



EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:

07.02.2024 Bulletin 2024/06

(51) International Patent Classification (IPC):

D06F 58/26 ^(2006.01)

(21) Application number: **22778443.6**

(52) Cooperative Patent Classification (CPC):

D06F 58/26

(22) Date of filing: **01.03.2022**

(86) International application number:

PCT/CN2022/078546

(87) International publication number:

WO 2022/206258 (06.10.2022 Gazette 2022/40)

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

• **HAIER SMART HOME CO., LTD.**

Laoshan District

Qingdao

Shandong 266101 (CN)

(72) Inventors:

• **ZHAO, Zhiqiang**

Qingdao, Shandong 266101 (CN)

• **XU, Sheng**

Qingdao, Shandong 266101 (CN)

(30) Priority: **02.04.2021 CN 202110361947**

02.04.2021 CN 202110361912

(74) Representative: **Beck & Rössig**

European Patent Attorneys

Denninger Str. 169

81925 München (DE)

(71) Applicants:

- **Qingdao Haier Drum Washing Machine Co., Ltd.**
Qingdao, Shandong 266101 (CN)

(54) **ELECTROMAGNETIC HEATING MODULE, MANUFACTURING PROCESS, AND CLOTHES TREATMENT DEVICE**

(57) An electromagnetic heating module, a manufacturing process and a clothing treatment device, the electromagnetic heating module (400) is used in the clothing treatment device, comprising a support (404) of a plate-like structure, an electromagnetic heating coil (401) is fixedly provided on the surface of one side of the support (404), and a magnet (402) is fixedly provided on the surface of the other side of the support (404); the electromagnetic heating coil (401) and magnet (402) are fixedly provided on the surface of the support (404) during the molding process of the support (404). The electromagnetic heating device is applied to the clothing treatment device, which can heat the water container made of metal, so as to realize the contactless heating of water; the electromagnetic heating coil (401) and the magnet (402) are respectively set on the surfaces on both sides of the support (404), which are in direct contact with the air, and have a good heat dissipation effect. At the same time, the electromagnetic heating coil (401) and the magnet (402) are directly fixed to the surface of the support (404) during the molding process of the support (404), eliminating the complex assembly process and making the manufacturing process simple.

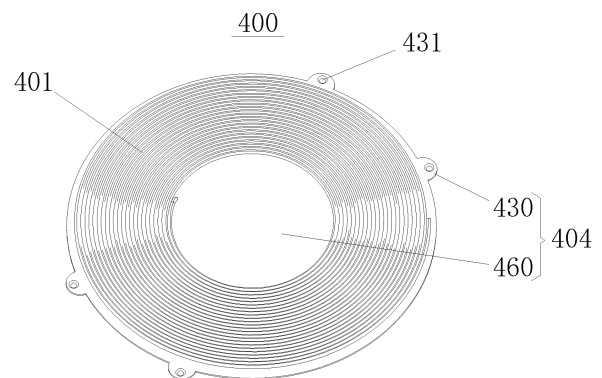


Fig. 1

Description

TECHNICAL FIELD

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

BACKGROUND

[0002] Most of the existing clothing treatment devices, such as a washing machine, having a heating function, realize the purpose of heating washing water by means of 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 seals to a certain extent, and is prone to sealing failure, leading to the situation in which the washing water penetrates 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 at the least, or cause installation hazards at worst.

[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 operating, 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, is not conducive to the promotion of application.

[0006] At the same time, the existing electromagnetic heating module is generally set up on the support with a fixed structure, such as a wire-winding slot, etc., and the electromagnetic heating coil and the magnet, which plays a role in shielding the magnetic field, need to be mounted on the support through the fixed structure during assembly. This results in a complex structure of the electromagnetic heating module and a cumbersome assembly process, while the electromagnetic heating coil and the magnet are later installed on the support, and the vibration generated during the working process of the clothing treatment device may cause the electromagnetic heating coil or the magnet to fall off from the support, which affects the use of the electromagnetic heating module.

[0007] Furthermore, when the electromagnetic heating module is used in a washing machine, there is a risk of contact with the washing water, which may lead to a short-circuit failure of the electromagnetic heating coil or even cause a safety hazard. Existing waterproofing methods mostly use a plastic shell to completely cover the electromagnetic heating coil, however, due to the need to place the electromagnetic heating coil inside the plastic shell, the plastic shell is set up as separated, and then after assembly, the joints are sealed. However, after long time use, the seals are prone to aging and lead to a decline in sealing performance or even failure, resulting in the loss of waterproof performance, which can easily lead to electromagnetic heating coil and water contact short circuit failure.

[0008] In view of this, the present disclosure is proposed.

SUMMARY

[0009] The technical problem to be solved by the present disclosure is to overcome the deficiencies of the prior art, and to provide an electromagnetic heating module, a manufacturing process, and a clothing small fox device.

[0010] In order to solve the above technical problems, a first object of the present disclosure is to provide an electromagnetic heating module, in which an electromagnetic heating coil and a magnet are respectively provided on the two side surfaces of a plate-like support, which has a good heat dissipation effect, and in which the electromagnetic heating coil and the magnet are directly fixed to the surface of the support through the molding process of the support, which simplifies the manufacturing process, and, specifically, the following technical solution is adopted:

An electromagnetic heating module being applicable to a clothing treatment device, comprising a support of plate-like structure, the support having an electromagnetic heating coil fixedly provided on a surface of one side and a magnet fixedly provided on a surface of the other side; the electromagnetic heating coil and magnet being fixed to the surface of the support during molding of the support.

[0011] Further, the support includes a supporting portion formed as a disc structure, the electromagnetic heating coil is helically wound on one side surface of the supporting portion to form a number of concentric circles co-centered with the supporting portion; the magnet is a bar magnet, set along the radial direction of the supporting portion and fixed on the other side surface of the supporting portion.

[0012] Preferably, a plurality of bar magnets are spaced apart on the circumference of the supporting portion.

[0013] Further, the electromagnetic heating coil is partially embedded in one side surface of the supporting portion; and/or, the magnet is partially embedded in the other side surface of the supporting portion.

[0014] Further, the support further comprises a fixing portion, the fixing portion being provided with a fixing hole.

[0015] Preferably, the fixing portion is provided on the periphery of the supporting portion.

[0016] The present disclosure also provides a manufacturing process for an electromagnetic heating module as described above, comprising:

placing the magnet, the sheet of material and the electromagnetic heating coil in the mold, so that the electromagnetic heating coil and the magnet are located on both sides of the sheet of material; the sheet of material being cured and molded to form a support so that the magnet and electromagnetic heating coil are fixed to the surface of the support; demolding and obtaining the electromagnetic heat-

ing module.

[0017] Further, the sheet of material is a rubber sheet, the rubber sheet being vulcanized and then cured to form the support.

[0018] Further, the sheet of material is a sheet prepreg, the sheet prepreg being heat treated and thermally cured to form the support.

[0019] Preferably, the sheet prepreg is carbon fiber prepreg with epoxy resin or glass fiber prepreg with epoxy resin.

[0020] Further, the sheet of material is a mass molding compound, the mass molding compound being thermally cured and molded in a mold after pressure and heat treatment to form the support.

[0021] Further, the sheet of material is a sheet molding compound, the sheet molding compound being thermally cured and molded in a mold after pressure and heat treatment to form the support.

[0022] A second object of the present disclosure is to provide an electromagnetic heating module that avoids the risk of the electromagnetic heating coil coming into contact with water by completely wrapping the electromagnetic heating coil with the encapsulation body, and has a reliable waterproof effect, and specifically, the following technical solution is adopted:

An electromagnetic heating module being applicable to a clothing treatment device comprising an encapsulation body, and an electromagnetic heating coil embedded inside the encapsulation body, the surface of the electromagnetic heating coil being completely encapsulated by the encapsulation body.

[0023] Further, the encapsulation body comprises an encapsulation portion of a disk structure, and the electromagnetic heating coil is embedded inside the encapsulation portion; the electromagnetic heating coil is helically wound to form a number of concentric circles co-centered with the encapsulation portion.

[0024] Preferably, the encapsulation body further comprises a fixing portion, the fixing portion being provided with a fixing hole.

[0025] More preferably, the fixing portion is provided projecting over the periphery of the encapsulating portion.

[0026] Further, the encapsulation body is also embedded with a magnet inside, the magnet being provided below the electromagnetic heating coil, the surface of the magnet being completely encapsulated by the encapsulation body.

[0027] Preferably, the encapsulation body has a certain thickness, and the electromagnetic heating coil and magnet are spaced apart in the thickness direction of the encapsulation body.

[0028] Further, the magnet is embedded inside the encapsulation portion of the encapsulation body, the magnet being a bar magnet, the bar magnet being disposed in a radial direction along the encapsulation portion.

[0029] Preferably, a plurality of bar magnets are

spaced apart on the circumference of the encapsulated portion.

[0030] Further, the encapsulated portion has an upper surface proximate to the electromagnetic heating coil, and a lower surface proximate to the magnet; a distance between the upper surface of the electromagnetic heating coil and the upper surface of the encapsulation portion is less than the spacing distance between the electromagnetic heating coil and the magnet, and the distance between the lower surface of the magnet and the lower surface of the encapsulation portion is less than the spacing distance between the electromagnetic heating coil and the magnet.

[0031] The present disclosure also provides a manufacturing process for an electromagnetic heating module as described above, comprising:

injecting the insulating material into the mold and placing the electromagnetic heating coil in the mold; the insulating material being cured and molded to form an encapsulated body encasing an electromagnetic heating coil; demolding and obtaining the electromagnetic heating module.

[0032] Preferably, a magnet is also placed in the mold and the encapsulation formed by the insulating material encases the electromagnetic heating coil and the magnet.

[0033] Preferably, the insulating material is cured and molded by heat treatment to form the encapsulating body.

[0034] More preferably, the insulating material is an epoxy resin.

[0035] Further, the following steps are included:

S101, injecting insulating material into the mold;
S102, placing the magnet into the mold so that the insulating material does not go beyond the upper surface of the magnet;
S103, placing the electromagnetic heating coil into the mold so that the insulating material does not go beyond the upper surface of the electromagnetic heating coil;
S104, a heat treatment being performed to cure and mold the insulating material to form an encapsulated body;
S105, demolding and obtaining the electromagnetic heating module.

[0036] Further, the following steps are included:

S201, injecting the insulating material into the mold for the first time so that the thickness of the insulating material is at least higher than the thickness of the magnet;
S202, placing the magnet into the mold so that the insulating material does not go beyond the upper

surface of the magnet;

S203, placing the electromagnetic heating coil into the mold;

S204, injecting the insulating material into the mold for a second time so that the insulating material at least does not go beyond the upper surface of the electromagnetic heating coil;

S205, a high temperature treatment being performed to cure and mold the insulating material to form an encapsulated body;

S206, demolding and obtaining the electromagnetic heating module;

[0037] Preferably, the step S200 is further comprised between step S202 and S203: a high-temperature treatment being carried out to cure and form the insulating material that has been injected into the mold.

[0038] Further, the following steps are included:

S301, injecting the insulating material into the mold for the first time so that the insulating material spreads at least the bottom surface of the mold;

S302, placing the magnet into the mold;

S303, injecting the insulating material into the mold for a second time so that the insulating material at least does not go beyond the upper surface of the magnet;

S304, placing the electromagnetic heating coil into the mold;

S305, injecting the insulating material into the mold for the third time so that the insulating material at least does not go beyond the upper surface of the electromagnetic heating coil;

S306, a heat treatment being performed to cure and mold the insulating material to form an encapsulated body;

S307, demolding and obtaining the electromagnetic heating module;

[0039] Preferably, between steps S301 and S302, and/or between steps S303 and S304 further comprises a step S300: a heating process being performed to cure and shape the insulating material that has been injected into the mold.

[0040] A third object of the present disclosure is to provide a clothing treatment device comprising an electromagnetic heating module as described in the first object or the second object above;

preferably, an outer drum and an inner drum are also included, the 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.

[0041] Preferably, the electromagnetic heating module is provided below the outer drum and connected to the drum wall of the outer drum.

[0042] More preferably, the electromagnetic heating module is provided in a region of the drum wall of the

outer drum near the bottom of the drum of the outer drum.

[0043] After adopting the above technical solution, the present disclosure has the following beneficial effects compared with the prior art.

[0044] In the present disclosure, the electromagnetic heating coil and the magnet are respectively provided on the surfaces on both sides of the support of the plate-like structure, and the surface of one side of the electromagnetic heating coil is directly exposed to the air, which has a good heat dissipation effect. The magnet on the other side can play the role of shielding the magnetic field and preventing the magnetic field from leaking, so that the magnetic field generated by the electromagnetic heating coil acts on the water container to be heated more efficiently and improves the heating efficiency. The electromagnetic heating coil and/or the magnet are partially embedded in the surface of the supporting portion, increasing the contact area between the electromagnetic heating coil and the magnet and the supporting portion, making the fixing of the electromagnetic heating coil and the magnet on the supporting portion more solid, and avoiding the electromagnetic heating coil or the magnet falling off from the supporting portion.

[0045] In the present disclosure, the support is formed by curing and molding the sheet of material, such as rubber sheet, pre-preg resin fiber sheet, dough or sheet molding plastic, etc. The electromagnetic heating coil and magnet are put into the mold together with the sheet of material, and in the curing process of the material surface of the sheet of material, the electromagnetic heating coil and the magnet can be adhered with the material surface of the material sheet as a single entity, which can be directly fixed on the surface of the formed stent after the sheet of material has been cured and molded, and the complex assembly process can be avoided, and the manufacturing process can be greatly simplified. Thus eliminates the need for a complex assembly process and greatly simplifies the manufacturing process.

[0046] In the present disclosure, the electromagnetic heating coil is completely encapsulated by the encapsulation body, which avoids the risk of the electromagnetic heating coil coming into contact with water with a reliable waterproof effect, thereby avoiding the situation in which the electromagnetic heating coil comes into contact with water and causes a short-circuit failure, which affects the work of the electromagnetic heating module. The electromagnetic heating coil is helically wound to form a number of concentric circles, which is conducive to generating a more uniformly distributed magnetic field, thereby producing a uniform heating effect on the heated water container in the clothing treatment device. The magnet inside the encapsulation body can play the role of shielding the magnetic field, preventing the magnetic field from leaking, so that the magnetic field generated by the electromagnetic heating coil acts on the heated water container more efficiently and improves the heating efficiency. The electromagnetic heating coil and the magnet are spaced apart, and the two are filled with the material form-

ing the encapsulation body, avoiding the influence caused by the contact between the magnet and the wire forming the electromagnetic heating coil. The electromagnetic heating coil and the magnet are respectively provided close to the surface of the encapsulation part, so that the electromagnetic heating coil and the magnet are as close as possible to the external space while being encapsulated by the encapsulation part, which is conducive to improving the heat dissipation efficiency of the electromagnetic heating module, in particular the internal electromagnetic heating coil.

[0047] In the present disclosure, an encapsulation body encasing the electromagnetic heating coil and the magnet is formed by curing and molding the insulating material, so that the electromagnetic heating module can be molded in one piece, and the manufacturing process is simple and does not require a complicated assembly process. The insulating material is heated several times, so that when the magnet or the electromagnetic heating coil is placed in the mold, the insulating material that has been injected into the mold has been cured to form a solid state, so that the magnet or the electromagnetic heating coil can be stably placed on the surface of the cured insulating material, to ensure that the embedded position of the magnet and the electromagnetic heating coil in the encapsulation body, and to avoid that the insulating material has not been cured before the magnet or the electromagnetic heating coil sinks in the insulating material and fails to remain in the desired position. The magnet or electromagnetic heating coil will not sink in the insulating material before the insulating material is fully cured, and will not be able to keep in the ideal embedding position.

[0048] The installation of the electromagnetic heating module in the clothing treatment device of the present disclosure realizes contactless heating of the water contained in the inner drum. The electromagnetic heating module is provided below the outer drum, which can focus on heating the bottom area of the inner drum, i.e. the part where the washing water is concentrated, and the heating efficiency is higher. On the other hand, the electromagnetic heating module does not come into direct contact with the water during the working period of the laundry treatment device, which further reduces the safety hazard brought about by the electromagnetic heating coil coming into contact with the water.

[0049] Specific embodiments of the disclosure are described in further detail below in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0050] The accompanying drawings are used as part of the present disclosure to provide a further understanding of the disclosure, and the schematic embodiments of the disclosure and their illustrations are used to explain the disclosure but do not constitute an undue limitation of the disclosure. Obviously, the accompanying drawings

in the following description are only some of the embodiments, and other accompanying drawings may be obtained on the basis of these drawings for a person of ordinary skill in the art without creative labor. In the accompanying drawings:

FIG. 1 is a schematic diagram of the structure of the electromagnetic heating module in embodiments 1 to 6 of the present disclosure;

FIG. 2 is a schematic diagram of the structure of another angle of the electromagnetic heating module in embodiments 1 to 6 of the present disclosure;

FIG. 3 is a top view of the electromagnetic heating module in embodiments 1 to 6 of the present disclosure;

FIG. 4 is a schematic view of the A-A cross-section of FIG. 3 of the present disclosure;

FIG. 5 is a schematic diagram of the structure of the clothing treatment device in embodiment 6 of the present disclosure;

FIG. 6 is a schematic diagram of the structure of the electromagnetic heating module in embodiments 7 to 11 of the present disclosure;

FIG. 7 is a top view of the electromagnetic heating module in embodiments 7 to 11 of the present disclosure;

FIG. 8 is a schematic view of the B-B section of FIG. 7 of the present disclosure;

FIG. 9 is a schematic diagram of the manufacturing process of the electromagnetic heating module in embodiments 8 to 10 of the present disclosure;

FIG. 10 is a schematic diagram of the structure of the clothing treatment device in embodiment 11 of the present disclosure.

[0051] 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, electromagnetic heating coil; 402, magnet; 403, encapsulation body; 404, support; 430, fixing portion; 431, fixing hole; 450, encapsulation portion; 460, supporting portion; 500, mold.

[0052] 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 disclosure as conceived, but rather to illustrate the concepts of the disclosure for those skilled in the art by reference to particular embodiments.

DETAILED DESCRIPTION

[0053] In order to make the objects, technical solutions and advantages of the embodiments of the present disclosure 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 disclosure. The fol-

lowing embodiments are used to illustrate the present disclosure but are not used to limit the scope of the present disclosure.

[0054] In the description of the present disclosure, 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 disclosure 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 disclosure.

[0055] In the description of the present disclosure, 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. For example, 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 disclosure may be understood in specific cases.

Embodiment 1

[0056] As shown in FIGS. 1 to 4, this embodiment provides an electromagnetic heating module 400 for use in a clothing treatment device, comprising a support 404 in a plate-like structure, with an electromagnetic heating coil 401 fixedly provided on a surface of one side of the support 404, and a magnet 402 fixedly provided on a surface of the other side of the support 404. The electromagnetic heating coil 401 and the magnet 402 are fixed to the surface of the support 404 during a molding process of the support 404.

[0057] In this embodiment, the electromagnetic heating coil 401 fixed to the upper side surface of the support 404 can generate a high-frequency alternating magnetic field when a high-frequency alternating current is energized, and when it is installed inside the clothing treatment device, it can stimulate an eddy current effect in the clothing treatment drum made of metal or the other water container through the generated high-frequency alternating magnetic field, so as to make the clothing treatment drum or the other water container heat up by itself, thus realizing the heating of the water in a non-contact condition. The support 404 is made of an insulating material that is not excited by the magnetic field, so it will not heat up under the action of the electromagnetic heating coil 401 and will not affect the magnetic field generated by the electromagnetic heating coil 401.

[0058] The magnet 402 fixed on the lower side surface of the support 404 has the function of shielding the mag-

netic field, which can block most of the downwardly radiating magnetic field, reducing the downwardly radiating portion of the magnetic field generated by the electromagnetic heating coil 401, 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. The electromagnetic heating coil 401 is separated from the magnet 402 by means of the support 404, and the two are not in contact with each other, so as to avoid any influence caused by the contact of the magnet 402 with the wire forming the electromagnetic heating coil 401.

[0059] At the same time, the electromagnetic heating coil 401 and the magnet 402 are respectively provided on the upper and lower side surfaces of the support 404 of the plate-like structure, and the upper side surface of the electromagnetic heating coil 401 is directly exposed to the air, thereby having a good heat dissipation effect. The support 404 is of plate-like structure, so that the electromagnetic heating module 400 as a whole has a smaller thickness and a larger heating area, has a high heating efficiency, occupies a small space, and is conducive to saving the internal space of the clothing treatment device.

[0060] On the other hand, the electromagnetic heating coil 401 and the magnet 402 are directly fixed to the surface of the support 404 in the process of molding the support 404 with, without the need to set up a complicated mounting structure for fixing the electromagnetic heating coil 401 and the magnet 402, or fixing the electromagnetic heating coil 401 and the magnet 402 by an additional process step, simplifying the manufacturing process flow.

[0061] In a further embodiment of the present embodiment, the support 404 includes a supporting portion 460 formed into a disk structure, and the electromagnetic heating coil 401 is helically wound on one side surface of the supporting portion 460 to form a plurality of concentric circles co-centered with the supporting portion 460. The magnet 402 is a bar magnet 402, which is provided along the radial direction of the supporting portion 460, and is fixed on the other side surface of the supporting portion 460.

[0062] Specifically, the electromagnetic heating coil 401 is formed by winding a copper conductor coated with an insulating layer on the surface, with two adjacent turns of the copper conductor coiled in contact with each other or left finely spaced apart, and the diameter of the circumference encircled by the outermost turn of the copper conductor is as close as possible to the peripheral diameter of the supporting portion 460.

[0063] Preferably, a plurality of bar magnets 402 are spaced apart in the circumferential direction of the supporting portion 460, the plurality of bar magnets 402 being evenly distributed in the circumferential direction.

[0064] In the above-described embodiment, the electromagnetic heating 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 in the circumferential direction of the supporting portion 460 can provide a uniform shielding effect below the electromagnetic heating coil 401, thereby making the magnetic field radiated to the clothing treatment drum more uniform.

[0065] In a further embodiment of this embodiment, the electromagnetic heating coil 401 is partially embedded in one side surface of the supporting portion 460; and/or, the magnet 402 is partially embedded in the other side surface of the supporting portion 460.

[0066] In the above-described embodiment, the electromagnetic heating coil 401 and/or the magnet 402 is partially embedded in the surface of the supporting portion 460, which can increase the contact area between the electromagnetic heating coil 401 and the magnet 402 and the supporting portion 460, thereby enabling the electromagnetic heating coil 401 and the magnet 402 to be more securely fixed to the supporting portion 460, and avoiding the electromagnetic heating coil 401 or the magnet 402 from the supporting portion 460 from dislodging of the electromagnetic heating coil 401 or magnet 402 from the supporting portion 460.

[0067] Specifically, in this embodiment, the support 404 is made of a sheet of material curing and molding, the electromagnetic heating coil 401 and the magnet 402 are placed in a certain position on both sides of the sheet of material before the sheet of material is cured and molded, and the material on the surface of the sheet of material has a certain degree of fluidity before curing, which can wrap around the lower surface of the electromagnetic heating coil 401 as well as the upper surface of the magnet 402, and also penetrate into gaps between two adjacent turns of copper wire in the electromagnetic heating coil 401. After curing and molding, the bottom surface of the electromagnetic heating coil 401 and the top surface of the magnet 402 are wrapped by the material forming the support 404, so as to be firmly fixed on the surface of the supporting portion 460 and not easily dislodged.

[0068] In this embodiment, the support 404 further includes a fixing portion 430, and the fixing portion 430 is provided with fixing holes 431. The electromagnetic heating module 400 may be installed in the interior of the clothing treatment device, such as on the wall of the outer drum of the washing machine, through the high frequency alternating current passed in to stimulate the vortex effect of the inner drum in the outer drum, so as to realize the purpose of heating the washing water.

[0069] Specifically, the fixing portion 430 is provided at the outer periphery of the supporting portion 460, so that the electromagnetic heating module 400 can be installed so that the electromagnetic heating module 400 can be as close as possible to the mounting surface, i.e., the wall of the drum of the outer drum, and thus be closer to the inner drum to be heated, having a higher heating efficiency.

[0070] In this embodiment, the electromagnetic heat-

ing coil 401 and the magnet 402 are fixed to form the electromagnetic heating module 400 by the support 404 of a plate-like structure, and the electromagnetic heating coil 401 and the magnet 402 are located on the two sides of the surface of the support 404, respectively. The upper surface of the electromagnetic heating coil 401 is directly exposed to the air, so as to achieve a higher heat dissipation efficiency and avoid overheating faults of the electromagnetic heating module 400 that affect the use. The electromagnetic heating module 400 is in the shape of a thin plate as a whole, which can save the space it occupies while providing a certain heating area, and avoid the setting of the electromagnetic heating module 400 from affecting the installation of other components in the clothing treatment device.

Embodiment 2

[0071] As shown in FIGS. 1 to 4, the present embodiment provides a manufacturing process for the electromagnetic heating module 400 described in embodiment 1 above, comprising:

the magnet 402, the sheet of material and the electromagnetic heating coil 401 being placed in the mold so that the electromagnetic heating coil 401 and the magnet 402 being located on each side of the sheet of material;

the sheet of material is cured and molded to form the support 404 so that the magnet 402 and the electromagnetic heating coil 401 are fixed to the surface of the support 404;

demolding to obtain the electromagnetic heating module 400.

[0072] In this embodiment, the support 404 formed by curing and molding may have imperfections such as flying edges, bumps, etc. In order to improve the overall aesthetics of the electromagnetic heating module 400, and at the same time to avoid that the imperfections cause an impact when installing the electromagnetic heating module 400 into the clothing treatment device at a later stage. For example, when the fixing holes 431 are blocked to affect the installation, the imperfections may be eliminated by sanding and corrections, so that the electromagnetic heating module 400 has a surface of the electromagnetic heating module 400 is smoother.

[0073] In the above-described embodiment, the electromagnetic heating coil 401 and the magnet 402 are placed into the mold together with the sheet of material forming the support 404, and the material on the surface of the sheet of material, i.e., the portion of the sheet that is in contact with the electromagnetic heating coil 401 and the magnet 402, is adhered to the electromagnetic heating coil 401 and the magnet 402 as an integrated body during the curing process, which further can fix the electromagnetic heating coil 401 and the magnet 402 on the the surface of the formed support 404. The electro-

magnetic heating module 400 is integrally formed in a mold and does not require a subsequent assembly process or subsequent processing to secure the electromagnetic heating coil 401 and magnet 402, simplifying the manufacturing process substantially.

[0074] Further, the material sheet is a rubber sheet, the rubber sheet being vulcanized and then cured and molded to form the support 404.

[0075] Specifically, this embodiment adopts a heat vulcanization method of curing and molding the rubber sheet to form the support 404, and the unvulcanized rubber sheet is cut into suitable shapes and sizes similar to the shapes and sizes of the support 404 to be obtained. Then the magnet 402, the rubber sheet, and the electromagnetic heating coil 401 are placed sequentially in the mold, so that the rubber sheet is located between the magnet 402 and the electromagnetic heating coil 401, the mold is closed, and the heating treatment is carried out, and the pressure treatment is carried out if necessary. After a certain period of time, the electromagnetic heating coil 401 and the magnet 402 are adhered and fixed to both sides of the rubber sheet, and the rubber sheet itself is cured and molded to form the support 404, and after demolding, the electromagnetic heating module 400 can be obtained in which the electromagnetic heating coil 401 and the magnet 402 are fixed to both sides of the surface of the support 404, respectively.

Embodiment 3

[0076] As shown in FIGS. 1 to 4, this embodiment differs from embodiment 2 above in that the sheet of material is a sheet prepreg, and the sheet prepreg is heat cured and molded after heat treatment to form the support 404.

[0077] Prepreg refers to the impregnation of continuous fibers or fabrics with a resin matrix to make a combination of resin matrix and reinforcement, generally used as an intermediate material in the manufacture of composite materials.

[0078] Specifically, in this embodiment, the resin matrix is selected from epoxy resin and the reinforcement is selected from carbon fiber or glass fiber. That is, the sheet prepreg is carbon fiber prepreg with epoxy resin or glass fiber prepreg with epoxy resin.

[0079] In detail, the manufacturing process of the present embodiment is described by using carbon fiber cloth as an example.

[0080] The carbon fiber cloth is cut according to the shape and size of the desired support 404 to obtain a plurality of pieces of carbon fiber cloth substantially matching the shape and size of the support 404 and pre-impregnated with epoxy resin; alternatively, the carbon fiber cloth is pre-impregnated with epoxy resin and then cut to obtain a plurality of pieces of carbon fiber cloth pre-impregnated with epoxy resin.

[0081] The magnet 402 is placed into a specific location in the mold, and then a plurality of carbon fiber cloths

pre-pregged with epoxy resin are stacked on top of each other and placed on top of the magnet 402 in the mold.

[0082] The electromagnetic heating coil 401 is placed over the plurality of carbon fiber cloths and the mold is closed.

[0083] The mold is heated and pressurized to cure and form the epoxy resin, connecting the plurality of carbon fiber cloths as well as the electromagnetic heating coil 401 and magnet 402 on the upper and lower sides as a single unit.

[0084] Remove the mold, sanding correction, and to get the electromagnetic heating module 400.

[0085] In this embodiment, the support 404 is made of a composite material of carbon fiber or glass fiber and epoxy resin, which has a high strength and a low density, which ensures that the electromagnetic heating module 400 has sufficient strength and is not easy to be damaged, and at the same time, the electromagnetic heating module 400 has a light mass, which does not cause a significant increase in weight of the clothing treatment device after the installation of the electromagnetic heating module 400.

Embodiment 4

[0086] As shown in FIGS. 1 to 4, this embodiment differs from the above embodiment 1 in that the sheet of material is bulk molding compounds (BMC), and the bulk molding compounds are thermally cured and molded in a mold after pressurization and heat treatment to form the support 404.

[0087] BMC is a thermo-fixed plastic with a blend of inert fillers, fiber reinforcements, catalysts, stabilizers and pigments. Generally, BMC is mainly composed of short-cut glass fibers, unsaturated resins, fillers, and various additives that are thoroughly mixed. The BMC used in this embodiment is a glass fiber reinforced unsaturated polyester thermosetting plastic.

[0088] In this embodiment, the BMC is pressed and molded to form the support 404. specifically, the mold comprises two individual parts, and the two parts are respectively provided with spaces for accommodating and limiting the electromagnetic heating coil 401 and the magnet 402, the magnet 402 and the electromagnetic heating coil 401 are placed into corresponding space respectively, and the BMC to be molded is placed on top of the magnet 402. the mold is closed so that the two parts of the mold snap together as one, and the BMC fills the molding cavity inside the mold to form the shape of the support 404. Pressurize and heat the mold as a whole and keep it under a certain pressure and temperature for a certain period of time, the BMC is cured and formed into the support 404, and at the same time, the electromagnetic heating coil 401 and the magnet 402 are fixed on its surface. The mold is demolded, polished and corrected, and the electromagnetic heating module 400 is obtained.

Embodiment 5

[0089] As shown in FIGS. 1 to 4, this embodiment differs from embodiment 4 above in that the sheet of material is a sheet molding compounds (SMC), and the sheet molding compounds are thermally cured and molded in a mold after pressurization and heat treatment to form the support 404.

[0090] SMC is a type of sheet molding compound made of resin paste impregnated with fiber or short-cut fiber mat and covered with polyethylene film on both sides. When used, it will be cut according to a certain shape and size, and then remove the two sides of the polyethylene film, stacked in the mold for heating and pressure molding, after the mold can be obtained after the desired shape of the product.

[0091] In this embodiment, the magnet 402 is first placed into a specific position in the mold, and then one or more pieces of SMC cut according to the thickness requirements of the support 404 are placed into the mold above the magnet 402, and then finally the electromagnetic heating coil 401 is placed on the surface of the SMC. After the mold is closed, after pressurization and heating, the SMC is thermally cured and formed in the mold, and the electromagnetic heating coil 401 and the magnet 402 are adhered to the surface. The electromagnetic heating coil 401 and magnet 402 are fixed on the surface. After the mold is removed from the mold and polished, the electromagnetic heating module 400 is obtained.

[0092] Since the support 404 itself is a plate-like structure, a plurality of pieces of SMC of the same shape and size can be cut and stacked into the molding cavity of the mold, so that the final resultant support 404 highly matches the expected structure. The use of SMC as the sheet of material for forming the support 404 in this embodiment is simple.

Embodiment 6

[0093] As shown in FIG. 5, the present embodiment provides a clothing treatment device including the electromagnetic heating module 400 described in the above embodiment 1.

[0094] Specifically, the present embodiment is illustrated with a washing machine as an example. The washing machine comprises an outer drum 200 and an inner drum, the inner drum being provided within the outer drum 200, and the drum wall of the inner drum being made of a metallic material that can generate eddy currents in an alternating magnetic field.

[0095] Preferably, the inner drum of the washing machine 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 of the inner drum, and is in a sealed state during the washing process, so that the washing water can be held independently. A drainage hole is provided on the drum 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 drum wall of the outer drum 200 that is connected to the drainage structure, and the water discharged from the inner drum enters the outer drum 200, and is then discharged from the washing machine through the drain port 211 and the drainage structure.

[0096] The drum wall of the inner drum is made of a metal material, and the outer drum 200 is made of a plastic material that does not excite eddy current effects in a magnetic field. The outer drum 200 is externally mounted with an electromagnetic heating module 400. As shown in FIGS. 1 and 5, after the washing machine starts the heating program, the input voltage, such as 220V household alternating current, is transformed into direct current by a bridge rectifier, and then transformed into high frequency alternating current by an IGBT power tube, and is input into the electromagnetic heating coil 401 in the electromagnetic heating module 400, and the electromagnetic heating coil 401 can generate a high frequency alternating magnetic field. The electromagnetic induction line of the the 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 currents under the action of electromagnetic induction, and the eddy currents overcome the internal resistance of the inner drum to complete the conversion of electric energy to thermal energy, realizing that the inner drum generates heat, so as to heat up the washing water therein.

[0097] 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.

[0098] In a preferred embodiment of the present embodiment, the electromagnetic heating module 400 is provided underneath the outer drum 200 and connected to the drum wall of the outer drum 200. An elevation view of the washing machine of the present embodiment is shown in FIG. 5, wherein the bottom region of the housing 100 is removed to show the internal structure of the washing machine. 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 an 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 a drum wall of the outer drum 200 by screws passing through the fixing holes 431.

[0099] Since the washing water is located in the inner drum in the bottom region of the inner drum, i.e., 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 and 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.

[0100] In a further preferred embodiment of the present embodiment, the electromagnetic heating module 400 is provided in a region on the drum wall of the outer drum 200 near the bottom of the drum of the outer drum 200.

[0101] In this embodiment, the drum wall of the outer drum 200 includes a front part of the outer drum 210 near the drum opening, and a rear part of the outer drum 220 connected to the bottom of the outer drum. The drain port 211 is provided in the front part of the outer drum 210, and the electromagnetic heating module 400 is installed in the rear part of the outer drum 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 two do not interfere with each other.

[0102] As shown in FIGS. 1 to 5, in this embodiment, the electromagnetic heating module 400 is installed with the side which the electromagnetic heating coil 401 is installed toward the drum wall of the outer drum 200. When the electromagnetic heating module 400 is in operation, the electromagnetic heating 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 below the electromagnetic heating coil 401 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 electromagnetic heating coil 401 acts on the inner drum more efficiently, and improves the heating efficiency.

[0103] The electromagnetic heating coil 401 and the magnet 402 are fixed to the upper and lower surfaces of the support 404, respectively, and the upper side surface of the electromagnetic heating coil 401 is directly exposed to the air so as to have a good heat dissipation effect, and overheating faults can be avoided, which affects the work of the electromagnetic heating module 400. The electromagnetic heating coil 401 is formed by winding copper wires covered with an insulating layer on the surface, and the electromagnetic heating module 400 is installed on the outside of the outer drum 200, which generally does not contact the washing water, and even if there is water seepage in the outer drum 200, the

amount of water seeped out is relatively small, and the protection of the insulating layer is sufficient to avoid the washing water from causing a short-circuit failure.

[0104] The washing machine 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 washing machine in which there is no 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 washing machine does not come into contact with the washing water during operation, and the electromagnetic heating coil 401 can be directly provided on the surface of the support 404 toward the outer drum 200, i.e., the upper surface of the electromagnetic heating coil 401 can be exposed to the air without having to worry about a short circuit of the electromagnetic heating coil 401 caused by the washing water, so that the electromagnetic heating coil 401 has good heat dissipation effect, which can effectively avoid the occurrence of overheating failure.

Embodiment 7

[0105] As shown in FIGS. 6 to 8, this embodiment provides an electromagnetic heating module 400 for use in a clothing treatment device, comprising an encapsulation body 403, and an electromagnetic heating coil 401 embedded inside the encapsulation body 403, with a surface of the electromagnetic heating coil 401 being completely encapsulated by the encapsulation body 403.

[0106] In this embodiment, the electromagnetic heating coil 401 can generate a high-frequency alternating magnetic field when a high-frequency alternating current is energized, and by installing the aforesaid electromagnetic heating module 400 in the interior of the clothing treatment device, the generated high-frequency alternating magnetic field can be used to stimulate an eddy current effect in the clothing treatment drum or other water-containing containers made of metal to cause the clothing treatment drum or other water-containing containers to heat up by themselves, so as to realize the heating of the water in a non-contact condition. The encapsulation body 403 is made of an insulating material that is not excited by the magnetic field, and will not heat up under the electromagnetic heating coil 401, nor will it affect the magnetic field generated by the electromagnetic heating coil 401, and it also completely encapsulates the electromagnetic heating coil 401, avoiding the risk of a short-circuit failure caused by the electromagnetic heating coil 401 coming into contact with water, and has a reliable sealing effect, realizing effective waterproofing.

[0107] In a further embodiment of the present embodiment, the encapsulation body 403 includes an encapsulation portion 450 of a disk structure, and the electromagnetic heating coil 401 is embedded inside the encapsulation portion 450. The electromagnetic heating coil 401 is helically wound to form a number of concentric circles

co-centered with the encapsulation portion 450.

[0108] Specifically, the electromagnetic heating coil 401 is formed by winding a copper conductor covered with an insulating layer on the surface, with two adjacent turns of the copper conductor coiled in contact with each other or with a fine spacing between them, and the diameter of the circumference around which the outermost turn of the copper conductor is surrounded is as close as possible to the peripheral diameter of the encapsulation portion 450.

[0109] In the above embodiment, spiral winding to form a plurality of concentric circles of electromagnetic heating coils 401 is conducive to generating a uniform magnetic field, so that uniform heating of the clothing treatment drum can be realized.

[0110] In a preferred embodiment of the present embodiment, the encapsulation body 403 further includes a fixing portion 430, and the fixing portion 430 is provided with fixing holes 431. The electromagnetic heating module 400 may be installed inside the clothing treatment device, such as on a drum wall of an outer drum of a washing machine, via the fixing holes 431 on the fixing portion 430, so as to realize heating of the washing water by passing in a high-frequency alternating current to stimulate an eddy current effect in the inner drum.

[0111] Specifically, the fixing portion 430 is provided protruding from the outer periphery of the encapsulation portion 450. By setting the fixing portion 430 on the outer periphery of the encapsulation portion 450, the electromagnetic heating module 400 can be installed as close as possible to the wall of the drum of the outer drum, thereby being closer to the inner drum to be heated, and thus realizing a higher heating efficiency.

[0112] In a further embodiment of the present embodiment, the encapsulation body 403 is further embedded with a magnet 402 inside the encapsulation body 403, the magnet 402 is provided below the electromagnetic heating coil 401, and the surface of the magnet 402 is completely encapsulated by the encapsulation body 403.

[0113] Preferably, the encapsulation body 403 has a certain thickness, and the electromagnetic heating coil 401 and the magnet 402 are spaced apart in the thickness direction of the encapsulation body 403.

[0114] In the above-described scheme, the magnet 402 below the electromagnetic heating coil 401 has the function of shielding the magnetic field, which can block most of the downwardly radiating magnetic field, reducing the downwardly radiating portion of the magnetic field generated by the electromagnetic heating coil 401, 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.

[0115] The electromagnetic heating coil 401 and the magnet 402 are spaced apart inside the encapsulation body 403, and the two are filled with an insulating material forming the encapsulation body 403, avoiding the effect

of the magnet 402 coming into contact with the wires forming the electromagnetic heating coil 401.

[0116] In this embodiment, the magnet 402 is embedded inside the encapsulation portion 450 of the encapsulation body 403, the magnet 402 is a bar magnet 402, and the bar magnet 402 is disposed along the radial direction of the encapsulation portion 450.

[0117] Preferably, a plurality of bar magnets 402 are spaced apart in a circumferential direction of the encapsulation portion 450, the plurality of bar magnets 402 being uniformly distributed in the circumferential direction.

[0118] In the above embodiment, a plurality of bar magnets 402 extending in the radial direction are spaced apart circumferentially in the encapsulation portion 450, which can provide a uniform shielding effect under the electromagnetic heating coil 401, so as to make the magnetic field radiated to the clothing treatment drum more uniform.

[0119] In a further embodiment of the present embodiment, the encapsulation portion 450 has an upper surface close to the electromagnetic heating coil 401, and a lower surface close to the magnet 402.

[0120] The distance between the upper surface of the electromagnetic heating coil 401 and the upper surface of the encapsulation portion 450 is less than the spacing distance between the electromagnetic heating coil 401 and the magnet 402, and the distance between the lower surface of the magnet 402 and the lower surface of the encapsulation portion 450 is less than the spacing distance between the electromagnetic heating coil 401 and the magnet 402.

[0121] In the above-described scheme, the electromagnetic heating coil 401 and the magnet 402 are provided near the upper and lower surfaces of the encapsulation portion 450, respectively, so that the electromagnetic heating coil 401 and the magnet 402 can be as close as possible to the external space when they are encapsulated by the encapsulation portion 450, that is to say, the thickness of the insulating material covering the upper surface of the electromagnetic heating coil 401, and the thickness of the insulating material covering the lower surface of the magnet 402, is thin, which is conducive to improving the heat dissipation efficiency of the electromagnetic heating module 400, especially the heat dissipation efficiency of the internal electromagnetic heating coil 401.

[0122] In this embodiment, the electromagnetic heating coil 401 in the electromagnetic heating module 400 is completely encapsulated by the encapsulation body 403, and there is no gap on the surface, so that the risk of the electromagnetic heating coil 401 coming into contact with water can be avoided without any sealing treatment, and there will not be a sealing failure due to aging of sealing parts in the prior art, so that it has reliable sealing performance, and can realize effective waterproofing. By designing the position of the electromagnetic heating coil 401 and the magnet 402 inside the encapsulation body 403, the electromagnetic heating coil 401

can be as close as possible to the surface of the electromagnetic heating module 400 when it is completely encapsulated, ensuring the heat dissipation efficiency of the electromagnetic heating coil 401 and avoiding overheating failure.

Embodiment 8

[0123] As shown in FIGS. 6 to 9, this embodiment provides a manufacturing process for the electromagnetic heating module 400 described in embodiment 7 above, comprising:

injecting insulating material and placing an electromagnetic heating coil into the mold 500;
the insulating material is cured and molded to form an encapsulation body 403 encasing the electromagnetic heating coil 401;
demolding to obtain the electromagnetic heating module 400.

[0124] For the electromagnetic heating module 400 that includes the magnet 402, the magnet 402 is also placed in the mold 500 during manufacturing, and the insulating material ultimately forms an encapsulation body 403 encasing the electromagnetic heating coil 401 and the magnet 402.

[0125] Specifically, the insulating material is a thermosetting resin, and the insulating material is heat-treated and thermally cured and molded to form the encapsulant body 403.

[0126] The insulating material is preferably an epoxy resin.

[0127] In the above-described scheme, the electromagnetic heating module 400 is integrally molded in the mold 500 to form a structure in which the encapsulation body 403 encapsulates the electromagnetic heating coil 401 and the magnet 402, which, compared to the prior art, eliminates the complex assembly process in which the electromagnetic heating coil 401 and the magnet 402 are mounted inside the electromagnetic heating module 400, and simplifies the manufacturing process to a large extent.

[0128] In this embodiment, imperfections such as flying edges and bumps may exist after the insulating material is cured and molded, and in order to improve the overall aesthetics of the electromagnetic heating module 400, as well as to avoid that the imperfections will cause an effect when the electromagnetic heating module 400 is installed into the clothing treatment device at a later stage, the imperfections may be eliminated by sanding and corrections to make the surface of the electromagnetic heating module 400 smoother.

[0129] In this embodiment, the manufacturing process of the electromagnetic heating module 400 specifically includes the following steps:

S101, injecting insulating material into the mold 500;

S 102, placing the magnet 402 into the mold 500 so that the insulating material does not go over the upper surface of the magnet 402;

S 103, placing the electromagnetic heating coil 401 into the mold 500 so that the insulating material is not over the upper surface of the electromagnetic heating coil 401;

S 104, a heating process being performed to cure and mold the insulating material to form the encapsulation body 403;

S 105, demolding and obtaining the electromagnetic heating module 400.

[0130] In the above-described embodiment, the magnet 402 and the electromagnetic heating coil 401 are placed sequentially after the insulating material is injected into the mold 500. The magnets 402 are placed along the radial direction of the molding cavity in the mold 500, and a plurality of the magnets are placed in a circumferential direction, and a certain distance is ensured between the magnets 402 and the bottom surface of the mold 500 when placing, so as to ensure that the magnets 402 are completely encapsulated after the insulating material is cured and molded. The electromagnetic heating coil 401 is placed above the magnet 402, so that the plane where the electromagnetic heating coil 401 is located is parallel to the bottom surface of the mold 500, and at the same time to ensure that the electromagnetic heating coil 401 is completely immersed in the insulating material and does not come into contact with the magnet 402 below, so as to ensure that the electromagnetic heating coil 401 and the magnet 402 are separated from the insulating material by a certain interval, and at the same time that the electromagnetic heating coil 401 is completely encapsulated by the cured and molded encapsulation body 403.

[0131] In this embodiment, the insulating material forming the encapsulation body 403 is injected into the mold 500 at one time, and the electromagnetic heating module 400 is obtained by curing and molding with one heating, which is a simple manufacturing process, a short process, and easy to implement.

Embodiment 9

[0132] As shown in FIGS. 6 to 9, this embodiment is distinguished from the above-described embodiment 8 in that the manufacturing process specifically comprises the following steps:

S201, injecting the insulating material into the mold 500 for the first time to a depth of the insulating material that is at least higher than the thickness of the magnet 402;

S202, placing the magnet 402 into the mold 500 so that the insulating material does not go over the upper surface of the magnet 402;

S203, placing the electromagnetic heating coil 401

into the mold 500;

S204, injecting the insulating material into the mold 500 for the second time so that the insulating material is at least not over the upper surface of the electromagnetic heating coil 401;

S205, a heating process being performed to cure and mold the insulating material to form the encapsulation body 403;

S206, demolding and obtaining the electromagnetic heating module 400.

[0133] In the above-described scheme, the insulating material is injected into the mold 500 in two times, and the magnet 402 is first placed after the first injection of the insulating material so that the magnet 402 is completely immersed in the insulating material. Then the electromagnetic heating coil 401 is placed, at which time the electromagnetic heating coil 401 can be placed directly on the surface of the insulating material without being submerged below the liquid level of the insulating material, and then the electromagnetic heating coil 401 is completely covered by the second injection of the insulating material.

[0134] The spacing distance between the electromagnetic heating coil 401 and the magnet 402 is effectively ensured in the above manner, which avoids the problem of using the manufacturing process of the above embodiment 8 in which the position of the magnet 402 is not accurately grasped when the electromagnetic heating coil 401 is put in, which leads to the two being too close or even coming into contact in the molded electromagnetic heating module 400.

[0135] In a preferred embodiment of the present embodiment, the step S200 is further comprised between the steps S202 and S203: a heating process being carried out to cure and mold the insulating material that has been injected into the mold 500.

[0136] In the above-described scheme, the insulating material in the mold 500 is heated before the electromagnetic heating coil 401 is put into the mold 500, so that it is cured and molded, and then when the electromagnetic heating coil 401 is put into the electromagnetic heating coil 401, the electromagnetic heating coil 401 can be stably placed on the surface of the cured insulating material, and there will not be a situation in which the electromagnetic heating coil 401 sinks in the liquid insulating material, so that the final molded electromagnetic heating module 400 with the electromagnetic heating coil 401 positioned lower than the expected position.

[0137] In this embodiment, the insulating material is injected into the mold 500 in two times, which is more conducive to placing the electromagnetic heating coil 401 at a suitable height position within the mold 500. The insulating material in the mold 500 is heated first between placing the electromagnetic heating coil 401, so that it is cured and shaped, and the electromagnetic heating coil 401 will not appear to sink in the insulating material after being placed in the mold 500, and the position control of

the electromagnetic heating coil 401 can be more accurate.

Embodiment 10

[0138] As shown in Figures 6 to 9, this embodiment is distinguished from the above-described embodiment 8 in that the manufacturing process specifically comprises the following steps:

S301, injecting the insulating material into the mold 500 for the first time so that the insulating material spreads at least over the bottom surface of the mold 500;

S302, placing the magnet 402 into the mold 500;

S303, injecting the insulating material into the mold 500 for the second time so that the insulating material is at least not beyond the upper surface of the magnet 402;

S304: placing the electromagnetic heating coil 401 into the mold 500;

S305, injecting the insulating material into the mold 500 for the third time so that the insulating material is at least not beyond the upper surface of the electromagnetic heating coil 401;

S306, a heating process being performed to cure and mold the insulating material to form the encapsulation body 403;

S307, demolding to obtain the electromagnetic heating module 400.

[0139] In the above-described embodiment, the insulating material is injected into the mold 500 in three times, and the three injections of the insulating material do not pass over the bottom surface of the mold 500, the upper surface of the magnet 402, and the upper surface of the electromagnetic heating coil 401, respectively. Both the magnet 402 and the electromagnetic heating coil 401, when placed in the mold 500, can be placed directly on the surface of the insulating material already present in the current mold 500 without being pressed down to immerse them in the insulating material.

[0140] The placement of both the magnet 402 and the electromagnetic heating coil 401 can be more accurately controlled in the above manner, avoiding a situation where the magnet 402 is too close to the bottom surface of the mold 500, resulting in incomplete encapsulation, or where the electromagnetic heating coil 401 is too close to or even in contact with the magnet 402.

[0141] In a preferred embodiment of the present embodiment, between steps S301 and S302, and/or between steps S303 and S304 further comprises a step S300: a heating treatment is performed to cure and shape the insulating material that has been injected into the mold 500.

[0142] Optimally, step S300 is performed between steps S301 and S302, and between steps S303 and S304.

[0143] In the above-described scheme, the insulating material in the mold 500 is heated before the magnet 402 and the electromagnetic heating coil 401 are put into the mold 500, so as to make the insulating material cured and molded before the magnet 402 or the electromagnetic heating coil 401 is put into the mold 500. In this way, the magnet 402 and the electromagnetic heating coil 401 can be stably placed on the surface of the cured insulating material, and it will not occur that the magnet 402 or the electromagnetic heating coil 401 sinking in the liquid insulating material, so that the height position of both in the final molded electromagnetic heating module 400 does not match the expected height position.

[0144] In this embodiment, the insulating material is injected into the mold 500 for three times, which is more conducive to placing the magnet 402 and the electromagnetic heating coil 401 at a suitable height position within the mold 500. The insulating material in the mold 500 is first heated between placing the magnet 402 or the electromagnetic heating coil 401, so that it is cured and shaped, and the magnet 402 and the electromagnetic heating coil 401 will not sink in the insulating material after being placed in the mold 500, so that the position of the magnet 402 and the electromagnetic heating coil 401 can be more accurately controlled.

Embodiment 11

[0145] As shown in FIG. 10, the present embodiment provides a clothing treatment device including the electromagnetic heating module 400 described in embodiment 6 above.

[0146] Specifically, the present embodiment is illustrated with a washing machine as an example. The washing machine comprises an outer drum 200 and an inner drum, the inner drum being provided within the outer drum 200, and the drum wall of the inner drum being made of a metallic material that can generate eddy currents in an alternating magnetic field.

[0147] Preferably, the inner drum of the washing machine 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 of the inner drum, and is in a sealed state during the washing process, so that the washing water can be held independently. A drainage hole is provided on the drum 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 drum wall of the outer drum 200 that is connected to the drainage structure, and the water discharged from the inner drum enters the outer drum 200, and is then discharged from the washing machine through the drain port 211 and the drainage structure.

[0148] The drum wall of the inner drum is made of met-

al, and the outer drum 200 is made of a plastic material that does not excite eddy current effects in a magnetic field. The outer drum 200 is externally mounted with an electromagnetic heating module 400. As shown in FIGS. 6 to 8 and FIG. 10, after the washing machine starts the heating program, the input voltage, such as 220V 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, and is inputted into the electromagnetic heating coil 401 in the electromagnetic heating module 400, and the electromagnetic heating coil 401 can generate a high frequency alternating magnetic field. The electromagnetic induction line of the the 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 currents under the action of electromagnetic induction, and the eddy currents overcome the internal resistance of the inner drum when flowing to complete the conversion of electric energy to heat energy, realizing that the inner drum generates heat, so as to heat up the washing water therein.

[0149] 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.

[0150] In a preferred embodiment of the present embodiment, the electromagnetic heating module 400 is provided underneath the outer drum 200 and connected to the drum wall of the outer drum 200. An elevation view of the washing machine of the present embodiment is shown in FIG. 10, wherein the bottom region of the housing 100 is removed to show the internal structure of the washing machine. 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 an outer periphery of the electromagnetic heating module 400, fixing holes 431 are provided in the fixing portion 430, and the electromagnetic heating module 400 is mounted on a drum wall of the outer drum 200 by screws passing through the fixing holes 431.

[0151] Since the washing water is located in the inner drum in the bottom region of the inner drum, i.e., 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 and 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.

[0152] In a further preferred embodiment of the present embodiment, the electromagnetic heating module 400 is provided in a region on the drum wall of the outer drum 200 near the bottom of of the outer drum 200.

[0153] 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 outer drum. The drain port 211 is provided in the front part of the outer drum 210, and the electromagnetic heating module 400 is installed in the rear part of the outer drum 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 do not interfere with each other.

[0154] As shown in FIGS. 6 to 8 and FIG. 10, in this embodiment, the electromagnetic heating module 400 is installed with the side which the electromagnetic heating coil 401 is installed toward the drum wall of the outer drum 200. When the electromagnetic heating module 400 is in operation, the electromagnetic heating 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 below the electromagnetic heating coil 401 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 electromagnetic heating coil 401 acts on the inner drum more efficiently, and improves the heating efficiency.

[0155] The electromagnetic heating coil 401 and the magnet 402 are embedded in the interior of the encapsulation body 403, so that both the electromagnetic heating coil 401 and the magnet 402 are completely encapsulated by the encapsulation body 403, and there is no gap on the surface. There is no part of the electromagnetic heating coil 401 that is exposed to the outside of the electromagnetic heating module 400, so that even if water seepage from the outer drum 200 drips onto the surface of the electromagnetic heating module 400, it will not come into contact with the electromagnetic heating coil 401 that is encapsulated in the inside of the encapsulation body 403, which avoids a situation in which the electromagnetic heating coil 401 contacts the washing water to cause a short-circuit failure, and has a reliable waterproof effect.

[0156] The washing machine 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 washing machine in which there is no water between the inner drum and the outer drum 200. The elec-

tromagnetic heating module 400 is provided below the outer drum 200, so that the washing machine does not come into contact with the washing water during operation, and the electromagnetic heating coil 401 is completely encapsulated by the encapsulation body 403, which completely avoids the safety hazard brought about by the electromagnetic heating coil 401 coming into contact with the washing water, and at the same time, it is possible to heat the portion of the bottom of the inner drum that comes into contact with the washing water, and the heating efficiency is higher.

[0157] The above is only a preferred embodiment of the present disclosure, and is not a formal limitation of the present disclosure. Although the present disclosure has been disclosed as a preferred embodiment, it is not intended to limit the present disclosure, and any skilled person familiar with the present patent may, without departing from the scope of the technical scheme of the present disclosure, 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 disclosure are still within the scope of the technical scheme of the present disclosure. However, any simple modifications, equivalent changes and modifications made to the above embodiments based on the technical substance of the present disclosure without departing from the content of the technical scheme of the present disclosure are still within the scope of the present disclosure.

Claims

1. An electromagnetic heating module being applicable to a clothing treatment device, **characterized in that** it comprises a support of plate-like structure, an electromagnetic heating coil is fixedly disposed on a side surface of the support and a magnet is fixedly disposed on an other side surface of the support; the electromagnetic heating coil and magnet are fixed on a surface of the support during a molding process of the support.
2. The electromagnetic heating module according to claim 1, **characterized in that** the support includes a supporting portion which is formed into a disc structure, the electromagnetic heating coil is helically wound on a surface of one side of the supporting portion to form a number of concentric circles which are co-centered with the supporting portion; and the magnet is a bar magnet, which is set along a radial direction of the supporting portion and is fixed on a surface of an other side of the supporting portion; preferably, a plurality of bar magnets are spaced apart on a circumference of the supporting portion.
3. The electromagnetic heating module according to claim 2, **characterized in that** the electromagnetic heating coil is partially embedded in one side surface of the supporting portion; and/or, the magnet is partially embedded in the other side surface of the supporting portion.
4. The electromagnetic heating module according to claim 2 or 3, **characterized in that** the support further comprises a fixing portion, the fixing portion being provided with fixing holes; preferably, the fixing portion is provided on a periphery of the supporting portion.
5. A manufacturing process for an electromagnetic heating module as claimed in any one of claims 1-4, **characterized in that** comprising:
 - placing the magnet, a sheet of material and the electromagnetic heating coil in a mold, so that the electromagnetic heating coil and the magnet are located sides of the sheet respectively; the sheet of material being cured and molded to form the support so that the magnet and electromagnetic heating coil are fixed to the surface of the support; demolding and obtaining the electromagnetic heating module.
6. The manufacturing process according to claim 5, **characterized in that** the sheet of material is a rubber sheet of material, the rubber sheet of material being vulcanized and then cured and molded to form the support.
7. The manufacturing process according to claim 5, **characterized in that** the sheet of material is a sheet prepreg, the sheet prepreg being heat treated and then thermally cured and molded to form the support; preferably, the sheet prepreg is carbon fiber prepreg with epoxy resin or a glass fiber prepreg with epoxy resin.
8. The manufacturing process according to claim 5, **characterized in that** the sheet of material is a mass molding plastic, the mass molding plastic being thermally cured and molded in the mold after pressure and heat treatment to form the support.
9. The manufacturing process according to claim 5, **characterized in that** the sheet of material is a sheet molding compound, the sheet molding compound being thermally cured and molded in the mold after pressure and heat treatment to form the support.
10. A clothing treatment device, **characterized in that** it comprises the electromagnetic heating module as claimed in any one of claims 1-4;

- preferably, an outer drum and an inner drum are included, 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 a 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 a bottom of the outer drum.
11. An electromagnetic heating module being applicable to a clothing treatment device, **characterized in that** it comprises an encapsulation body, and an electromagnetic heating coil embedded inside the encapsulation body, a surface of the electromagnetic heating coil being completely encapsulated by the encapsulation body.
12. The electromagnetic heating module according to claim 11, **characterized in that** the encapsulation body comprises an encapsulation portion of a disc structure, and the electromagnetic heating coil is embedded in an interior of the encapsulation portion; and the electromagnetic heating coil is wound in a spiral shape to form a number of concentric circles co-centered with the encapsulation portion;
 preferably, the encapsulation body further comprises a fixing portion, the fixing portion being provided with fixing holes;
 more preferably, the fixing portion is provided projecting over a periphery of the encapsulating portion.
13. The electromagnetic heating module according to claim 11 or 12, **characterized in that** the encapsulation body is embedded with a magnet inside, the magnet being provided below the electromagnetic heating coil, surfaces of the magnet being completely encapsulated by the encapsulation body;
 preferably, the encapsulation body has a certain thickness, and the electromagnetic heating coil and magnet are spaced apart in a thickness direction of the encapsulation body.
14. The electromagnetic heating module according to claim 13, **characterized in that** the magnet is embedded inside the encapsulation portion of the encapsulation body, the magnet is a bar magnet, the bar magnet is disposed along a radial direction of the encapsulation portion;
 preferably, a plurality of bar magnets are spaced apart on a circumference of the encapsulated portion.
15. The electromagnetic heating module according to claim 14, **characterized in that** the encapsulated portion has an upper surface close to the electromagnetic heating coil, and a lower surface close to the magnet;
 a distance between an upper surface of the electromagnetic heating coil and the upper surface of the encapsulation portion is less than a spacing distance between the electromagnetic heating coil and the magnet, and a distance between a lower surface of the magnet and the lower surface of the encapsulation portion is less than the spacing distance between the electromagnetic heating coil and the magnet.
16. A manufacturing process for the electromagnetic heating module as claimed in any one of claims 11-15, **characterized in that** comprising:
 injecting an insulating material into a mold and placing the electromagnetic heating coil in the mold;
 the insulating material being cured and molded to form the encapsulated body encasing the electromagnetic heating coil;
 demolding and obtaining the electromagnetic heating module;
 preferably, placing the magnet in the mold and the encapsulation body formed by the insulating material encasing the electromagnetic heating coil and the magnet;
 preferably, the insulating material being cured and molded by heat treatment to form the encapsulating body;
 more preferably, the insulating material is an epoxy resin.
17. The manufacturing process according to claim 16, **characterized in that** it comprises the following steps:
 S101, injecting the insulating material into the mold;
 S 102, placing the magnet into the mold so that the insulating material does not go beyond an upper surface of the magnet;
 S 103, placing the electromagnetic heating coil in the mold so that the insulating material does not go beyond the upper surface of the electromagnetic heating coil;
 S 104: a heat treatment being performed to cure and mold the insulating material to form the encapsulated body;
 S105, demolding and obtaining the electromagnetic heating module.
18. The manufacturing process according to claim 16, **characterized in that** it comprises following the

steps:

S201, injecting the insulating material into the mold for a first time so that a thickness of the insulating material is at least higher than a thickness of the magnet; 5
 S202, placing the magnet into the mold so that the insulating material does not go beyond the upper surface of the magnet;
 S203, placing the electromagnetic heating coil into the mold; 10
 S204, injecting the insulating material into the mold for a second time so that the insulating material at least does not go beyond the upper surface of the electromagnetic heating coil; 15
 S205, the heat treatment being performed to cure and mold the insulating material to form the encapsulation body;
 S206, demolding and obtaining the electromagnetic heating module; 20
 preferably, between steps S202 and S203 further comprises step S200: the heating treatment is carried out to solidify and shape the insulating material that has been injected into the mold 25
 (500).

19. The manufacturing process according to claim 16, **characterized in that** it comprises the following steps:

30
 S301, injecting the insulating material into the mold for the first time so that the insulating material spreads at least a bottom surface of the mold;
 S302, placing the magnet into the mold; 35
 S303, injecting the insulating material into the mold for the second time so that the insulating material at least does not go beyond the upper surface of the magnet;
 S304, placing the electromagnetic heating coil into the mold; 40
 S305, injecting the insulating material into the mold for a third time so that the insulating material at least does not go beyond the upper surface of the electromagnetic heating coil; 45
 S306, the heat treatment being performed to cure and mold the insulating material to form the encapsulated body;
 S307, demolding and obtaining the electromagnetic heating module; 50
 preferably, between steps S301 and S302, and/or between steps S303 and S304 further comprises a step S300: the heating treatment being performed to cure and shape the insulating material that has been injected into the mold. 55

20. A clothing treatment device **characterized in that** it comprises the electromagnetic heating module as

claimed in any one of claims 11-15;

preferably, an outer drum and an inner drum are also included, 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 a 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 a bottom of the outer drum.

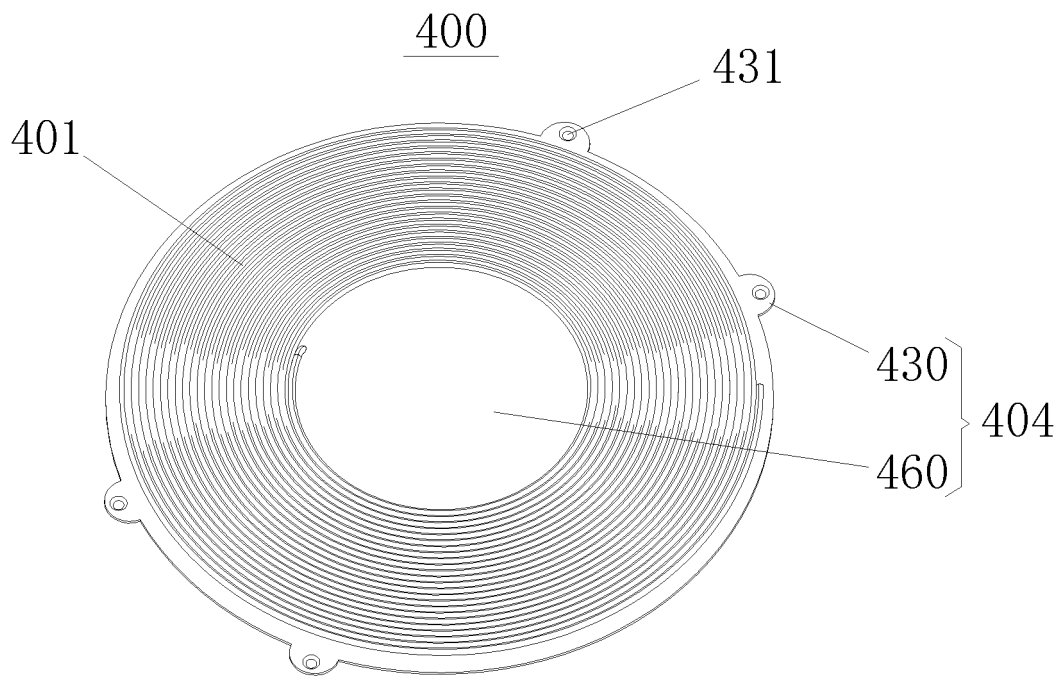


Fig. 1

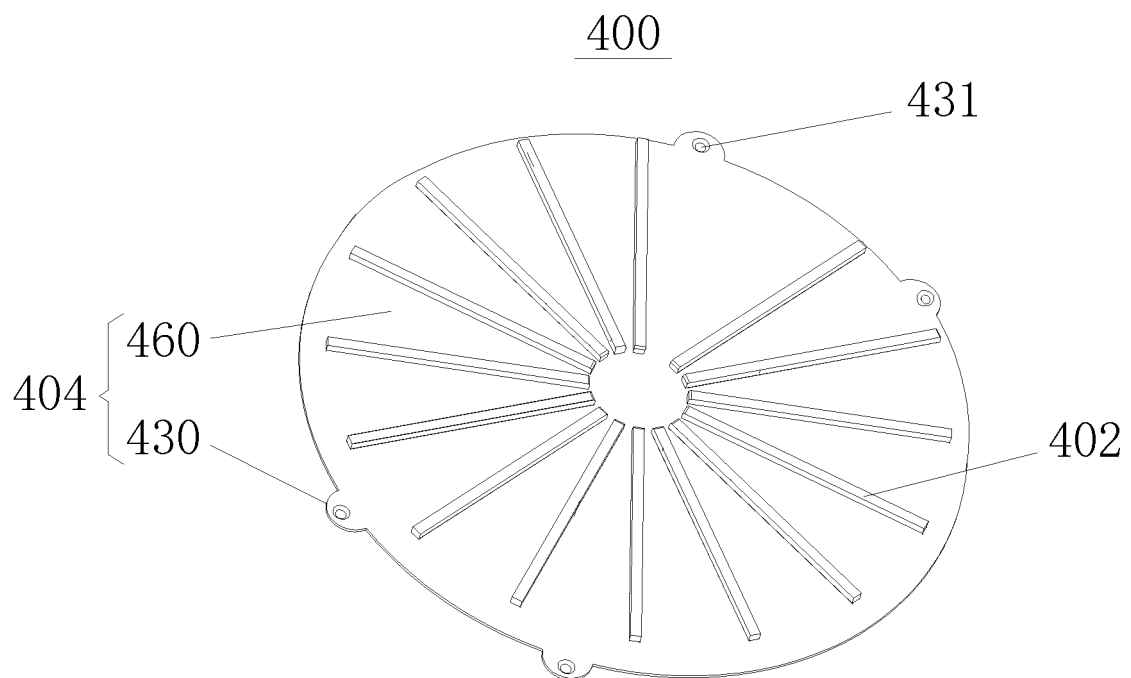


Fig. 2

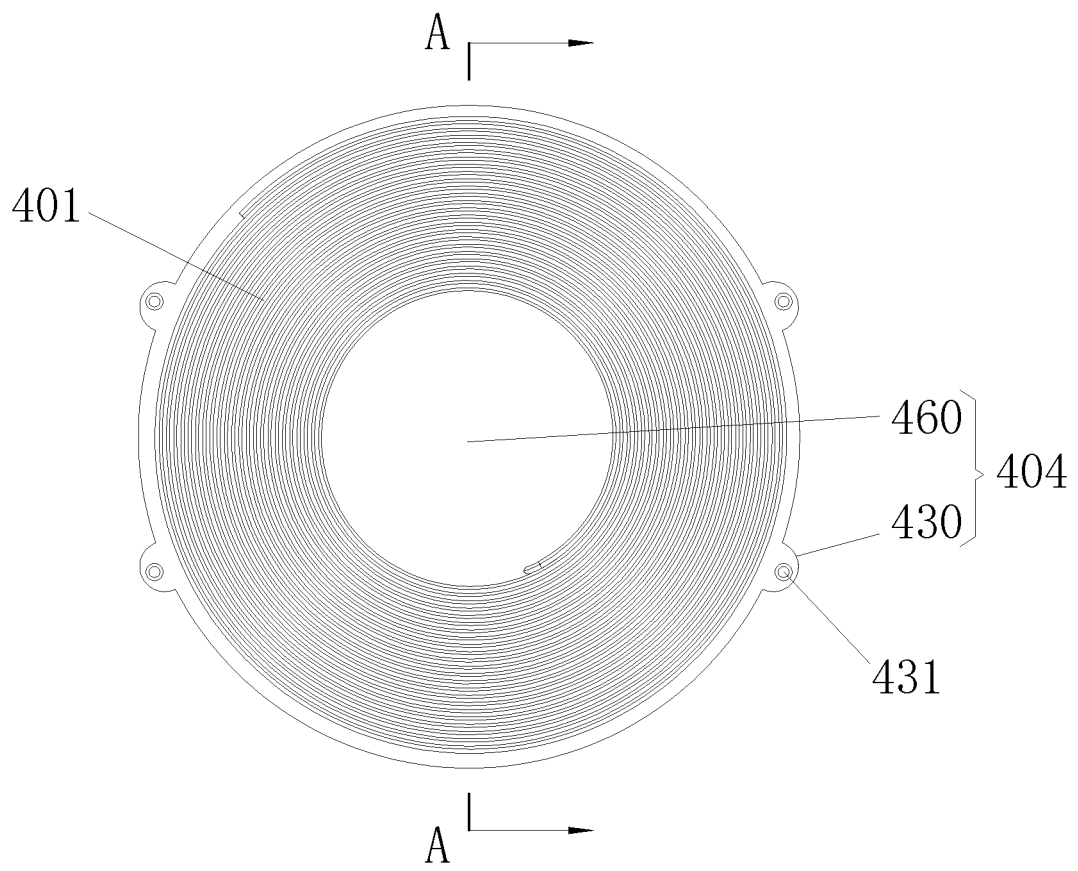


Fig. 3

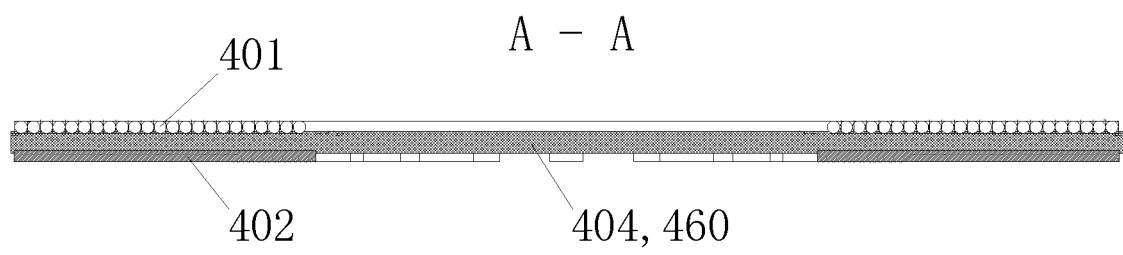


Fig. 4

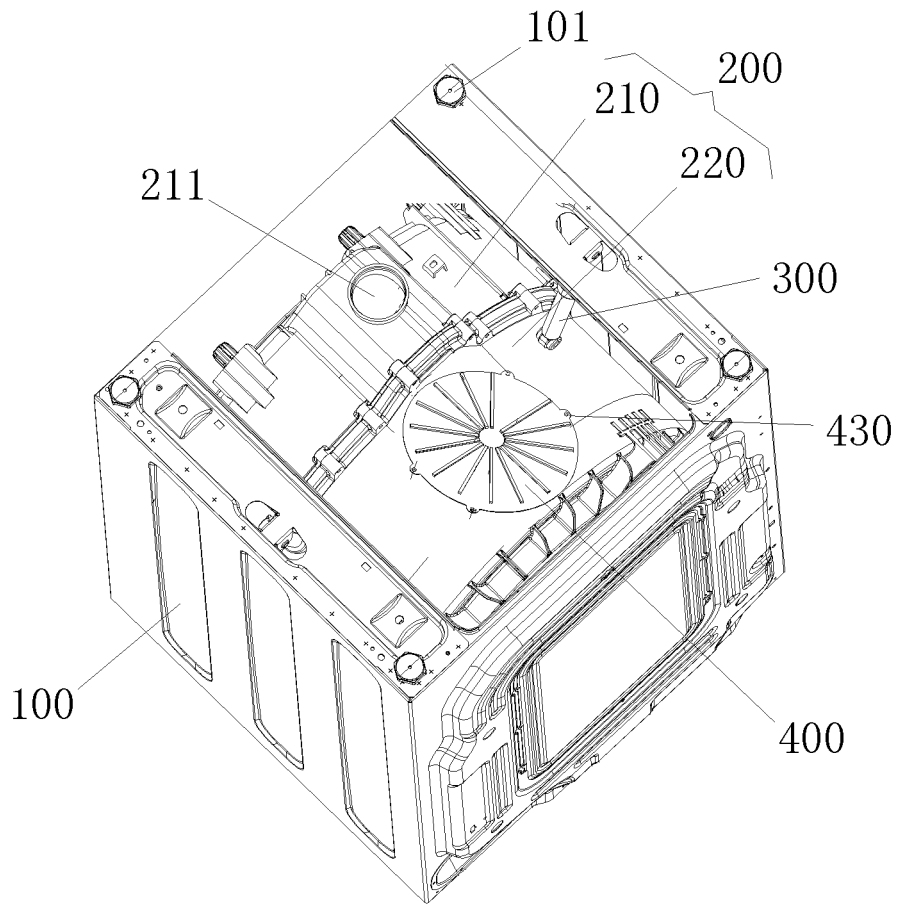


Fig. 5

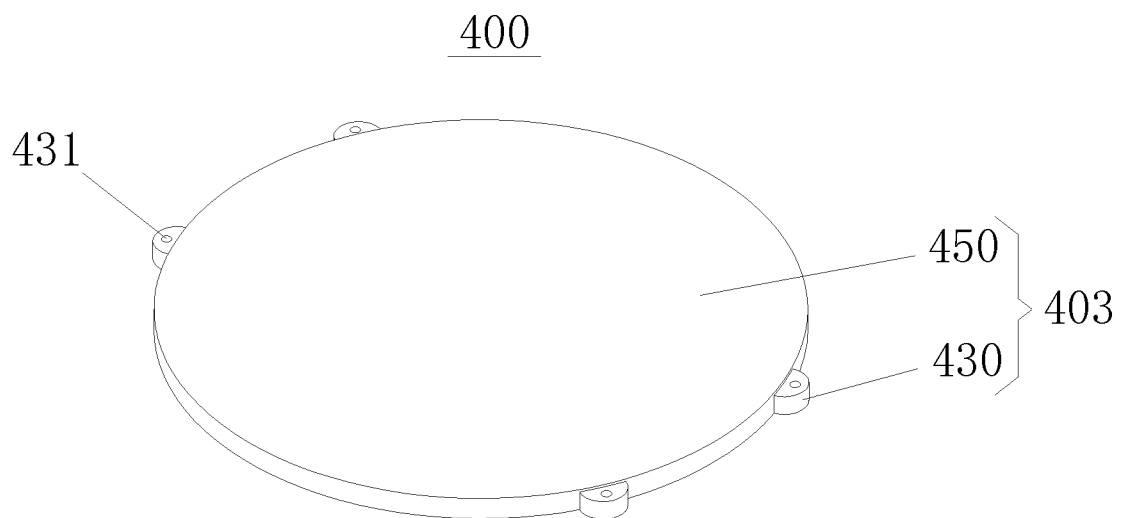


Fig. 6

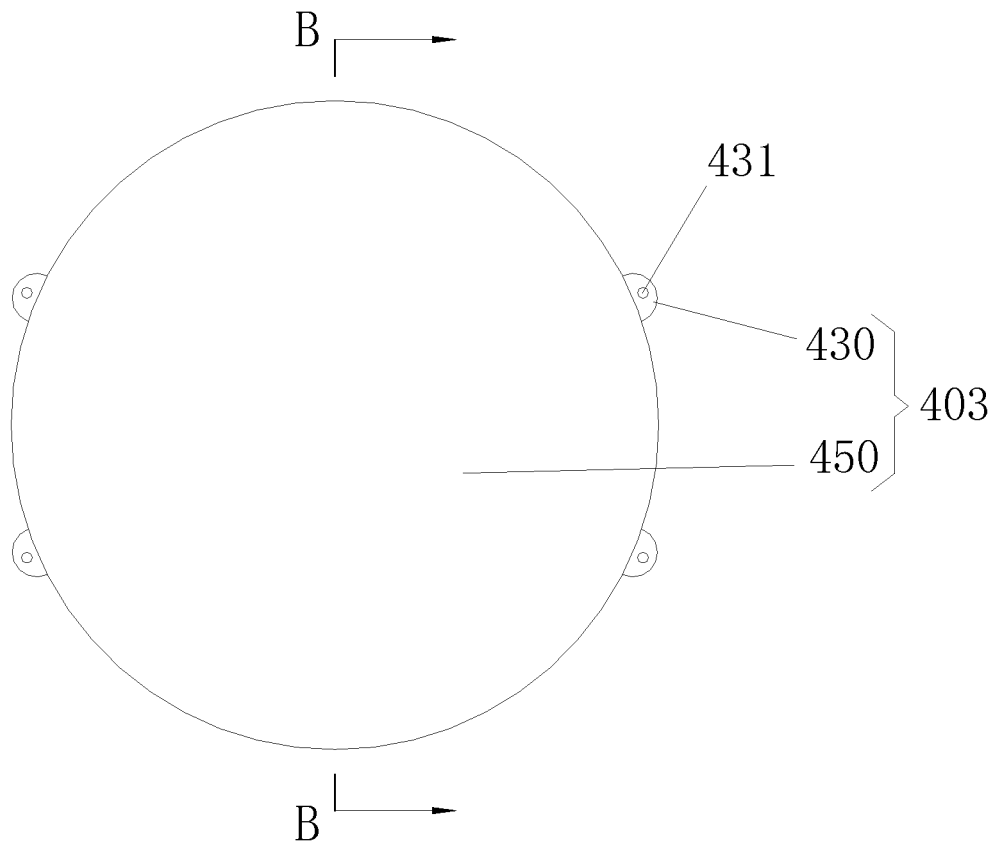


Fig. 7

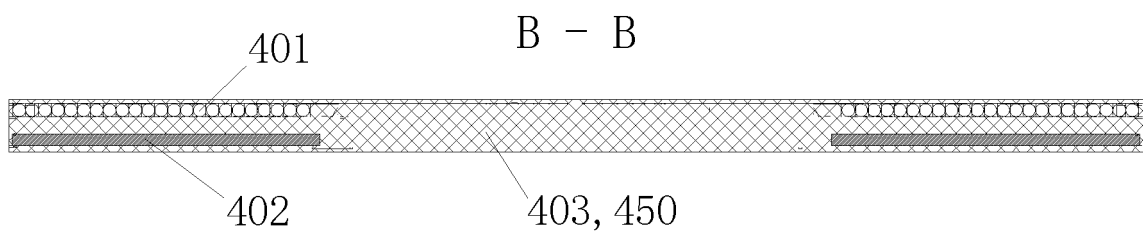


Fig. 8

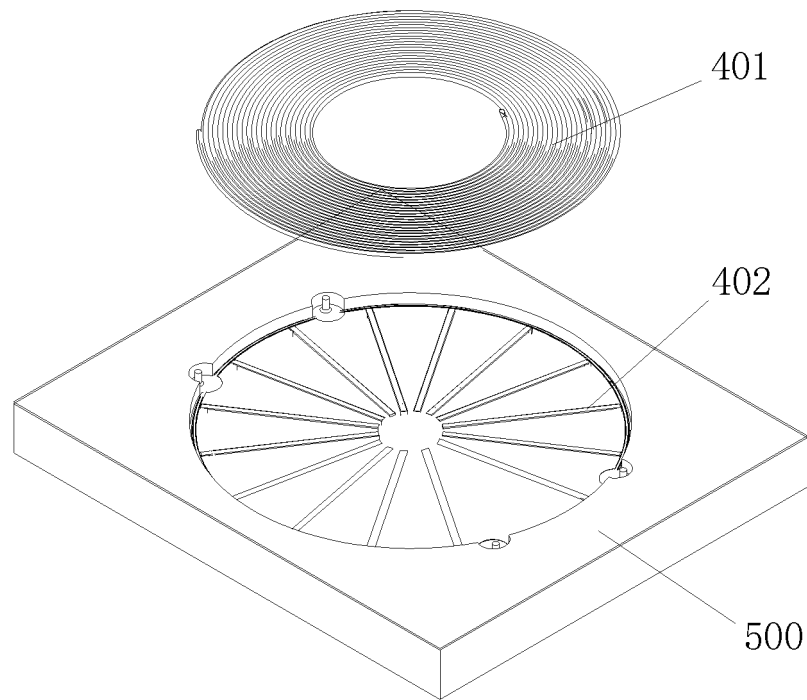


Fig. 9

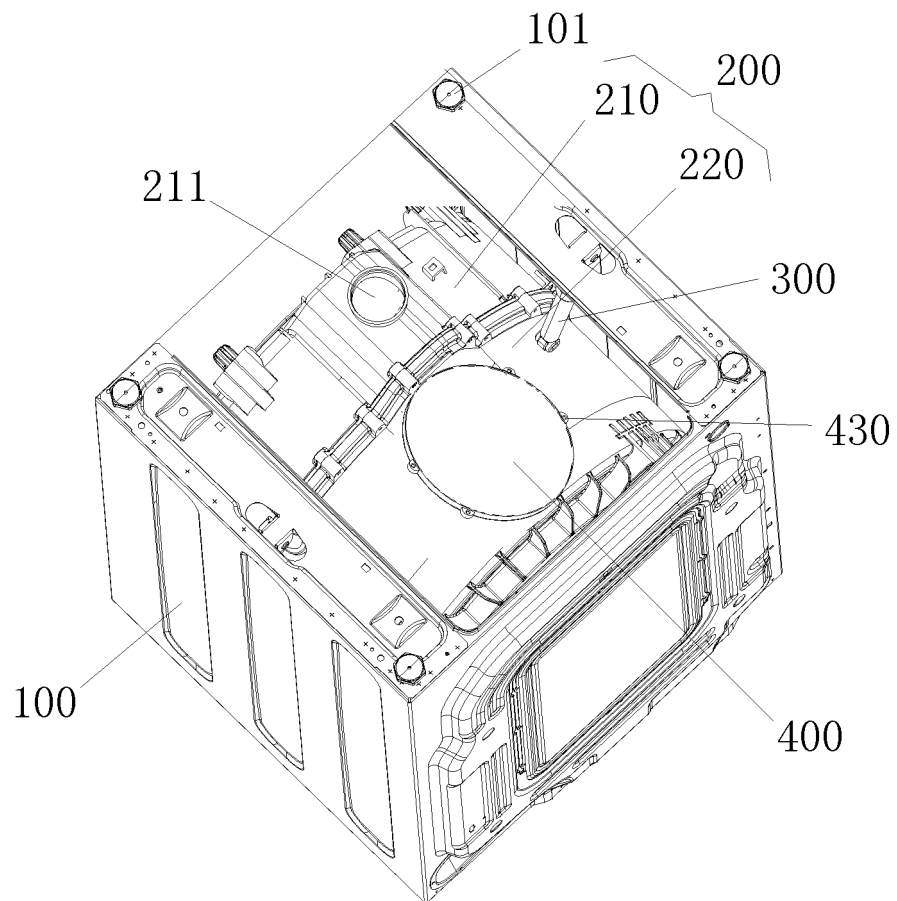


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/078546

A. CLASSIFICATION OF SUBJECT MATTER

D06F 58/26(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

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)

CNKI; CNABS; CNTXT; DWPI; SIPOABS: 磁, 热, 电磁加热, 电磁热, 电磁炉, 线圈, 绕组, 绕线, 磁体, 磁铁, 磁条, 磁块, 板, 支架, 模具, 熔, 固化, 成型, 凝固, 注射, 注入, 注塑, 另一侧, 另一面, 另一表面, 另一端, 两侧, 两面, 封装, 包裹, 包围, 包覆, 封闭, electromagnet+, heat???, magnet+, coiling, coil, winding, loop, bracket, plank, board, solidify???, mould+, mold+, enclosur+, envelop+, encapsulat+, side, surface

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 210670628 U (ZHONGSHAN FODA ELECTRICAL TECHNOLOGY CO., LTD.) 02 June 2020 (2020-06-02) description, paragraphs [0017]-[0021], and figures 1-3	1-4
X	CN 112481945 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD. et al.) 12 March 2021 (2021-03-12) claims 1-6, and figures 1-24	11-15
PX	CN 215222526 U (FOSHAN SHUNDE MIDEA ELECTRICAL HEATING APPLIANCES MANUFACTURING CO., LTD.) 17 December 2021 (2021-12-17) description, paragraphs [0005]-[0036], and figures 1-4	1-4
X	CN 202210877 U (XIONG MINGGANG et al.) 02 May 2012 (2012-05-02) description, paragraphs [0017]-[0021], and figures 1-3	1-4
Y	CN 112481945 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD. et al.) 12 March 2021 (2021-03-12) claims 1-6, and figures 1-24	10

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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

Date of the actual completion of the international search

11 May 2022

Date of mailing of the international search report

02 June 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.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/078546

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 210670628 U (ZHONGSHAN FODA ELECTRICAL TECHNOLOGY CO., LTD.) 02 June 2020 (2020-06-02) description, paragraphs [0017]-[0021], and figures 1-3	10
E	CN 114381894 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD. et al.) 22 April 2022 (2022-04-22) claims 1, 4 and 7	11
A	CN 112210946 A (QINGDAO HAIER WASHING MACHINE CO., LTD. et al.) 12 January 2021 (2021-01-12) entire document	1-20
A	CN 112048883 A (QINGDAO HAIER WASHING MACHINE CO., LTD. et al.) 08 December 2020 (2020-12-08) entire document	1-20
A	CN 104066218 A (MIDEA GROUP CO., LTD. et al.) 24 September 2014 (2014-09-24) entire document	1-20
A	WO 2021040374 A1 (LG ELECTRONICS INC.) 04 March 2021 (2021-03-04) entire document	1-20
A	JP 2000213868 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 02 August 2000 (2000-08-02) entire document	1-20

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/078546

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 210670628 U	02 June 2020	None	
CN 112481945 A	12 March 2021	None	
CN 215222526 U	17 December 2021	None	
CN 202210877 U	02 May 2012	None	
CN 114381894 A	22 April 2022	None	
CN 112210946 A	12 January 2021	None	
CN 112048883 A	08 December 2020	None	
CN 104066218 A	24 September 2014	None	
WO 2021040374 A1	04 March 2021	None	
JP 2000213868 A	02 August 2000	None	

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