies too much space at the lowest part of the drum wall 510 of the outer drum 500, which affects the setting of the drain port and other structures. And the electromagnetic heating module 600 extends circumferentially upwardly of the outer drum 500 to provide a larger heating area, so that a higher heating efficiency can be achieved.

[0208] The clothing treatment device of the present embodiment realizes the heating function of the washing water by setting the electromagnetic heating module 600, which realizes the purpose of heating the washing water of the clothing treatment device without water between the inner drum and the outer drum 500. The electromagnetic heating module 600 is provided below the outer drum 500, so that the clothing treatment device does not come into contact with the washing water during its operation, reducing the safety hazard caused by the coil 601 coming into contact with the washing water, and at the same time, it can heat the portion of the bottom of the inner drum that comes into contact with the washing water, with higher heating efficiency. The electromagnetic heating module 600 has an upwardly facing arcuate surface so that the upper surface is parallel to the surface of the drum wall of the inner drum, which can provide a uniform heating effect. The electromagnetic heating module 600 extends in the circumferential direction of the outer drum 500 to provide a larger heating area, and does not have an excessively long extension length in the radial direction of the outer drum 500 to avoid occupying too much space at the lowest part of the drum wall 510 of the outer drum 500.

[0209] The above is only a preferred embodiment of the present invention, and is not a formal limitation of the present invention. Although the present invention has been disclosed as a preferred embodiment, it is not intended to limit the present invention, and any skilled person familiar with the present patent may, without departing from the scope of the technical scheme of the present invention, use the technical content of the above mentioned hints to make some changes or modifications for equivalent changes of equivalent embodiments, but any

simple modifications and modifications made to the above embodiments based on the technical substance of the present invention are still within the scope of the technical scheme of the present invention. However, any simple modifications, equivalent changes and modifications made to the above embodiments based on the technical substance of the present invention without departing from the content of the technical scheme of the present invention are still within the scope of the present invention.

Claims

1. An electromagnetic heating module, **characterized in that** it comprises:

a first mounting disk, a coil is provided on an upper surface of the first mounting disk;
a second mounting disk, provided below the first mounting disk, a magnet is mounted on a surface of the second mounting disk opposite to the first mounting disk.

2. The electromagnetic heating module according to claim 1, **characterized in that** the first mounting disk and the second mounting disk both have a circular outer contour, and the coil is spirally wound on the upper surface of the first mounting disk to form a number of concentric circles co-centered with the first mounting disk;

the magnet is a bar magnet, and the bar magnet is set along a radial direction of the second mounting disk and mounted on a lower surface of the second mounting disk;
preferably, a plurality of the bar magnets are spaced apart on a circumference of the second mounting disk.

3. The electromagnetic heating module according to claim 1 or 2, **characterized in that** the first mounting disk has a circular outer contour, the first mounting disk comprising a first outer ring, and a plurality of coil support parts extending radially from an inner side of the first outer ring; and hollows are provided between adjacent coil support parts;
preferably, a first fixing disk is provided in a central portion of the first mounting disk and an extended end of the coil support part is connected to the first fixing disk.

4. The electromagnetic heating module according to claim 3, **characterized in that** a number of fixing grooves are provided at intervals along an extension direction thereof on the coil support part, and the coil is provided in the fixing grooves;

- preferably, the coil support part comprises a bottom wall of the support part extending in a radial direction, and a side wall of the support part formed by extending upwardly from both sides of the bottom wall of the support part, the fixing grooves extending from upper edges of both sides of the side wall of the support part to the bottom wall of the support part;
more preferably, one end of the bottom wall, near the first outer ring, of the support part extends upwardly to form an end wall of the support part, the end wall of the support part being connected to an inner surface of the first outer ring.
5. The electromagnetic heating module according to claim 3 or 4, **characterized in that** the first mounting disk further comprises a reinforcing portion connected to the plurality of coil support parts;
- preferably, the reinforcing portion is a ring reinforcement that is co-circular with the first outer ring, and central portions of the plurality of coil support parts are connected as one by the ring reinforcement;
more preferably, the ring reinforcement is formed by extending downwardly from a lower surface of the coil support part.
6. The electromagnetic heating module according to any one of claims 3-5, **characterized in that** the second mounting disk has a circular outer contour, the second mounting disk comprising a second outer ring, and a plurality of magnet mounting portions extending radially from an inner side of the second outer ring; and hollows are provided between the adjacent magnet mounting portions;
- preferably, a second fixing disk is provided in a central portion of the second mounting disk and an extended end of the magnet mounting portion is connected to the second fixing disk;
preferably, the magnet mounting portion comprises a bottom wall of the mounting portion extending in a radial direction, and side walls of the mounting portion formed by extending downwardly from edges of the bottom wall of the mounting portion on both sides, and the bar magnet is mounted in a space enclosed by the bottom wall of the mounting portion and the side walls of the mounting portion on both sides.
7. The electromagnetic heating module according to claim 6, **characterized in that** the plurality of magnet mounting portions are provided at least partially overlapping with the coil support parts in a circumferential direction;
preferably, the plurality of magnet mounting portions and the coil support parts overlap one-to-one in the circumferential direction.
8. An electromagnetic heating module according to any one of claims 1-7, **characterized in that** the first mounting disk is provided with a connection hole and the second mounting disk is provided with a connection portion; or, the second mounting disk is provided with the connection hole and the first mounting disk is provided with the connection portion;
- the connecting portion is inserted in the connecting hole, connecting the first mounting disk with the second mounting disk;
alternatively, the first mounting disk and the second mounting disk are integrally molded;
preferably, a certain distance is provided between opposite surfaces of the first mounting disk and the second mounting disk;
more preferably, a lower surface of the first mounting disk is provided with a ring reinforcement formed by extending downwardly, the ring reinforcement abuts against an upper surface of the second mounting disk; or the first mounting disk is integrally connected to the second mounting disk by the ring reinforcement.
9. The electromagnetic heating module according to any one of claims 1-8, **characterized in that** further comprises a first shielding member provided above the first mounting disk for preventing the coil from detaching from the first mounting disk, and a second shielding member provided below the second mounting disk for preventing the magnet from detaching from the second mounting disk;
- preferably, the first shielding member is an upper baffle covering an upper surface of the first mounting disk and the second shielding member is a lower baffle covering a lower surface of the second mounting disk;
more preferably, the electromagnetic heating module further comprises a side wall connecting the upper baffle and the lower baffle, the upper baffle, lower baffle and side wall forming an encapsulation housing encasing the first mounting disk with the second mounting disk inside the encapsulation housing.
10. A clothing treatment device, **characterized in that** comprising the electromagnetic heating module as claimed in any one of claims 1-9;
- preferably, the clothing treatment device includes an outer drum and an inner drum, the inner drum being provided within the outer drum, a drum wall of the inner drum being made of a metallic material that can generate eddy currents in an alternating magnetic field;

- preferably, the electromagnetic heating module is provided below the outer drum and connected to the drum wall of the outer drum;
more preferably, the electromagnetic heating module is provided in a region of the drum wall of the outer drum near a bottom of the outer drum.
11. An electromagnetic heating module comprising an encapsulation housing and a coil provided inside the encapsulation housing, **characterized in that** the encapsulation housing is provided with a heat dissipation structure communicating an inner space and an outer space of the encapsulation housing, and a water retaining structure provided around the heat dissipation structure.
 12. The electromagnetic heating module according to claim 11, **characterized in that** the encapsulation housing has a lower surface, the heat dissipation structure being a heat dissipation hole provided on the lower surface; the lower surface being partially raised to form the water retaining structure surrounding the heat dissipation hole.
 13. The electromagnetic heating module according to claim 12, **characterized in that** the lower surface located at a periphery of the heat dissipation hole bulges downwardly to form the water retaining structure.
 14. The electromagnetic heating module for a clothing treatment device according to claim 12, **characterized in that** the water retaining structure is a water retaining flange formed by projecting downwardly from a periphery of the lower surface.
 15. The electromagnetic heating module according to claim 14, **characterized in that** the water retaining flange is provided at an angle from the periphery of the lower surface to an inner side of the lower surface.
 16. The electromagnetic heating module according to any one of claims 12-15, **characterized in that** the encapsulation housing comprises a first housing and a second housing, the second housing comprising a bottom wall, and a side wall surrounding the bottom wall, the first housing being connected to the side wall; and the heat dissipation hole being provided through the bottom wall.
 17. The electromagnetic heating module for a clothing treatment device according to claim 16, **characterized in that** a fixing portion is provided on the first housing and/or the second housing, the fixing portion is provided with a fixing hole;
preferably, the fixing portion is provided projecting from the side wall.
 18. The electromagnetic heating module according to any one of claims 12-17, **characterized in that** a first mounting disk is provided in the encapsulation housing, and the coil is provided on a surface of the first mounting disk that is opposite to the heat dissipation hole; and
a second mounting disk is provided below the first mounting disk, and a magnet is mounted on a surface of the second mounting disk facing the heat dissipation hole;
preferably, the first mounting disk is spaced apart from the second mounting disk.
 19. The electromagnetic heating module according to claim 18, **characterized in that** the first mounting disk and the second mounting disk both have a circular outer contour;
the first mounting disk includes a plurality of coil support parts radially extending for securing the coil, and hollows are provided between the adjacent coil support parts;
the second mounting disk comprises a plurality of magnet mounting portions extending in a radial direction, the magnet is a bar magnet mounted on the magnet mounting portions, and hollows are provided between the adjacent magnet mounting portions;
preferably, the plurality of magnet mounting portions are provided at least partially overlapping with the coil support parts in a circumferential direction;
more preferably, the plurality of magnet mounting portions and the coil support parts overlap one-to-one in the circumferential direction.
 20. A clothing treatment device **characterized in that** comprising the electromagnetic heating module as claimed in any one of claims 11-19;
preferably, the clothing treatment device includes an outer drum and an inner drum, the inner drum being provided within the outer drum, a drum wall of the inner drum is made of a metallic material that can generate eddy currents in an alternating magnetic field;
preferably, the electromagnetic heating module is provided below the outer drum and connected to the drum wall of the outer drum;
more preferably, the electromagnetic heating module is provided on the drum wall of the outer drum in a region near the bottom of the outer drum.
 21. An electromagnetic heating module comprising a

mounting bracket, and a coil set on the mounting bracket, **characterized in that** the coil is of a toroidal structure, an inner periphery of the coil is provided with an inner magnet shielding a magnetic inductance generated by the coil, and the inner magnet fills a hollowed area enclosed by the inner periphery of the coil.

22. The electromagnetic heating module according to claim 21, **characterized in that** the inner magnet is a sheet structure having an outer contour matching the hollowed area; preferably, the inner magnet is mounted within the hollowed area, an upper surface of the inner magnet is flush with an upper surface of the coil.

23. The electromagnetic heating module according to claim 22, **characterized in that** an isolation frame is provided between an inner periphery of the coil and an outer periphery of the inner magnet, the coil is wound helically around an outer periphery of the isolation frame, the inner periphery of the coil is affixed to the outer periphery of the isolation frame;

preferably, the outer periphery of the inner magnet is provided in apposition with an inner periphery of the isolation frame;

preferably, the mounting bracket comprises a bottom wall and a side wall, the coil is provided in a holding groove surrounded by the bottom wall and the side wall, and an outer periphery of the coil is affixed to an inner side of the side wall of the mounting bracket.

24. The electromagnetic heating module according to claim 23, **characterized in that** the isolation frame has a certain length, the isolation frame is provided with a reinforcement inside, the reinforcement is provided along a direction extending perpendicular to a length of the isolation frame, and is connected to the isolation frame at both ends;

preferably, the reinforcement separates an inner side of the isolation frame into at least two separate regions, and the inner magnet comprise at least two magnet sheets set respectively in the separate regions; preferably, the isolation frame is integrally molded with the reinforcement.

25. The electromagnetic heating module according to claim 24, **characterized in that** the ends of the reinforcement have extension portions extending towards a bottom wall of the mounting bracket, and extended ends of the extension portions are provided with clamping jaws; and a slot is provided on the bottom wall of the mounting bracket corresponding to the clamping jaws;

preferably, a strip through hole is provided in the bottom wall of the mounting bracket corresponding to the reinforcement, and the slot is provided at both ends of the strip through hole.

26. The electromagnetic heating module according to claim 25, **characterized in that** a bottom magnet is provided between the coil and the bottom wall of the mounting bracket, the bottom magnet is a sheet-like structure laid on the bottom wall of the mounting bracket; and the extension portion penetrates the bottom magnet so that the clamping jaws snap into the slot;

preferably, an isolation layer is provided between the coil and the bottom magnet, the isolation layer is provided with a through hole in a middle of the layer matching the hollowed area of the coil;

preferably, the bottom magnet comprises a plurality of magnetic steel sheets laid on the bottom wall of the mounting bracket, two adjacent magnetic steel sheets having a gap between them, and the extension portion passing through the gap so that the clamping jaws snap into the slot; more preferably, the bottom wall is provided with a divider inserted in the gap, the divider is provided with an avoidance notch in a region corresponding to the reinforcement.

27. The electromagnetic heating module according to any one of claims 21-26, **characterized in that** a periphery of the coil is provided with an outer magnet that shields the coil from generating magnetic inductance;

preferably, the mounting bracket is provided with a mounting groove on the side wall for mounting the outer magnet; more preferably, the side wall has a certain thickness, the mounting groove is provided between an inner and an outer periphery of the side wall, and an opening of the mounting groove is provided on an upper surface of the side wall.

28. A clothing treatment device **characterized in that** comprising an inner drum, at least a portion of the inner drum being made of a metallic material capable of generating eddy currents in an alternating magnetic field, and further comprising the electromagnetic heating module as claimed in any one of claims 21-27.

29. The clothing treatment device according to claim 28, **characterized in that** further comprises an outer drum, the inner drum is set inside the outer drum, and the electromagnetic heating module is set below the outer drum and connected to a drum wall of the

outer drum;

preferably, the outer drum is provided with a convex rib on the drum wall of the drum, and the electromagnetic heating module is installed in an area surrounded by the convex rib;
more preferably, the bottom wall of the mounting bracket is provided with a mounting portion formed by extending in a peripheral direction toward a side wall of the mounting bracket, the mounting portion is provided with a mounting hole; a screw post corresponding to the mounting hole is provided in the area surrounded by the convex rib.

30. The clothing treatment device according to claim 29, **characterized in that** the electromagnetic heating module has an upper surface facing the drum wall of the outer drum, the upper surface is a circular curved surface co-axial with the drum wall of the inner drum;
preferably, an extension length of the electromagnetic heating module along a circumferential direction of the outer drum is greater than its extension length along a radial direction of the outer drum.

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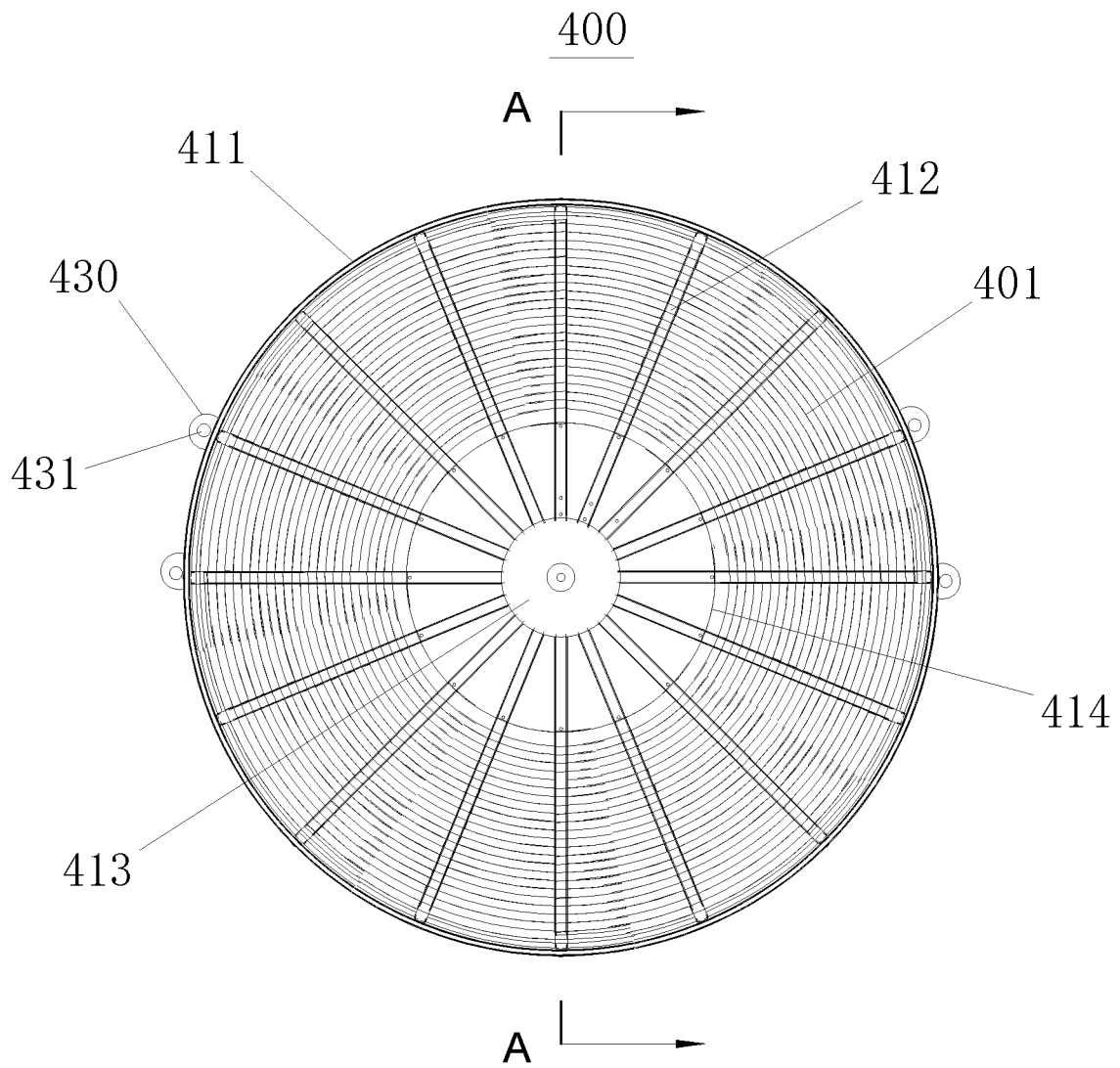


Fig. 1

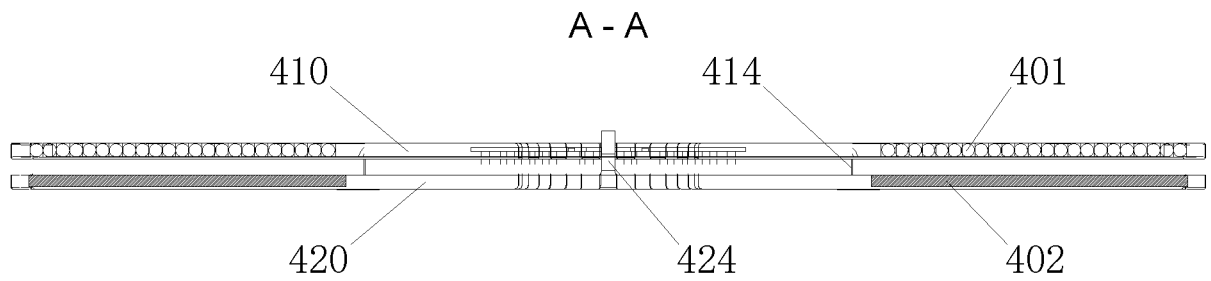


Fig. 2

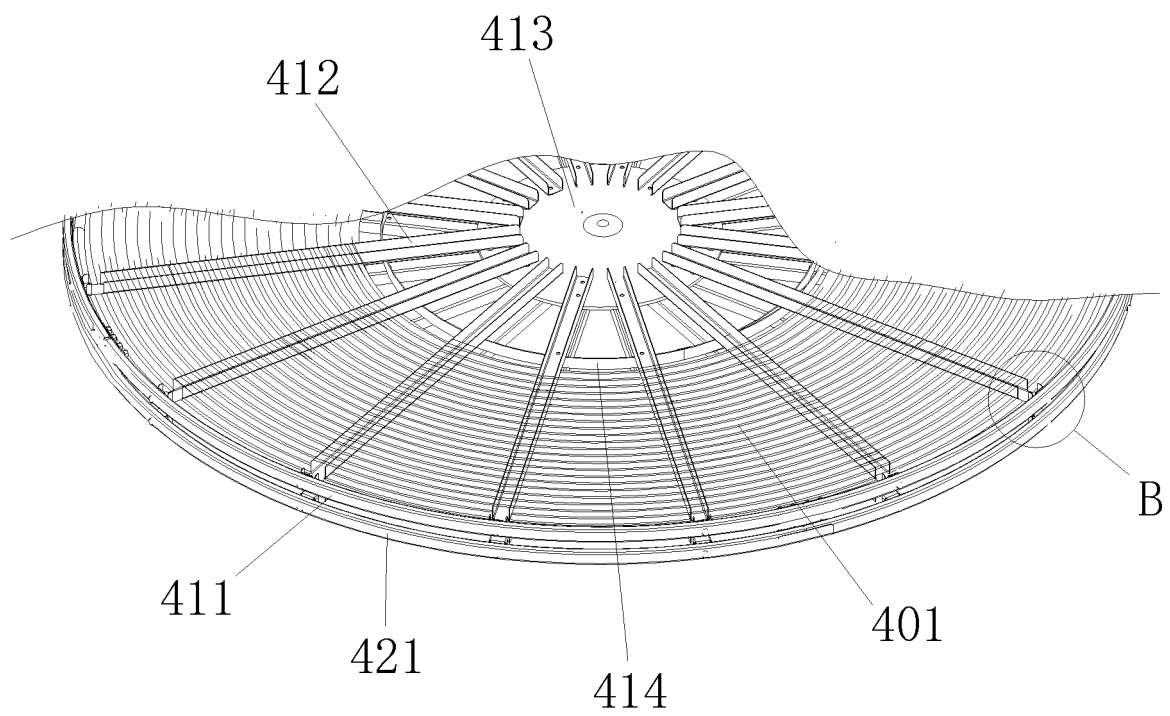


Fig. 3

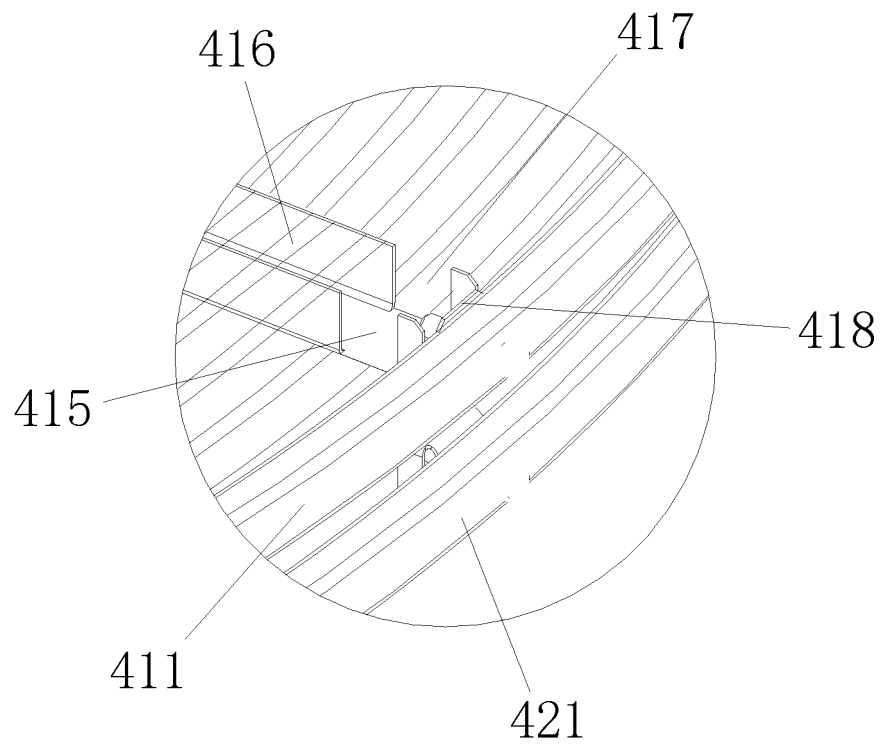


Fig. 4

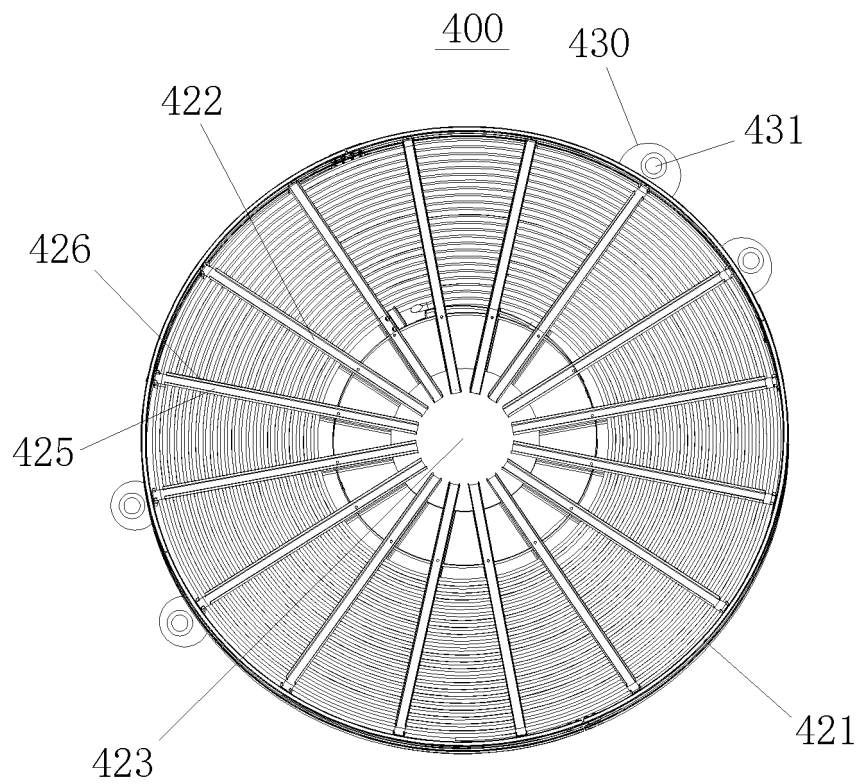


Fig. 5

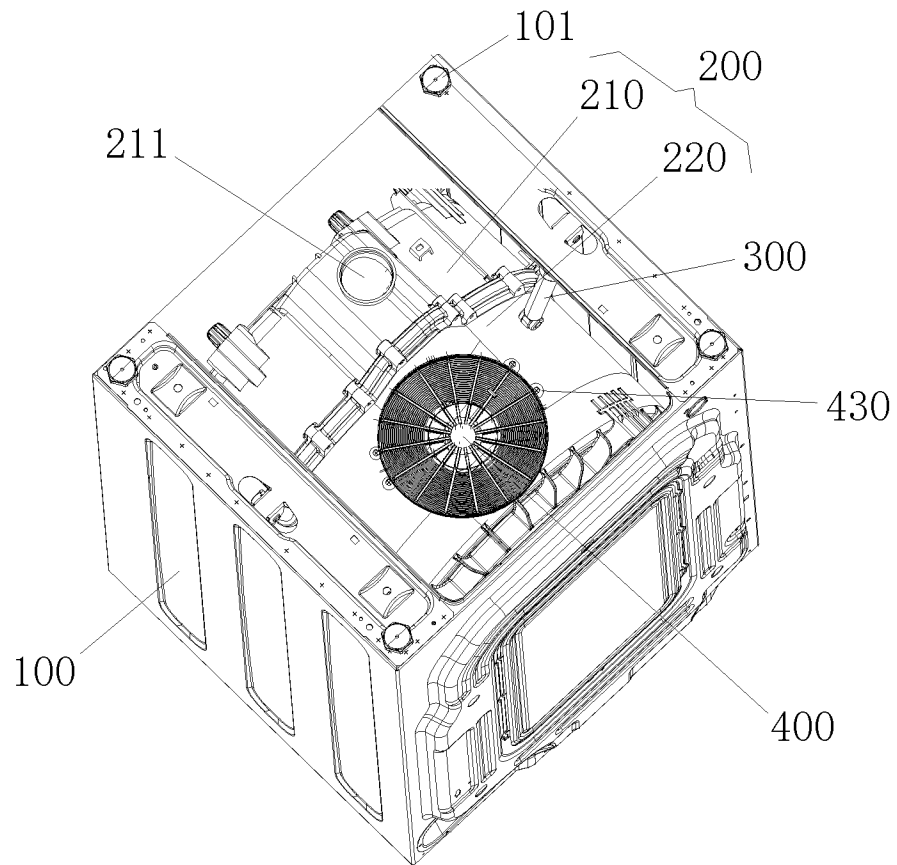


Fig. 6

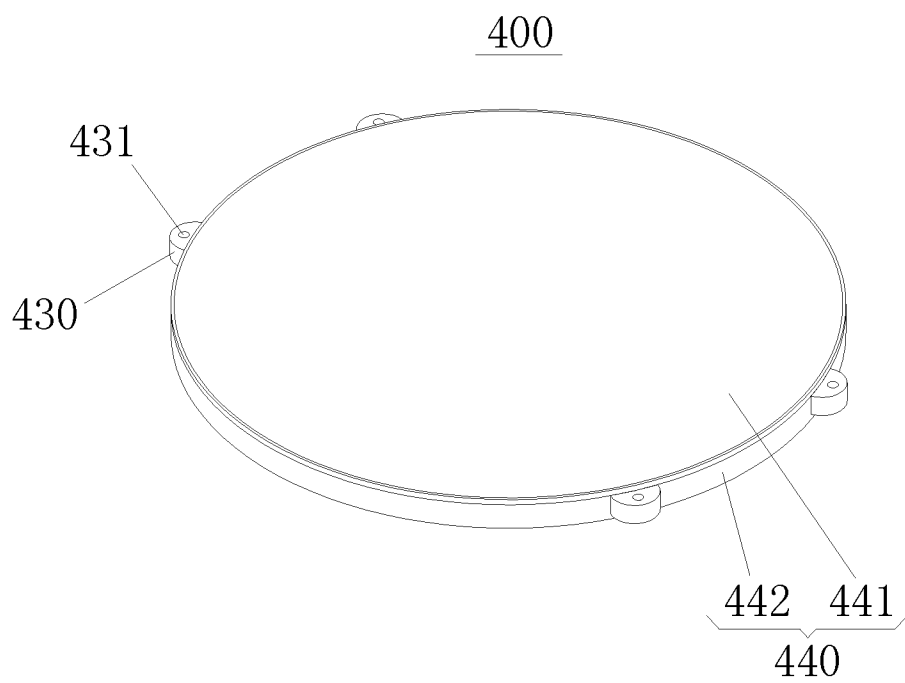


Fig. 7

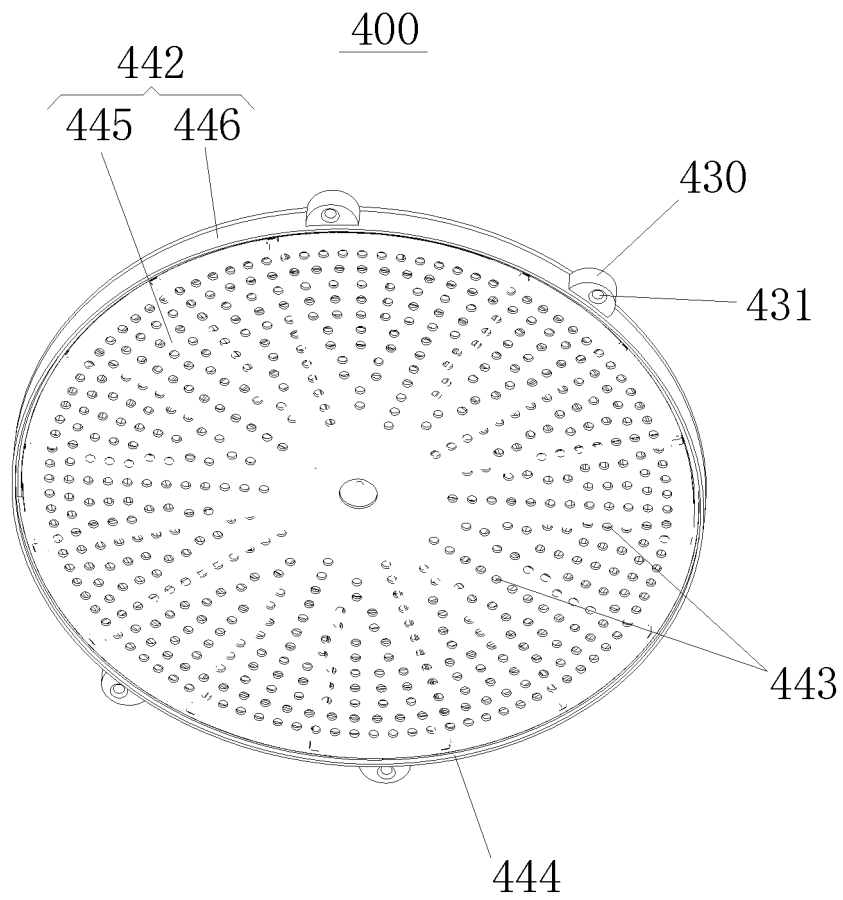


Fig. 8

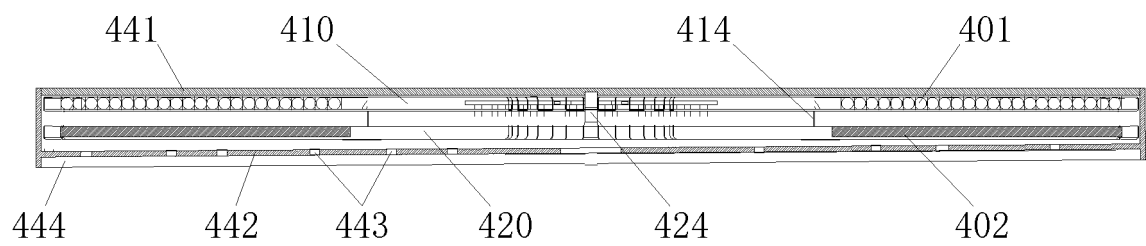


Fig. 9

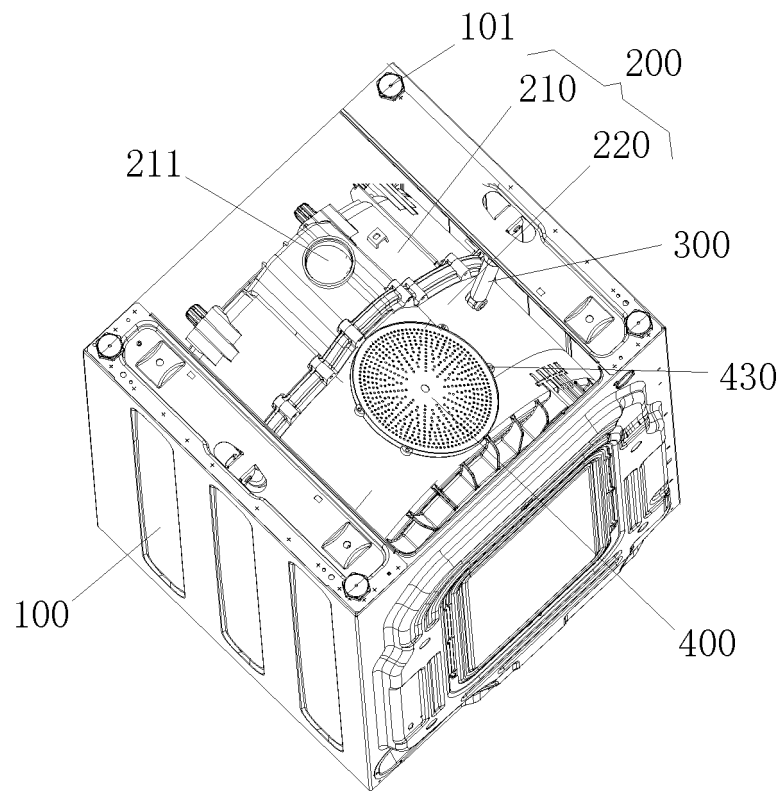


Fig. 10

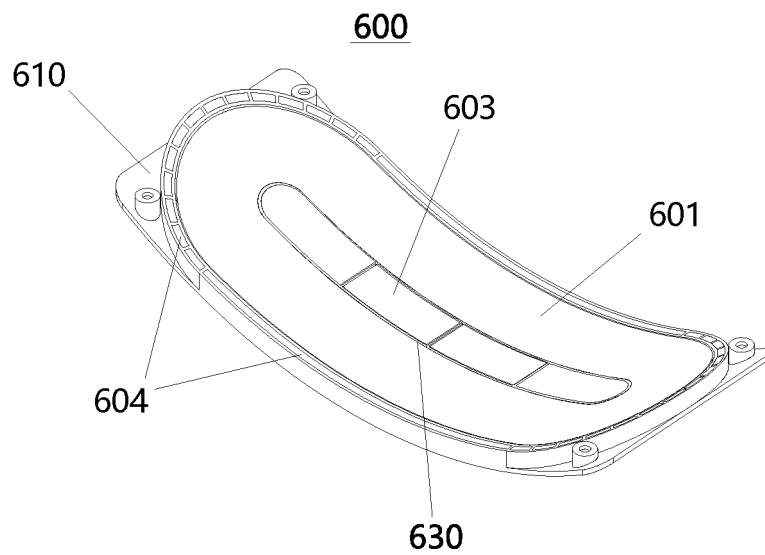


Fig. 11

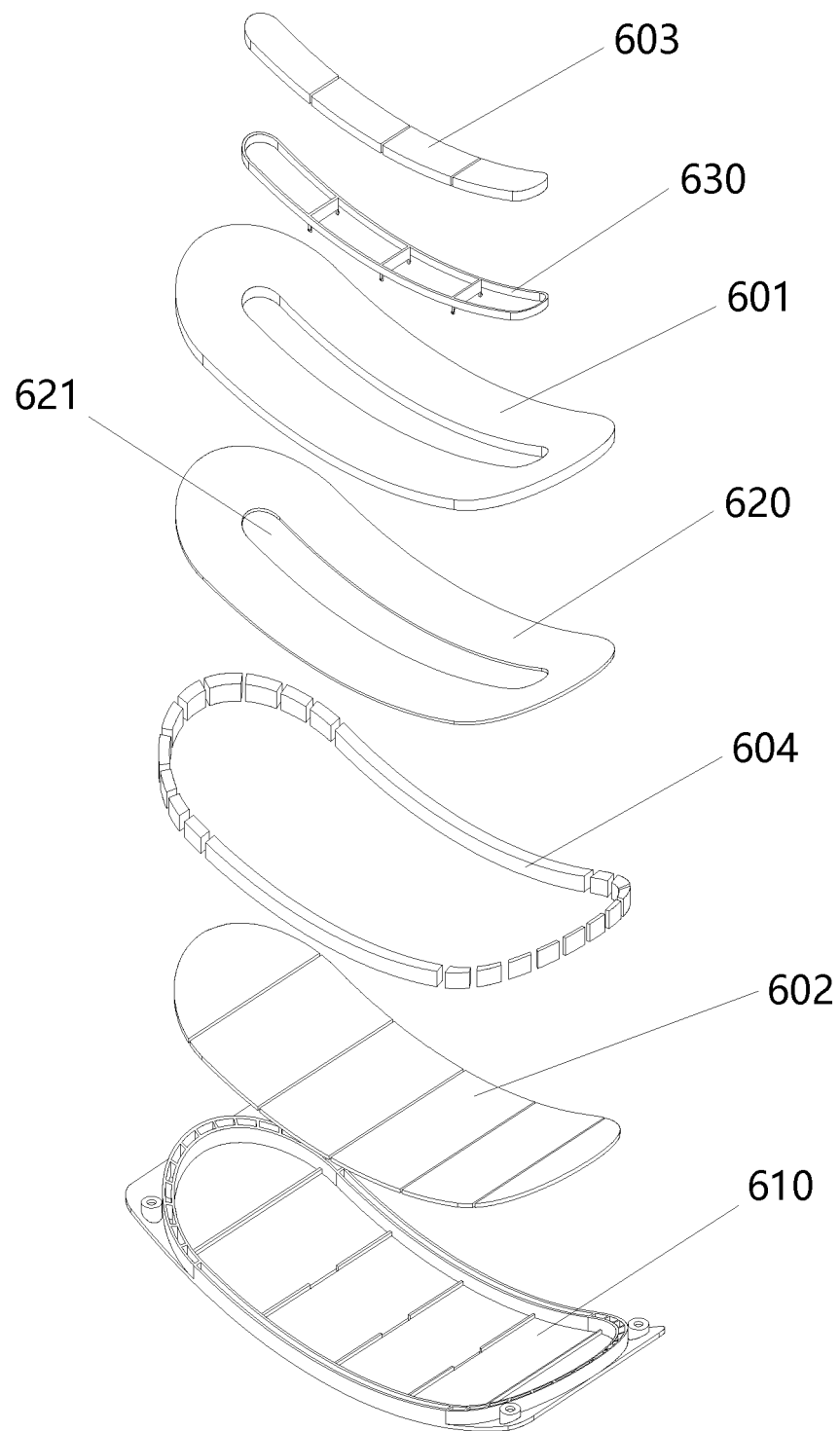


Fig. 12

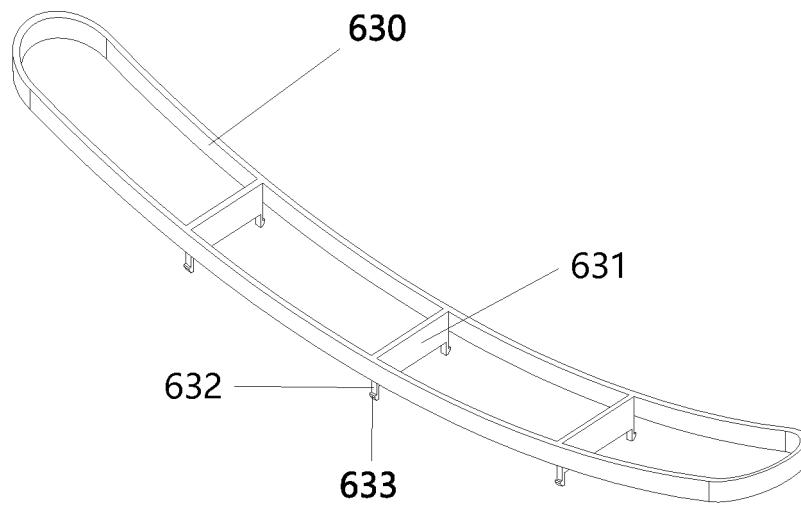


Fig. 13

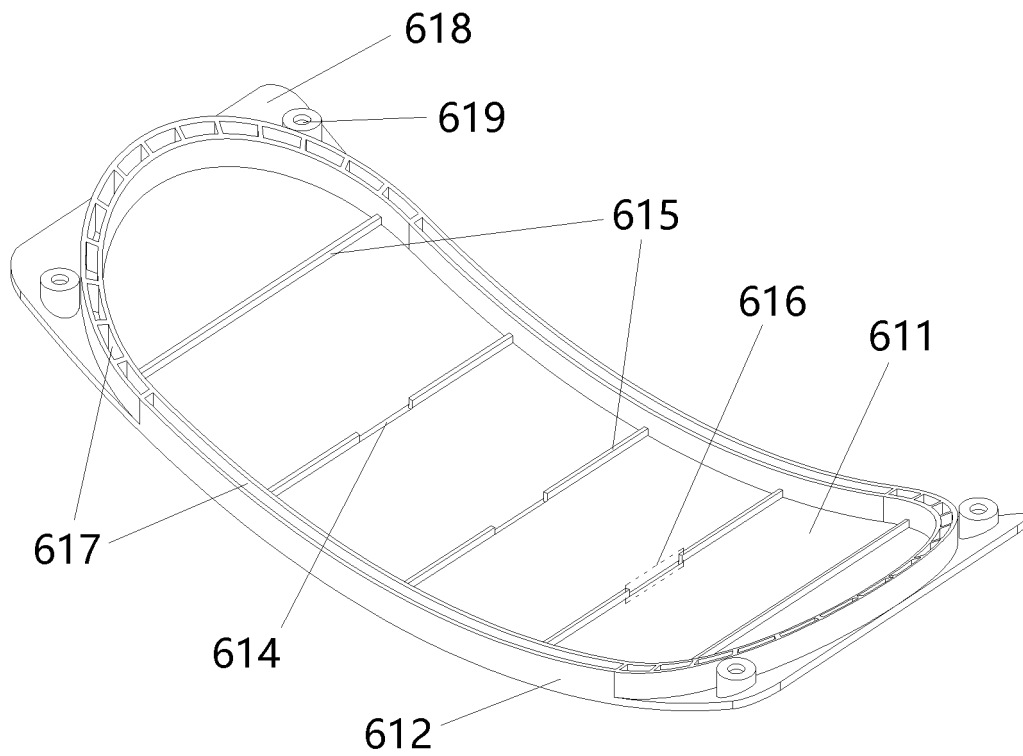


Fig. 14

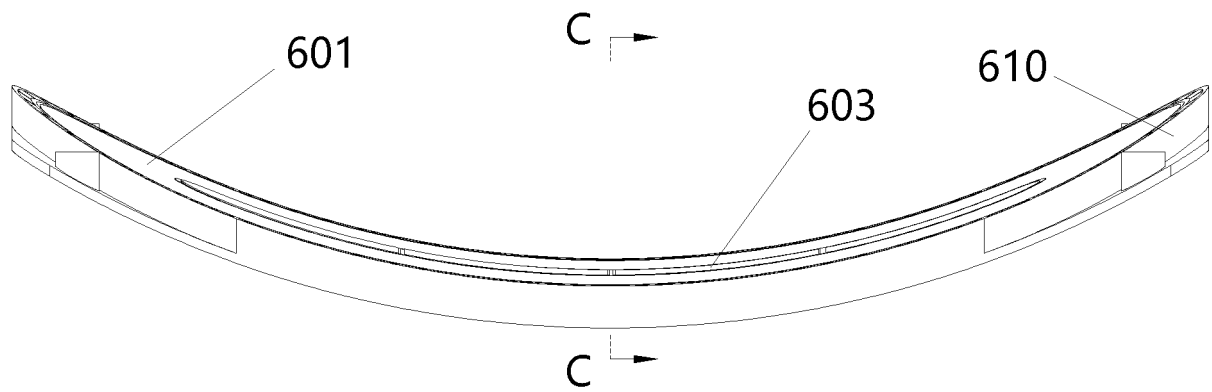


Fig. 15

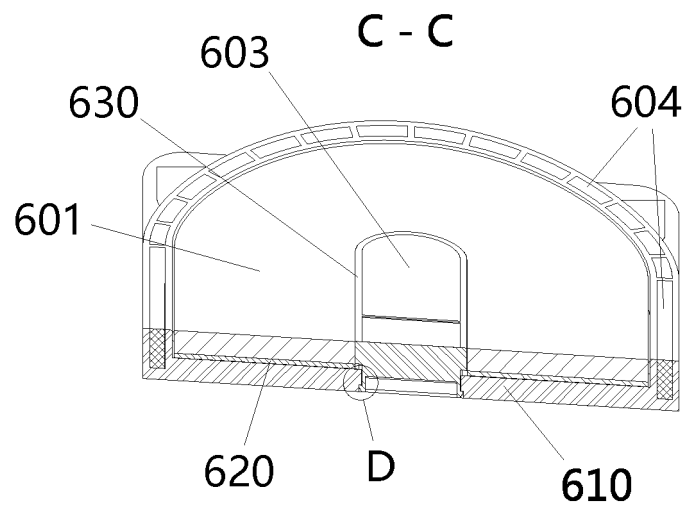


Fig. 16

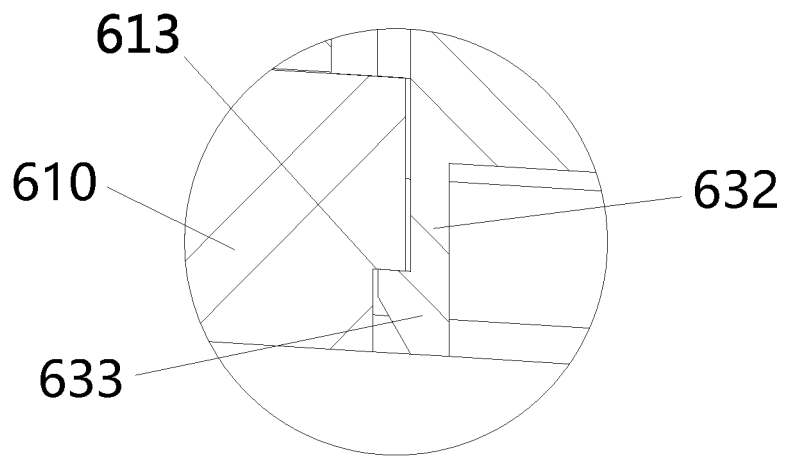


Fig. 17

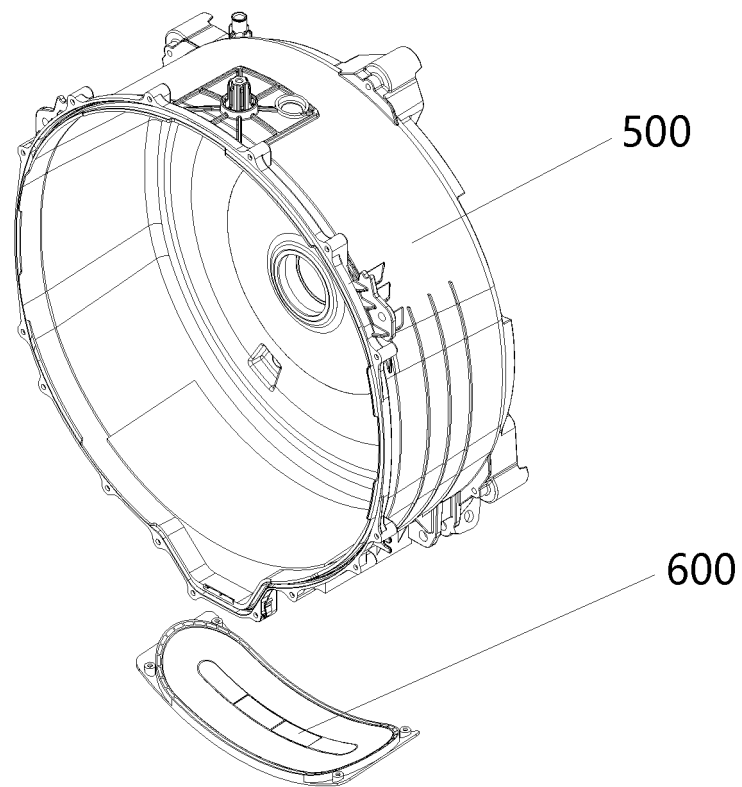


Fig. 18

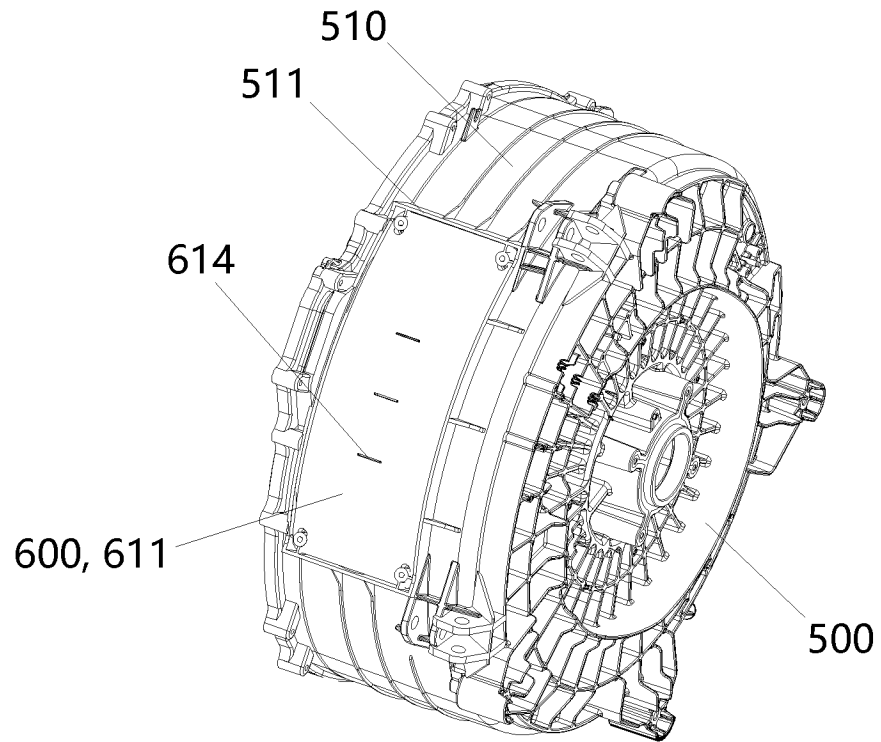


Fig. 19

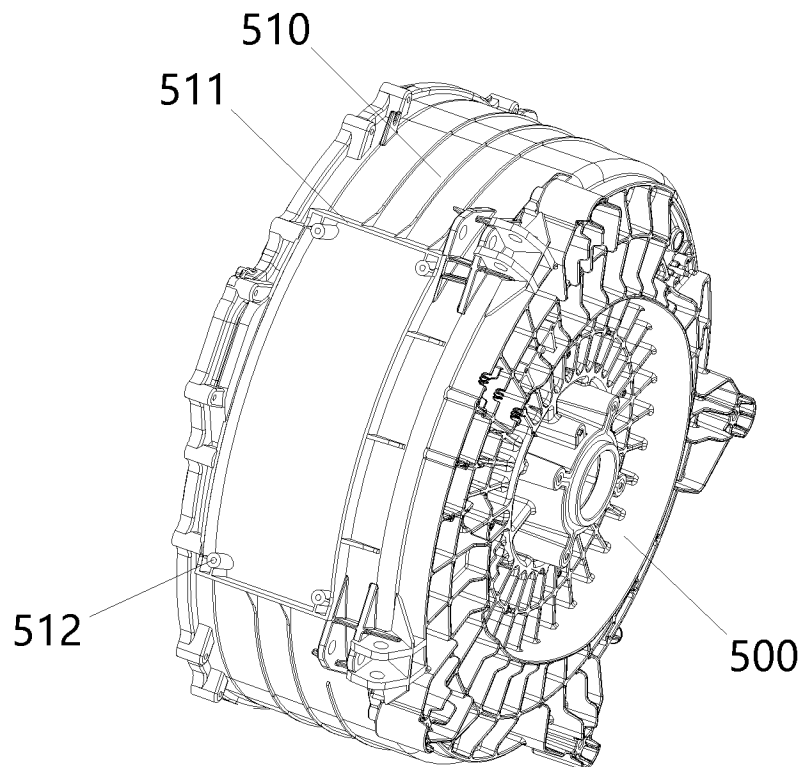


Fig. 20

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/080077

A. CLASSIFICATION OF SUBJECT MATTER D06F 39/04(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; H05B 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) VEN; WPABS; CNTXT; CNKI; 加热, 烘干, 电磁, 线圈, 磁体, 散热, 挡水, 防水, heat???, dry???, electromagnet???, magnet???, coil, dissipat???, reject???, keep w out																								
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>X</td> <td>US 2021017695 A1 (LG ELECTRONICS INC.) 21 January 2021 (2021-01-21) description, specific embodiments, and figures 1-10</td> <td>1-20</td> </tr> <tr> <td>Y</td> <td>US 2021017695 A1 (LG ELECTRONICS INC.) 21 January 2021 (2021-01-21) ditto</td> <td>21-30</td> </tr> <tr> <td>X</td> <td>KR 20210024886 A (LG ELECTRONICS INC.) 08 March 2021 (2021-03-08) description, specific embodiments, and figures 1-6</td> <td>1-20</td> </tr> <tr> <td>Y</td> <td>KR 20210024886 A (LG ELECTRONICS INC.) 08 March 2021 (2021-03-08) ditto</td> <td>21-30</td> </tr> <tr> <td>X</td> <td>CN 107780163 A (LG ELECTRONICS INC.) 09 March 2018 (2018-03-09) description, specific embodiments, and figures 1-8</td> <td>1-20</td> </tr> <tr> <td>Y</td> <td>CN 107780163 A (LG ELECTRONICS INC.) 09 March 2018 (2018-03-09) ditto</td> <td>21-30</td> </tr> <tr> <td>X</td> <td>KR 20200017233 A (HANON SYSTEMS) 18 February 2020 (2020-02-18) description, specific embodiments, and figures 1-8</td> <td>1-9</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 2021017695 A1 (LG ELECTRONICS INC.) 21 January 2021 (2021-01-21) description, specific embodiments, and figures 1-10	1-20	Y	US 2021017695 A1 (LG ELECTRONICS INC.) 21 January 2021 (2021-01-21) ditto	21-30	X	KR 20210024886 A (LG ELECTRONICS INC.) 08 March 2021 (2021-03-08) description, specific embodiments, and figures 1-6	1-20	Y	KR 20210024886 A (LG ELECTRONICS INC.) 08 March 2021 (2021-03-08) ditto	21-30	X	CN 107780163 A (LG ELECTRONICS INC.) 09 March 2018 (2018-03-09) description, specific embodiments, and figures 1-8	1-20	Y	CN 107780163 A (LG ELECTRONICS INC.) 09 March 2018 (2018-03-09) ditto	21-30	X	KR 20200017233 A (HANON SYSTEMS) 18 February 2020 (2020-02-18) description, specific embodiments, and figures 1-8	1-9
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Date of the actual completion of the international search 22 April 2022	Date of mailing of the international search report 12 May 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.

PCT/CN2022/080077

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 206564710 U (FOSHAN SHUNDE MIDEA ELECTRICAL HEATING APPLIANCES MANUFACTURING CO., LTD.) 17 October 2017 (2017-10-17) description, specific embodiments, and figures 1-7	1-9
Y	WO 2015114623 A1 (KUJMAN, T.) 06 August 2015 (2015-08-06) description, specific embodiments, and figure 1	21-30
Y	US 4621177 A (BELOIT CORP.) 04 November 1986 (1986-11-04) description, columns 3-4, and figures 1-4	21-30
A	CN 110191527 A (FOSHAN SUMYEETA ELECTRICAL APPLIANCE CO., LTD. et al.) 30 August 2019 (2019-08-30) entire document	1-30
A	EP 1914339 A1 (ELECTROLUX HOME PROD CORP.) 23 April 2008 (2008-04-23) entire document	1-30
A	CN 111041761 A (QINGDAO HAIER WASHING MACHINE CO., LTD. et al.) 21 April 2020 (2020-04-21) entire document	1-30
A	US 2020146498 A1 (LG ELECTRONICS INC.) 14 May 2020 (2020-05-14) entire document	1-30
A	KR 20180085319 A (LG ELECTRONICS INC.) 26 July 2018 (2018-07-26) entire document	1-30

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/080077

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
US 2021017695 A1	21 January 2021	WO 2021010544 A1	21 January 2021
		WO 2021010543 A1	21 January 2021
		KR 20200018242 A	19 February 2020
		EP 3767023 A1	20 January 2021
		US 2021017696 A1	21 January 2021
KR 20210024886 A	08 March 2021	None	
CN 107780163 A	09 March 2018	WO 2018038382 A1	01 March 2018
		EP 3536845 A1	11 September 2019
		US 2018057996 A1	01 March 2018
		EP 3287558 A1	28 February 2018
		KR 20180023276 A	07 March 2018
		TR 201905998 T4	21 May 2019
KR 20200017233 A	18 February 2020	None	
CN 206564710 U	17 October 2017	None	
WO 2015114623 A1	06 August 2015	IL 230752 D0	31 August 2014
US 4621177 A	04 November 1986	EP 0196264 A2	01 October 1986
		AT 69919 T	15 December 1991
		JP S61225792 A	07 October 1986
		CA 1255758 A	13 June 1989
		DE 3682602 D1	09 January 1992
CN 110191527 A	30 August 2019	None	
EP 1914339 A1	23 April 2008	PL 1914339 T3	31 August 2010
		RU 2007138843 A	27 April 2009
		DE 602006012845 D1	22 April 2010
		AT 460525 T	15 March 2010
		ES 2342726 T3	13 July 2010
CN 111041761 A	21 April 2020	None	
US 2020146498 A1	14 May 2020	EP 3627965 A1	25 March 2020
		WO 2018212600 A1	22 November 2018
		KR 20180126237 A	27 November 2018
KR 20180085319 A	26 July 2018	None	

Form PCT/ISA/210 (patent family annex) (January 2015)